Department of Planning, Housing and Infrastructure

Draft Schedule 10 West Schofields

Blacktown City Council Growth Centre Precincts Development Control Plan 2010

October 2025

Acknowledgement of Country

The Department of Planning, Housing and Infrastructure acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land, and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically. We acknowledge the Dharug people on whose land we plan for a more inclusive future and acknowledge their continuing connection to the land, waters and sky of Dharug land.

Published by NSW Department of Planning, Housing and Infrastructure

dphi.nsw.gov.au

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First published: October 2025

Department reference number: EF25/5592

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1 Introduction

1.1 Name and application of this schedule

Schedule 10 West Schofields Development Control Plan (this schedule) forms part of the Blacktown City Council Growth Centre Precincts Development Control Plan 2010 (BCC Growth Centre Precincts DCP), as amended.

This schedule applies to all development on the land shown in **Figure 1: Land application map.**

This schedule and related amendments to the BCC Growth Centre Precincts DCP give effect to the provisions of the BCC Growth Centre Precincts DCP for land within the West Schofields precinct (precinct) as shown on the Land application map.

1.2 Purpose of this schedule

The purpose of this schedule is to support and augment the objectives and controls set out in the overarching BCC Growth Centre Precincts DCP, by providing additional objectives and controls which are customised to the context of the West Schofields precinct.

This schedule should be read in conjunction with and in addition to the BCC Growth Centre Precincts DCP. In the event of an inconsistency between this schedule and the BCC Growth Centre Precincts DCP, this schedule takes precedence.

1.3 Structure of this schedule

Table 1 summarises the structure of this schedule.

Table 1: Structure of schedule

Section	Summary
Introduction	Identifies the land to which the schedule applies, and the schedule's purpose.
Precinct planning outcomes	Establishes an overall vision and provides the Indicative Layout Plan, which set out the high-level intent for the future development of the precinct. Provides precinct-specific figures and additional precinct-specific objectives and controls that support the controls in Part 2 Precinct planning outcomes of the BCC Growth Centre Precincts DCP.

Section	Summary
Neighbourhood and subdivision design	Provides additional objectives and controls for neighbourhood and subdivision design across the precinct.
Development in the residential zones	Provides additional objectives and controls for residential developments.
Centres development controls	Provides additional objectives and controls for development in the local centre (in the southern area of West Schofields) and the neighbourhood centre (in the northern area of West Schofields).
Employment lands subdivision and development controls	Provides additional objectives and controls for development in the urban services employment precinct on the southern side of South Street in the West Schofields precinct.
Site specific controls	Provides additional objectives and controls for specific locations within the precinct.
Appendix A Indicative Street Designs	Provides information on typical street designs that should be used in the West Schofields precinct, including design parameters and illustrations.
Appendix B West Schofields Precinct Water Cycle Management Assessment	Provides the water cycle management approach for the precinct, to supplement the Riparian and Water Cycle Management Strategy at Appendix B of the BCC Growth Centre Precincts DCP.
Appendix C West Schofields Precinct Vegetation Management Strategy	Provides the approach for the management and restoration of the vegetation communities in the precinct.

Additional notes are provided throughout this document. These notes are not part of the formal provisions of the DCP but are intended to provide additional guidance and explanation of the provisions. If further guidance is required on the interpretation of provisions in the DCP, readers should refer to the definitions or contact the consent authority for advice.

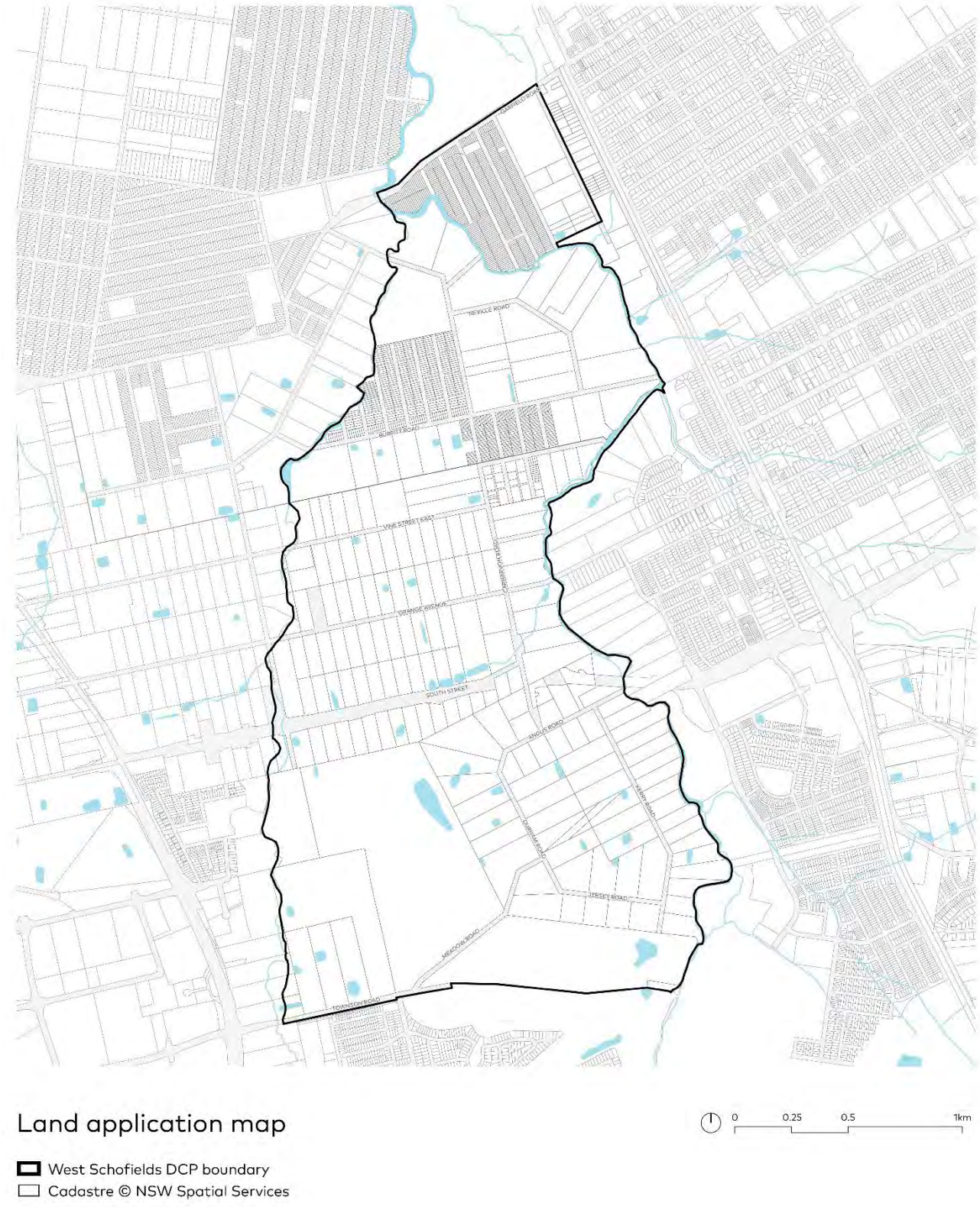

Figure 1: Land application map

2 Precinct planning outcomes

The following referenced figures and controls support the objectives, controls and design principles in Part 2 – Precinct Planning Outcomes in the BCC Growth Centre Precincts DCP.

2.1 Vision

West Schofields will be a diverse, green, resilient, and accessible precinct which responds to the needs of those who live, work, visit and play in it.

The precinct's Indicative Layout Plan has been informed and guided by Aboriginal perspectives and landscape features that extend beyond the precinct. The implementation of this plan will deliver a precinct that respects and responds to Country and the natural environment.

The precinct will provide a variety of home types, from detached homes through townhouses to apartments, to meet the needs of future residents. It will also provide opportunities for the delivery of less common, but much needed, housing types including affordable, multi-generational, and 'missing middle' typologies. These homes will also be future focussed, being designed to respond to a changing climate through careful management of risks such as flooding and heat. They will also be more sustainable, with a focus on reducing energy and water consumption, and reducing reliance on fossil fuels.

West Schofields will be a healthy and well-connected place to live. A network of accessible, green and shaded public spaces will support active and social lifestyles, enhance biodiversity, and connect with the broader region. Regional-scale sporting facilities will provide opportunities for active recreation and parks spread throughout the precinct will provide for smaller-scale active and passive recreation, located a short walk from homes. Streets will be designed to be safe, comfortable and attractive environments that prioritise walking, cycling and links to open space. An integrated cycle and pedestrian network will make active transport the most convenient choice for short trips, directly connecting homes to key destinations including community facilities, retail, and parks.

The regular shopping needs of people in the precinct will be met through diverse and centrally located shopping areas. The local centre in the south and smaller neighbourhood centre in the north will provide locals with their daily grocery and core retail needs, while also being a source of employment. The co-location of community facilities and open spaces with these centres will make them focal points for the precinct, and hubs of community activity. The

urban services precinct, strategically located along the key South Street regional connection, will provide opportunities for a range of jobs and business activities that are lower impact, but require a bit more space to operate. It will enable provision of a diversity of goods and services to meet the needs of the precinct and surrounding region.

2.2 The Indicative Layout Plan

The Indicative Layout Plan for the West Schofields precinct is provided at **Figure 2**. For related objectives and controls, refer to Section 2.2 – The Indicative Layout Plan of the BCC Growth Centre Precincts DCP.

Figure 2: Indicative Layout Plan

2.3 Designing with Country

2.3.1 Objectives

a. Acknowledge, respect, and celebrate Dharug Country.

b. Embed and promote Aboriginal knowledge in the built and natural environment.

c. Support the health and wellbeing of Country by valuing, respecting, and being guided by Aboriginal cultural knowledge.

d. Explore opportunities for the involvement of Aboriginal peoples in the care of Country, such as controlled access and co-management, to enable the fulfilment of cultural obligations.

2.3.2 Controls

1. The design of development is to be consistent with the *Connecting with Country Framework* (Government Architect NSW, 2023).

2. Engagement with Aboriginal communities should be thoughtful, proportionate, and focused to prevent over-consultation and consultation fatigue. The *Connecting with Country Framework* (Government Architect NSW, 2023), particularly Section 3.1 of the Framework, should be followed.

3. Cultural heritage items and significant areas, such as riparian corridors in the precinct, are to be protected and made accessible to Aboriginal people so that they can maintain a connection to Country.

4. Subdivision and development design should follow the lead of Country and work with it, not override it, respecting the cultural significance of high points, ridgelines, and natural topography. This includes through avoiding excessive fill, respecting flood plains, and preserving view corridors.

5. Integration of Aboriginal design practices into subdivision and development design is encouraged. Aboriginal people are to lead or co-lead all Aboriginal design elements. This is to be undertaken consistent with the approaches in the *Connecting with Country Framework* (Government Architect NSW, 2023).

6. Use signage, surface treatments, walls, and artwork to tell the story of Country and its peoples.

7. Where appropriate, use Aboriginal language or implement dual naming in the built environment, including streets, public places, community facilities, wayfinding signage, parks and open spaces.
8. Where appropriate, incorporate storytelling elements into wayfinding devices, to both orientate people to Country today as well as inform them of the stories and history that came before.
9. Provide communal and public outdoor spaces with areas to celebrate culture such as a viewing, yarning, or sitting place with references to local design. The design of these spaces and the facilities provided should be responsive to community need.

2.4 Flooding and Water Cycle Management

For related objectives and controls, refer to Section 2.3.1 Flooding and water cycle management of the BCC Growth Centre Precincts DCP. These work together with the additional objectives and controls which follow **Figure 3** and **Figure 4**.

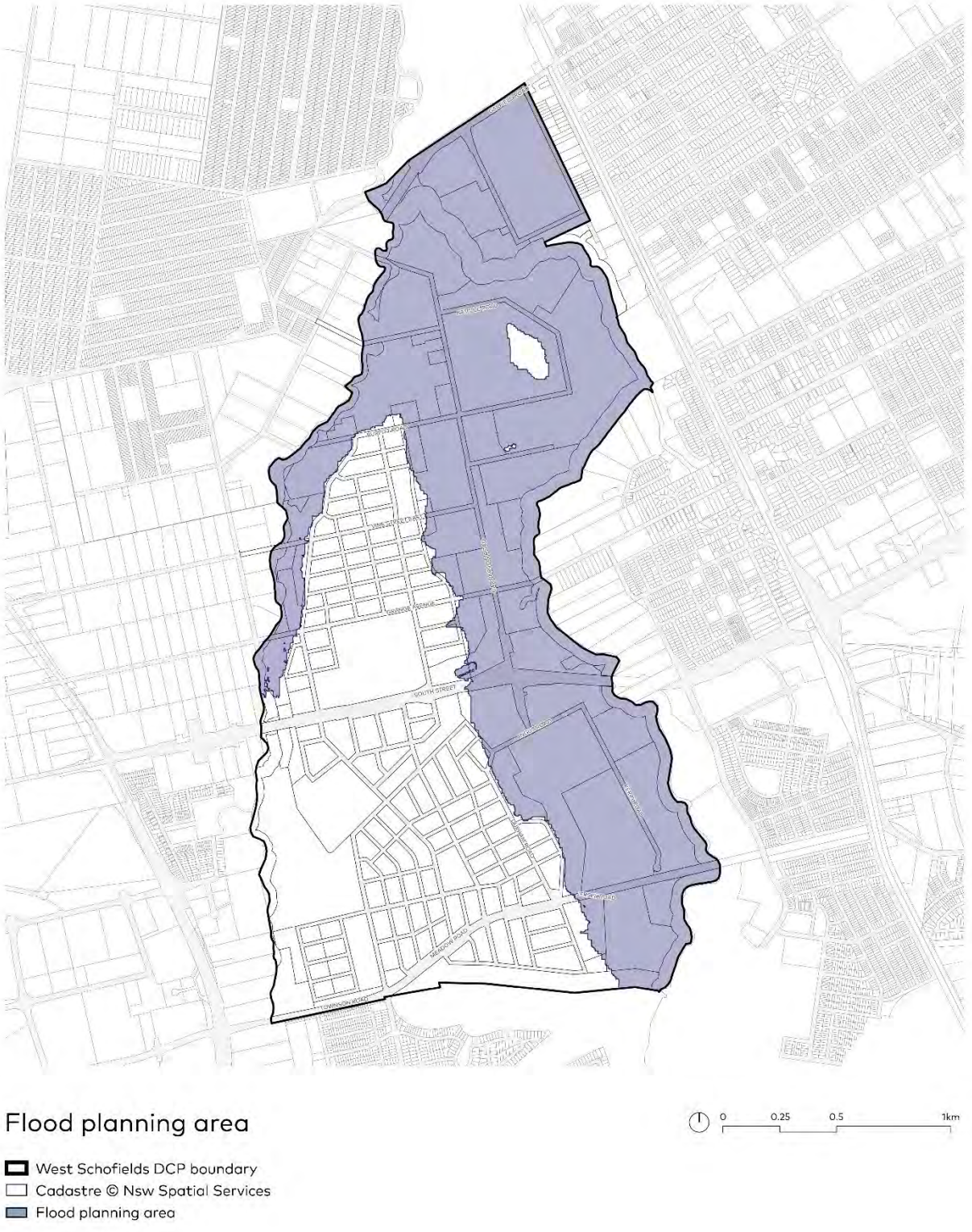

Figure 3: Flood planning area

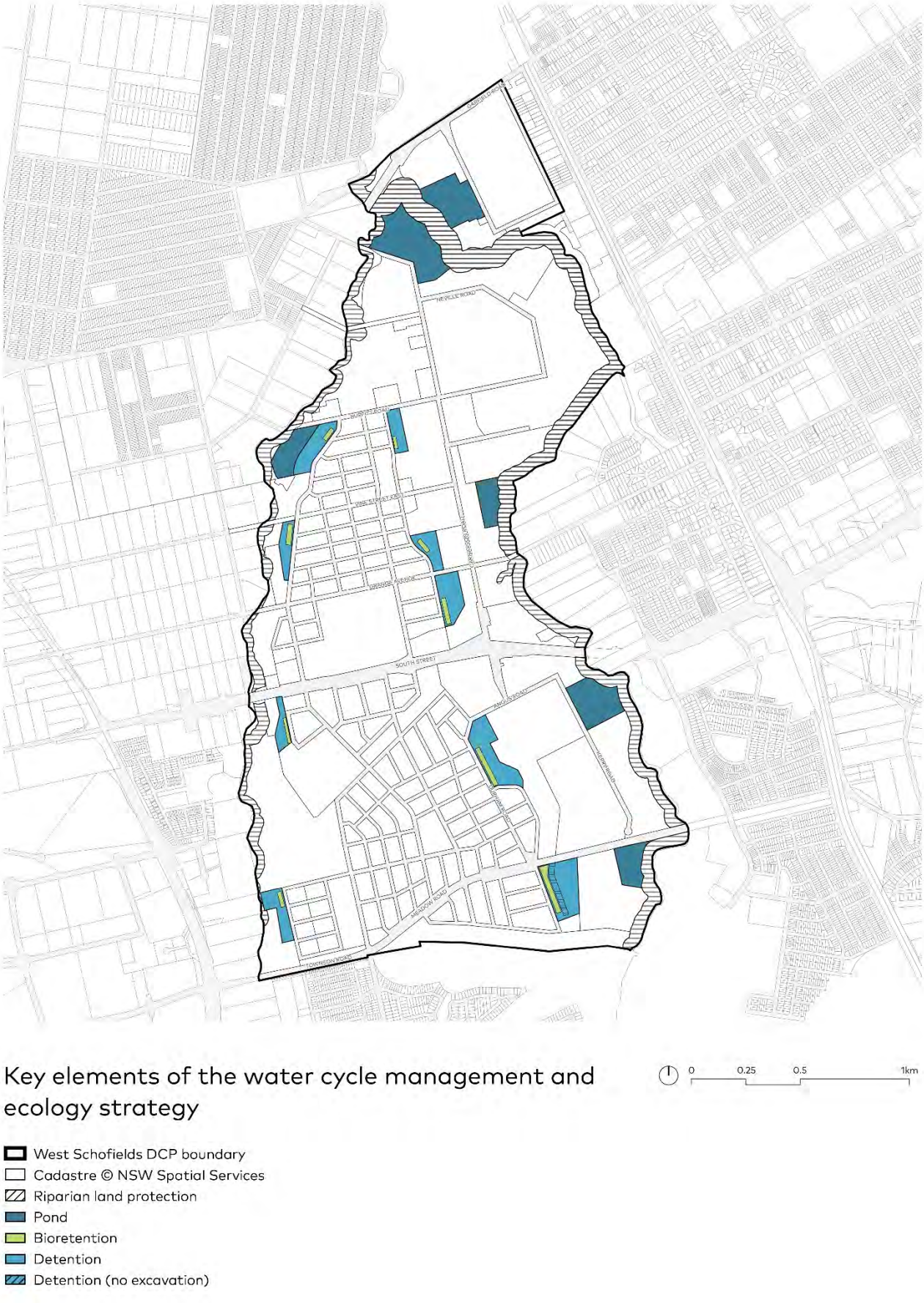

Figure 4: Key elements of the water cycle management and ecology strategy

Water Cycle Management

The precinct is part of the Wianamatta-South Creek catchment. Protection and restoration of creek health, ecology and biodiversity is a key policy for future development and delivery of the blue-green infrastructure network in the catchment. By improving and maintaining waterway health we can optimise environmental outcomes and promote healthy and resilient communities.

Waterway objectives (flow and water quality) have been established for the protection of waterways in the Wianamatta-South Creek catchment (refer to the *Wianamatta–South Creek stormwater management targets* (NSW Department of Planning and Environment, 2022)), in line with the NSW Government *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (2017). In addition, the NSW Government has prepared technical notes and guidance documentation on the modelling parameters and software packages that can be used to demonstrate compliance with these objectives and the controls below (refer to the *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (NSW Department of Planning and Environment, 2022)).

2.4.1 Precinct Specific Definitions

1. All references to the '1% Annual Exceedance Probability (AEP) flood level', '1% AEP', or 'flood planning area' in the BCC Growth Centre Precincts DCP are to be taken to mean the '1% Annual Exceedance Probability (AEP) plus 3 metres freeboard' for the West Schofields precinct.
2. The Flood Planning Area for West Schofields is the area below the Flood Planning Level.

2.4.2 Additional Objectives – Flooding

a. To integrate consideration of the effects of climate change on flooding and water cycle management into the design and delivery of the precinct.

b. To deliver a precinct which can be safely occupied and efficiently evacuated in flood events.

c. To ensure no detrimental increases in the potential flood affectation of other development or properties.

2.4.3 Additional Controls – Flooding

1. Roads adjoining residential and employment lands are to be located above the Flood Planning Area.
2. The design of the road systems within the areas of the precinct that are affected by the Probable Maximum Flood for West Schofields should provide a 'continuous rising grade' to ensure the evacuation of affected occupants within these areas. This is to ensure residents can evacuate their property along certain routes without needing to return below the flood planning area.
3. All designated evacuation routes are to be designed to ensure that they remain functional and safe during a 500-year local storm event.
4. Each Development Application for subdivision is to assess flood evacuation and demonstrate that people in the subdivision can evacuate in flood events.
5. Any Development Application which proposes a road layout that diverges from that shown in the Indicative Layout Plan in this schedule is to demonstrate that the different road layout still meets flood evacuation requirements.
6. For development in the *flood planning area*:
    a. All permanent structures have flood-compatible building components and flood-compatible building methods up to and including the flood planning level.
    b. An engineer's report is to be provided certifying that the permanent structures can withstand the forces of floodwater, debris and buoyancy up to and including the limit of the flood planning area. In the case of alterations or additions to an existing development, the newly constructed additions are to be certified.

2.4.4 Additional Objectives – Water Cycle Management

a. To protect, maintain or restore waterway health within Wianamatta-South Creek and its tributaries by managing development impacts.
b. To ensure the waterway objectives (flow and water quality) for Wianamatta-South Creek are achieved.
c. To ensure integrated land use and water cycle management outcomes.
d. To safely and effectively convey stormwater flows from urban areas to the existing waterways or stormwater treatment infrastructure.
e. To protect groundwater quality and availability.
f. To consider whole of life costs and ease of maintenance in water planning.

2.4.5 Additional Controls – Water Cycle Management

1. Management of 'minor' flows using piped systems for the 20% AEP (residential land use) and 10% AEP (commercial land use) shall be in accordance with the *Engineering Guidelines for Subdivision and Development* (Blacktown City Council). Management measures shall be designed to:
    a. prevent damage by stormwater to the built and natural environment,
    b. reduce nuisance flows to a level which is acceptable to the community,
    c. provide a stormwater system which can be economically maintained, and which uses open space in a compatible manner,
    d. control flooding,
    e. minimise urban water run-off pollutants to watercourses, and
    f. meet the standards for a 20% AEP flood level.
2. Management of 'major' flows using dedicated overland flow paths such as open space areas, roads and riparian corridors for all flows in excess of the pipe drainage system capacity and above the 20% AEP shall be in accordance with the *Engineering Guidelines for Subdivision and Development* (Blacktown City Council). Management measures shall be designed to:
    a. prevent both short-term and long-term inundation of habitable dwellings,
    b. manage flooding to create lots above the designated flood level with flood free access to a public road located above the 1% AEP flood level,
    c. control flooding and enable access to lots, stabilise the landform and control erosion,
    d. provide for the orderly and efficient evacuation of people away from rising floodwaters,
    e. stabilise the landform and control erosion, and
    f. meet the standards for a 1% AEP flood level.
3. Designs for management of 'minor' and 'major' flows is to include consideration of climate change, made in accordance with the latest guidance published in *Australian Rainfall and Runoff* (Commonwealth of Australia (Geoscience Australia)) and the NSW *Flood Risk Management Manual*. Considerations should align with a conservative projection (such as SSP3.0-7 or equivalent) or any relevant Commonwealth or State policy on a projection (whichever is the higher).

4. Development is to deliver the waterway objectives (flow and water quality) as set out in the *Wianamatta-South Creek stormwater management targets* (NSW Department of Planning and Environment, 2022) and *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (NSW Department of Planning and Environment, 2022). These targets are below, and are a reduction in mean annual load from unmitigated development:
    a. Gross pollutants (anthropogenic litter >5 mm and coarse sediment >1 mm): 90% reduction
    b. Total suspended solids: 90% reduction
    c. Total phosphorus: 80% reduction
    d. Total nitrogen: 65% reduction.
5. The trunk stormwater system is to be constructed and maintained by council in accordance with the *West Schofields Precinct Water Cycle Management Assessment* (Rhelm, 2025) at **Appendix B** of this schedule.
6. Regional detention basins and treatment areas must be positioned as shown in **Figure 4**.
7. Where temporary detention basins are required, these are to be constructed and maintained by the developer until such time as the ultimate operational detention basins are in place. Developers will be required to connect temporary basins to the operational detention basins. Where a temporary basin is proposed in place of a future residential lot, the land must be fully compacted under the supervision of a qualified geotechnical engineer on the Engineers Australia National Engineers Register. Following completion of compaction, the works must be certified by the supervising engineer to be suitable for residential dwelling construction.
8. Stormwater management plans are to be prepared for development applications to demonstrate how the quantity and quality of urban run-off as a result of development will be managed.
9. All development is to incorporate water sensitive urban design (WSUD).
10. The design and mix of WSUD infrastructure shall consider ongoing operation and maintenance. Subdivision applications must include a detailed lifecycle cost assessment and maintenance plan for WSUD measures.
11. Stormwater detention is to reduce post development flows to less than pre-development levels. It should be demonstrated that there will be no increase in runoff

from the site as a result of the development under all durations for all storm events up to and including the 1% AEP with allowance for long term climate change.

12. Erosion control and bank stabilisation measures are to be incorporated within riparian corridors where required.
13. Development must not significantly adversely impact soil salinity or sodic soils and shall balance the needs of groundwater dependent ecosystems.
14. All lots are to provide rainwater tanks, which will collect water from the roof. Multiple smaller tanks may be provided to meet the required tank capacities, which are:
    a. For each single-dwelling residential lot: 4,000 litres.
    b. For employment, mixed-use, and multi-dwelling developments: As per the requirements of the *WSUD developer handbook – MUSIC modelling and design guide 2020* by Blacktown City Council.
15. Stormwater drainage is to be provided in accordance with the provisions of Australian Standard AS3500.

2.5 Salinity and soil management

Areas identified as having potential salinity and soil aggressivity risks are mapped in **Figure 5**. Refer to Section 2.3.2 Salinity and soil management of the BCC Growth Centre Precincts DCP for objectives and controls.

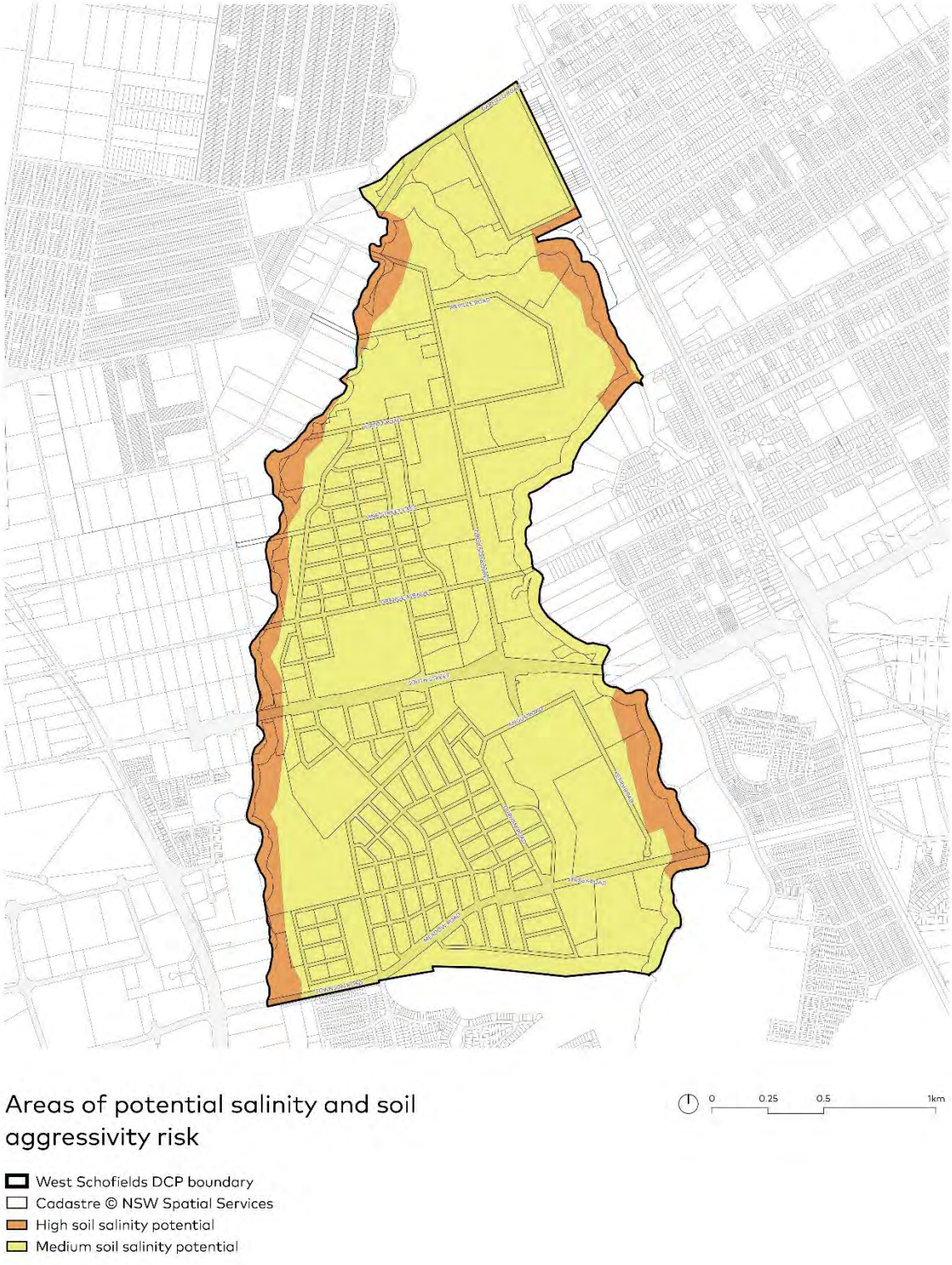

Figure 5: Areas of potential salinity and soil aggressivity risk

2.6 Aboriginal and non-Aboriginal heritage

Refer to Section 2.3.3 of the BCC Growth Centre Precincts DCP – Aboriginal and European heritage for objectives and controls.

2.6.1 Additional Objectives

a. To minimise impacts on Aboriginal heritage particularly within riparian corridors.

b. To protect items of heritage and potential historic archaeological significance.

2.6.2 Additional Controls – General

1. A subdivision development application is to detail opportunities for ongoing consultation and interpretation of Aboriginal and non-Aboriginal heritage values.

2.6.3 Additional Controls – Aboriginal Heritage

1. For development involving subdivision or ground disturbance works, further analysis of the potential presence of Aboriginal heritage may be required. Based on the category of likeliness that Aboriginal heritage items are present as shown in **Figure 6**, the following is required to be included in Development Application (or equivalent) package:

    a. **For locations of known Aboriginal sites and areas marked as 'very likely' or 'likely':** an Aboriginal Cultural Heritage Assessment Report (ACHAR), undertaken in accordance with the relevant guidelines.

    b. **For areas marked 'unlikely' or 'very unlikely':** an Aboriginal Heritage Due Diligence Assessment, undertaken in accordance with relevant guidelines. If this assessment concludes that further assessment is required, this should also be undertaken for the application package.

    c. **For areas of 'nil' likelihood:** no further Aboriginal heritage assessment is needed as part of an application.

2.6.4 Additional Controls – Non-Aboriginal Heritage

1. For development involving subdivision or ground disturbance works in identified areas of archaeological potential, as shown on **Figure 7**, an archaeological impact assessment must be undertaken in accordance with the relevant guidelines. The assessment should include an assessment of the cumulative impacts of the proposed

development on the precinct's archaeological resource, including a reassessment of significance.

2. All other areas of the precinct should be subject to an unexpected heritage finds procedure.

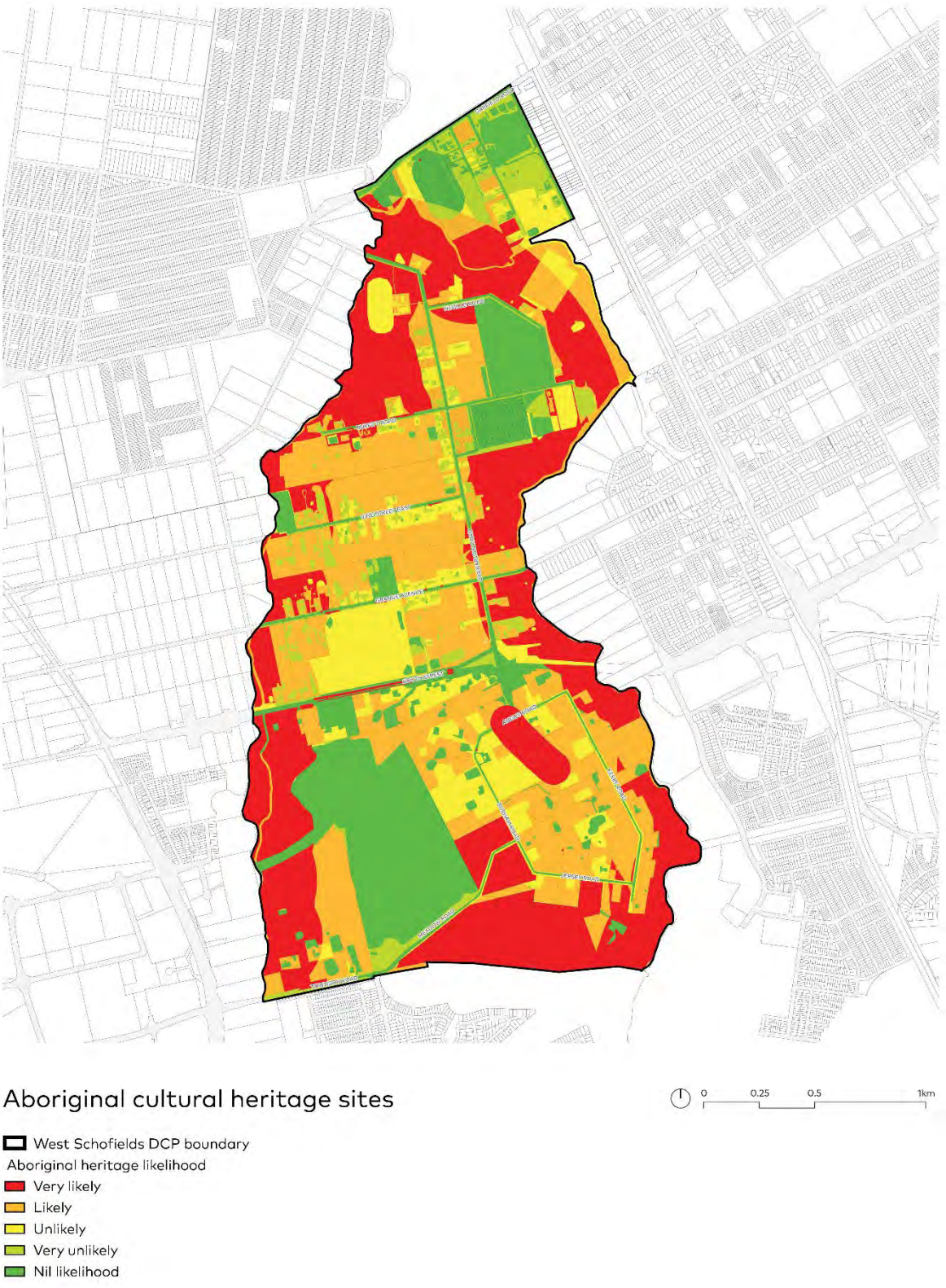

Figure 6: Aboriginal cultural heritage sites

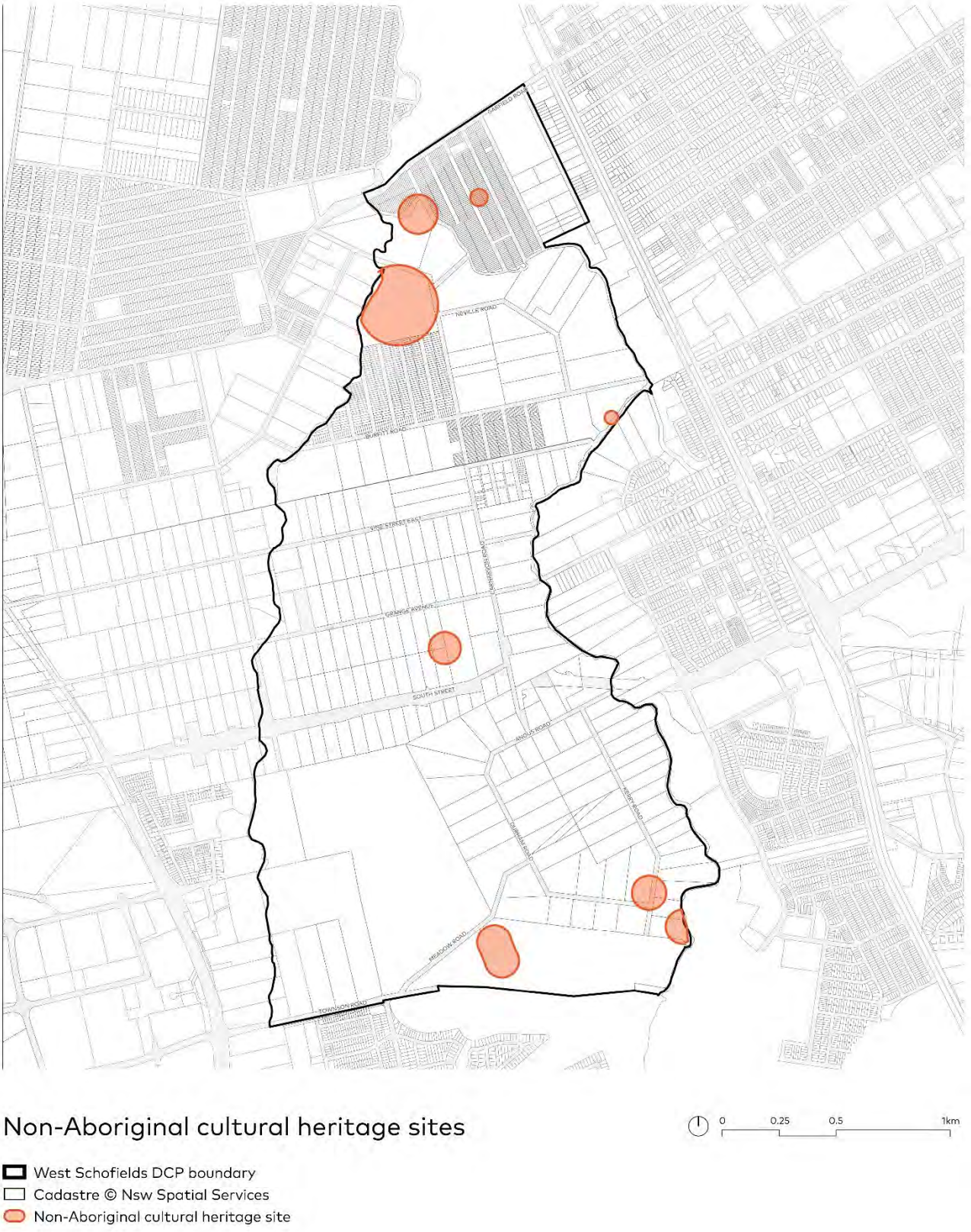

Figure 7: Non-Aboriginal cultural heritage sites

2.7 Native vegetation and ecology

Refer to Section 2.3.4 Native vegetation and ecology and Appendix B Riparian protection area controls of the BCC Growth Centre Precincts DCP for objectives and controls.

2.7.1 Additional controls

1. The management of native vegetation and wildlife habitat in land zoned C2 Environmental Conservation, RE1 Public Recreation, and RE2 Private Recreation shall be generally in accordance with the *West Schofields Precinct Vegetation Management Strategy* at **Appendix C** of this schedule, and Appendix B Riparian protection area controls of the BCC Growth Centre Precincts DCP.
2. Utilise the *Biodiversity in Place framework* (Government Architect NSW, 2024), to provide landscapes that prioritise use of native vegetation, consider and allow for the movement of native animals and plants, support pollinators and deliver on other Biodiversity Sensitive Urban Design (BSUD) principles.
3. Where practical, prior to and during development commencing, applicants are to:
    a. provide for the appropriate re-use of native plants, habitat features such as logs and tree hollows and topsoil that contains known or potential native seed bank for re-use within nature reserves, council bushland reserves, regionally significant core areas or regionally significant corridors or other ecological restoration areas, and
    b. provide ecologists or wildlife rescue staff during tree felling activities and relocate native animals from development sites into appropriate local areas with suitable habitat. Applicants should refer to the *Translocation operational policy* (Department of Planning, Industry and Environment, September 2019).
4. Within land that is in a Riparian protection area (**Figure 8**) or Native vegetation area (**Figure 9**):
    a. all existing native vegetation is to be retained and rehabilitated, except where clearing is required for essential infrastructure such as roads. Rehabilitation is to be guided by a Vegetation Management Plan, prepared by a suitably qualified person in accordance with applicable requirements,
    b. roads and bridges crossing riparian corridors should ensure the designs appropriately allow for wildlife movement, such as fauna-friendly culverts or animal bridges, and

c. native vegetation is to be conserved and managed in accordance with the *West Schofields Precinct Vegetation Management Strategy* at **Appendix C** of this schedule and the Riparian Protection Area controls at Appendix B of the BCC Growth Centre Precincts DCP.

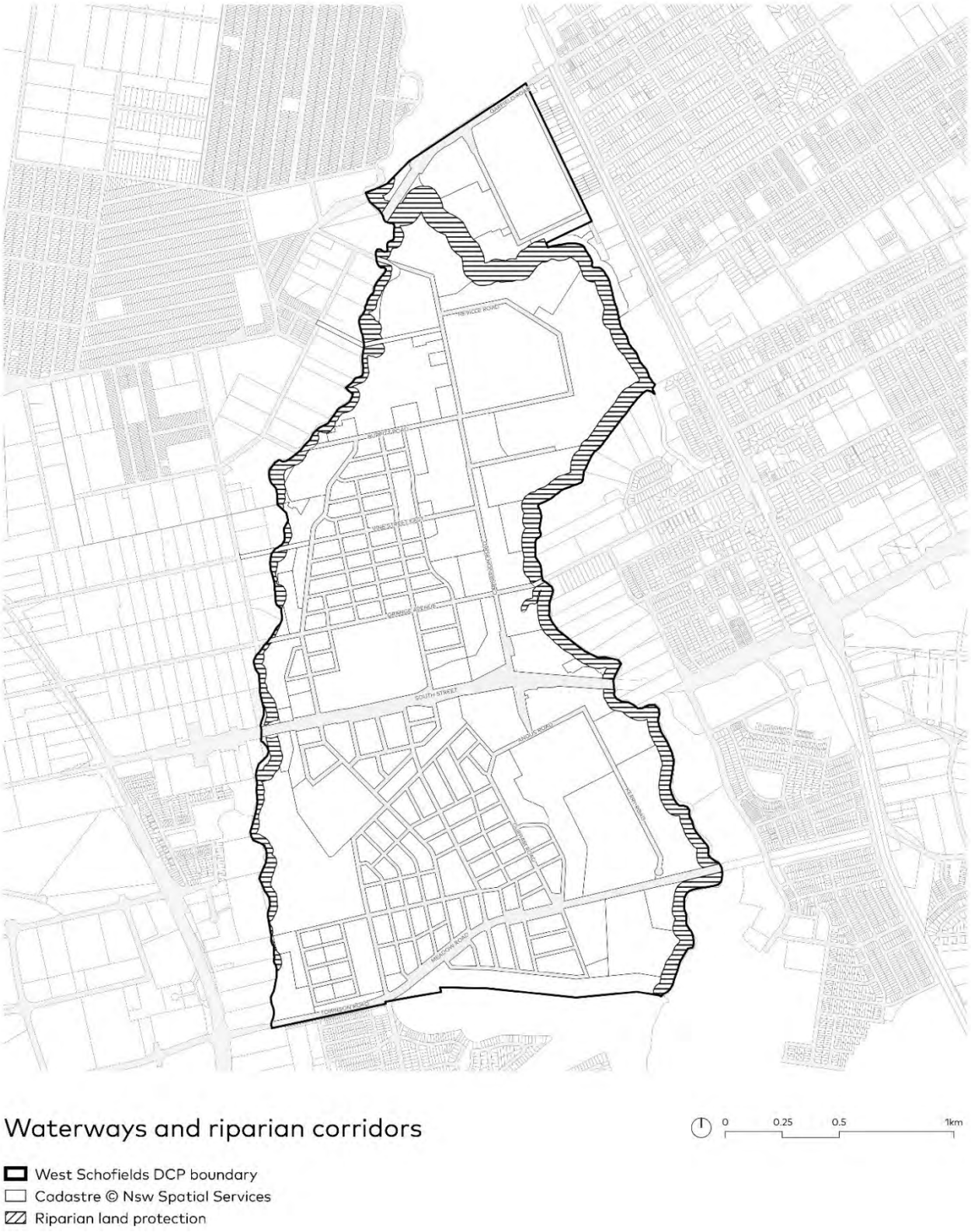

Figure 8: Riparian protection area

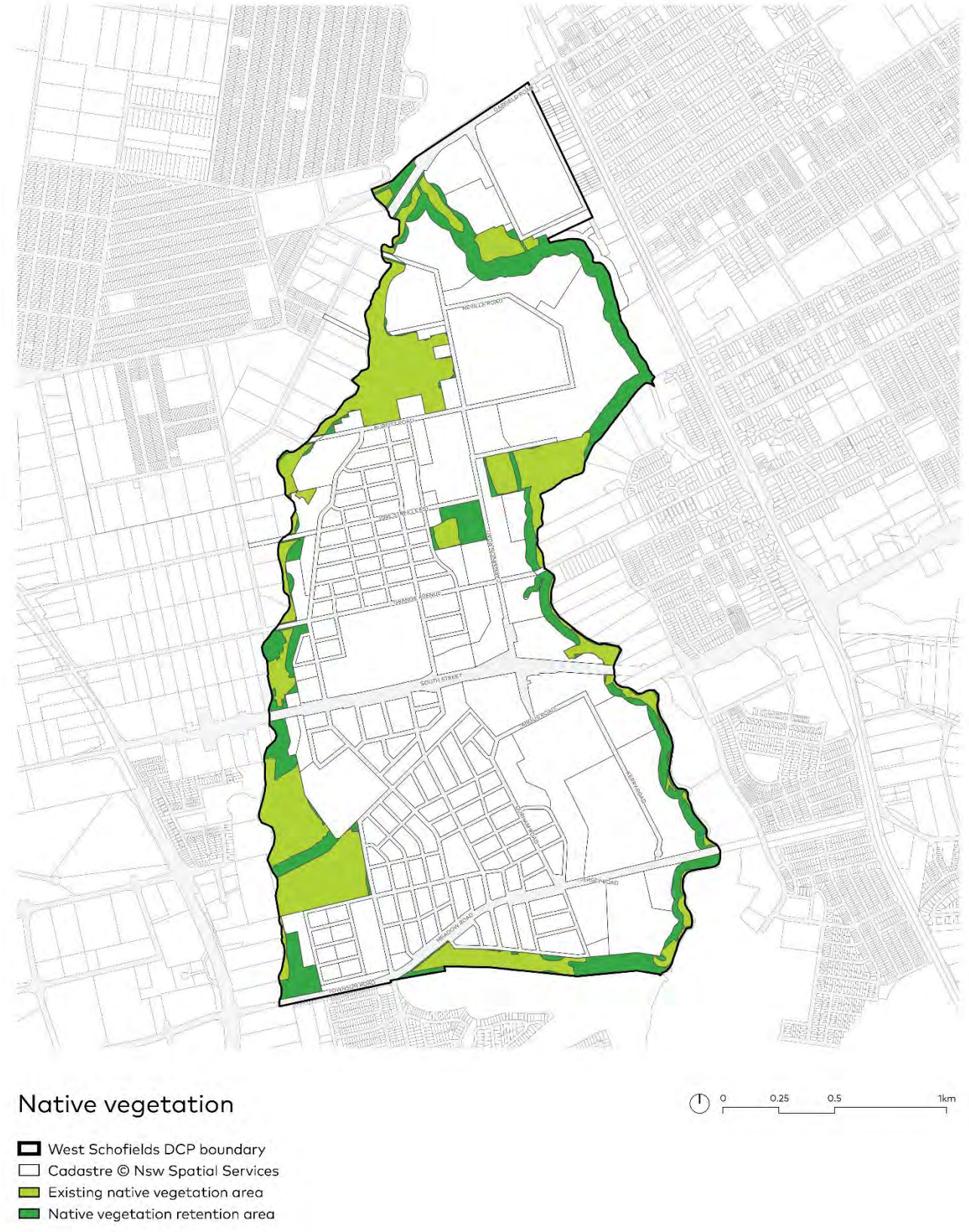

Figure 9: Native vegetation

2.8 Bushfire hazard management

Refer to Section 2.3.5 Bushfire hazards management of the BCC Growth Centre Precincts DCP for objectives and controls.

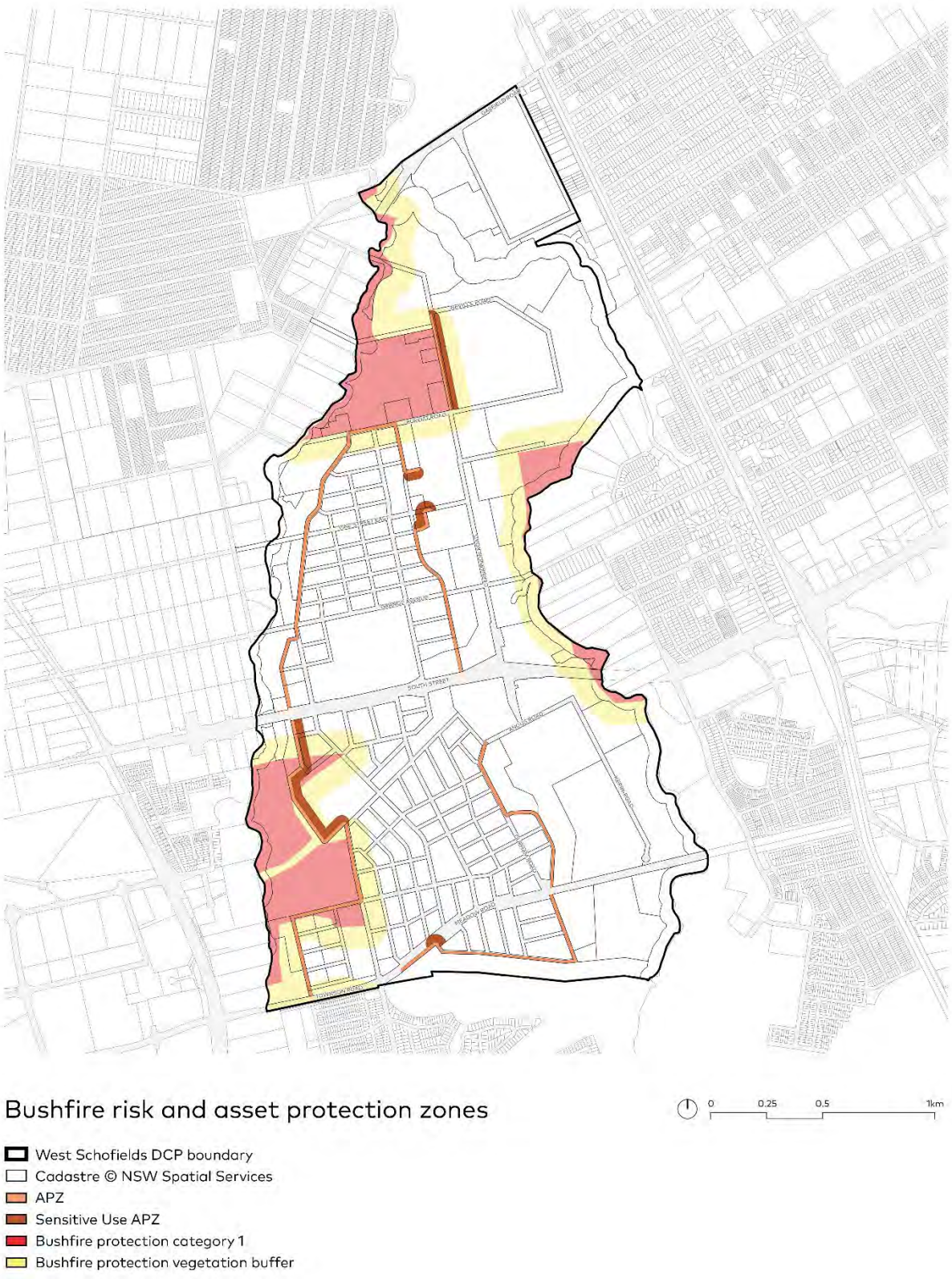

Figure 10: Bushfire risk and asset protection zone requirements

2.9 Air quality and odour assessment and control

2.9.1 Objectives

a. To manage and reduce the impact of air and odour-related air pollution on surrounding development.

2.9.2 Controls

1. Orient and design buildings to encourage air flow.
2. Avoid design and construction of dead-end courtyards or long narrow spaces perpendicular to the prevailing winds where air can lay dormant and stagnate.
3. Development on land adjoining busy roads will demonstrate compliance with:
    a. Minimum separation distances from the kerb as outlined in **Table 2**; or
    b. Where minimum separation distances are not achievable, ducted mechanical ventilation for the supply of outdoor air is to be provided, in compliance with Australian Standard AS 1668.2:2024, *The use of ventilation and airconditioning in buildings – part 2: mechanical ventilation in buildings* (Standards Australia, June 2024). Mechanical ventilation outdoor air intakes will be located at least the minimum distance from the kerb specified in **Table 2**, measured in the horizontal and vertical planes from the kerb. Filtration of outdoor air will be to a minimum Australian Standard performance rating of F6 or minimum efficiency reporting value (MERV) 9.
4. Alternative setbacks may be considered by Council, where the applicant can demonstrate that a development will comply with required air quality outcomes, and the application is adequately supported by specialist studies prepared by a suitably qualified professional.

Table 2: Air quality setbacks for development within different road classifications

Road classification (existing or forecast)	Residential type buildings	Childcare centres, hospitals, aged care facilities, schools
High-volume Roads: *more than 60,000 annual average daily traffic (AADT); and 40,000–60,000 AADT with 5% or more heavy vehicles*	20m	80m

Road classification (existing or forecast)	Residential type buildings	Childcare centres, hospitals, aged care facilities, schools
Moderate-volume Roads: *20,000–40,000 AADT*	n/a	40m
Intermediate Roads: *40,000–60,000 AADT; and 30,000–40,000 AADT with 10% or more heavy vehicles*	10m	40m

3 Neighbourhood and subdivision design

This part provides additional objectives and controls to those set out in Part 3 Neighbourhood and subdivision design of the BCC Growth Centre Precincts DCP.

3.1 Residential density and subdivision

The precinct will accommodate a range of housing typologies from single dwellings and terraces to manor houses and apartments. A combination of controls, including minimum lot sizes, maximum density provisions and maximum building heights, are set out in *State Environmental Planning Policy (Precincts—Central River City) 2021*.

3.1.1 Additional controls

1. The precinct is to be developed in accordance with the residential structure plan shown at **Figure 11**.
2. The maximum dimensions of street blocks are to be controlled to provide for improved walkability.
    a. Street blocks are to be generally a maximum of 160 m long and 70 m deep, or a maximum 1.2 hectares in area.
    b. Block lengths in excess of 160 m may be considered by council where pedestrian connectivity, stormwater management and traffic safety objectives are achieved.
    c. In the area zoned R3 Medium Density Residential around the local centre, roads or through-site links should be provided generally every 120m to increase permeability and promote walking.

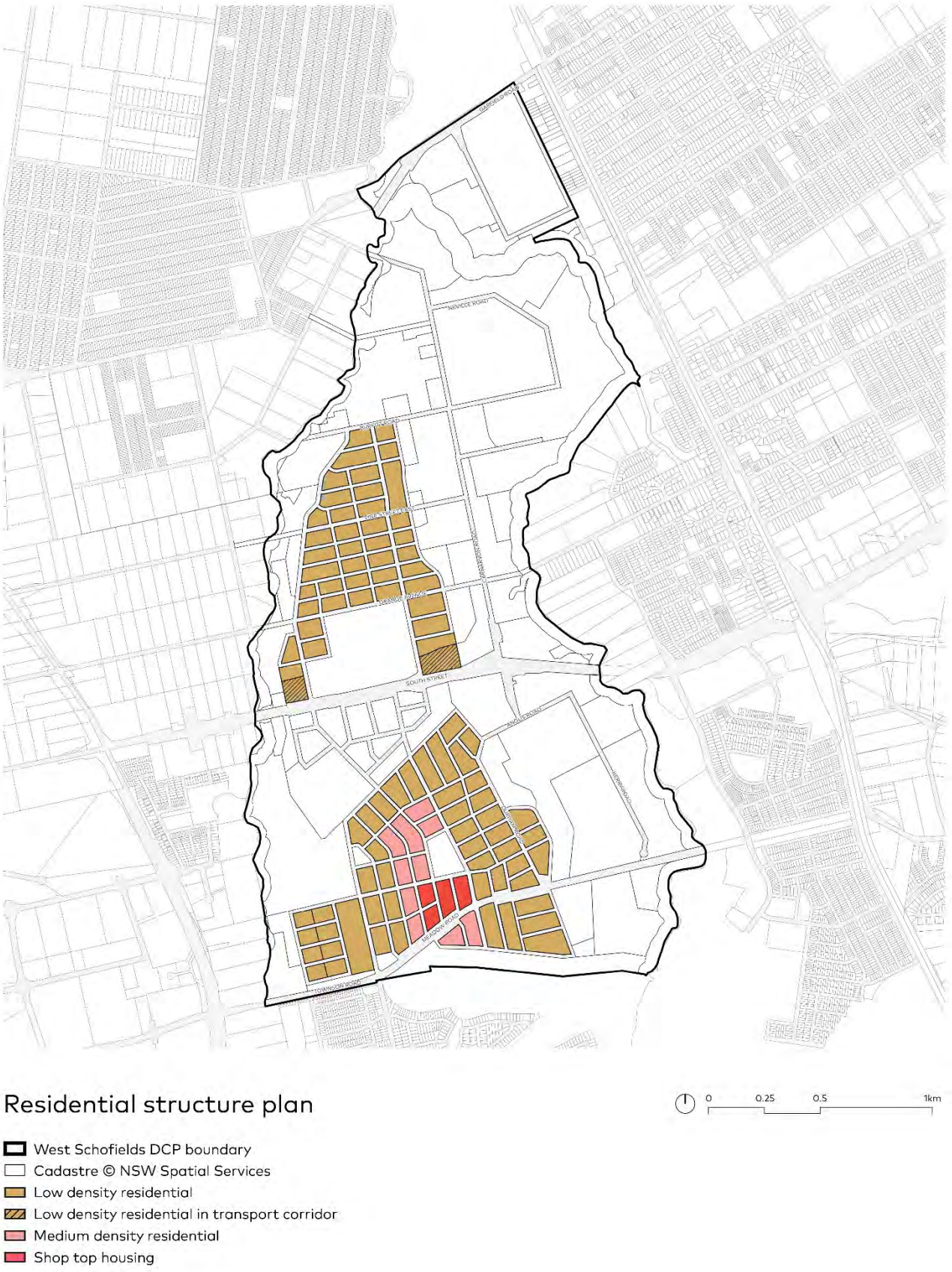

Figure 11: Residential structure

3.2 Movement network

Refer to Section 3.4 Movement network of the BCC Growth Centre Precincts DCP for objectives and controls.

3.2.1 Additional objectives

a. To create a permeable pedestrian and cyclist network throughout and beyond the precinct.

b. To allow provisions for street trees within road/street corridor that mitigate the urban heat effect and meet the tree canopy targets set out in **Section 3.4** below.

3.2.2 Additional controls

1. The street network and hierarchy are to be provided generally in accordance with **Figure 12**.
2. The shared cycle and pedestrian network is to be provided in accordance with **Figure 13**.
3. Streets are to be designed in accordance with the street hierarchy (**Figure 12**) and the tables and diagrams provided in **Appendix A**. Where existing street widths are greater than the minimums stated in **Appendix A**, the road corridor is to not be reduced, with the additional space preferred to be allocated to verge planting areas.
4. Active transport routes (pedestrian footpaths, shared pathways, and bicycle paths) near riparian protection areas (as shown in **Figure 8**) and protected vegetation areas (as shown in **Figure 9**) should follow these design principles:
    a. be located outside these protected areas,
    b. run parallel to the areas (i.e. not weaving through the riparian corridor), and
    c. crossings of riparian corridors are to be perpendicular, to minimise impacts on the vegetation of the corridor.
5. Roads, including any supporting structures such as batters and embankments, are to not intrude into any riparian protection areas (as shown in **Figure 8**) or protected vegetation areas (as shown in **Figure 9**).
6. Bicycle parking provided for use by employees, residents, or resident visitors as part of a development, is to be secure and sheltered.

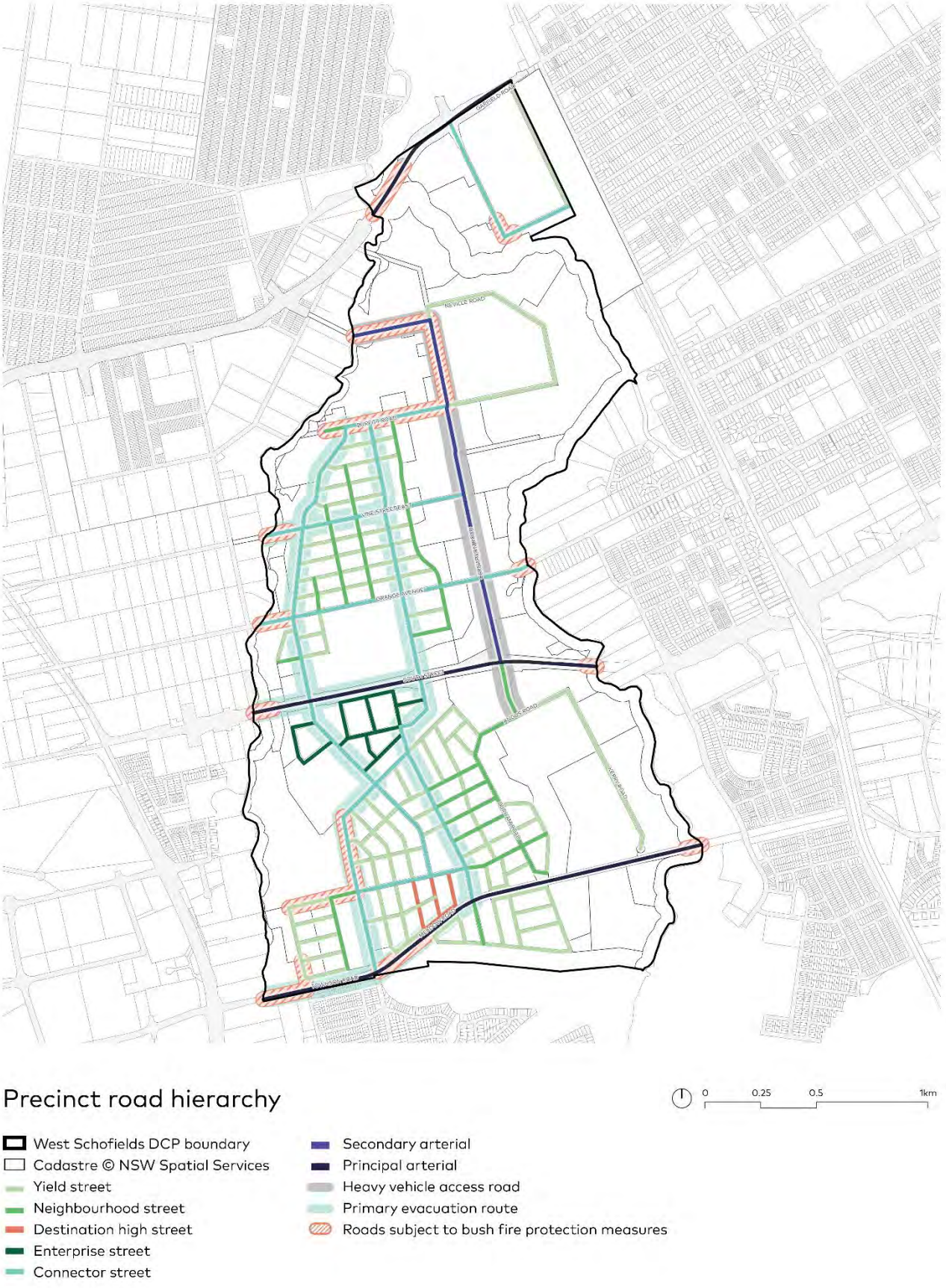

Figure 12: Precinct road hierarchy

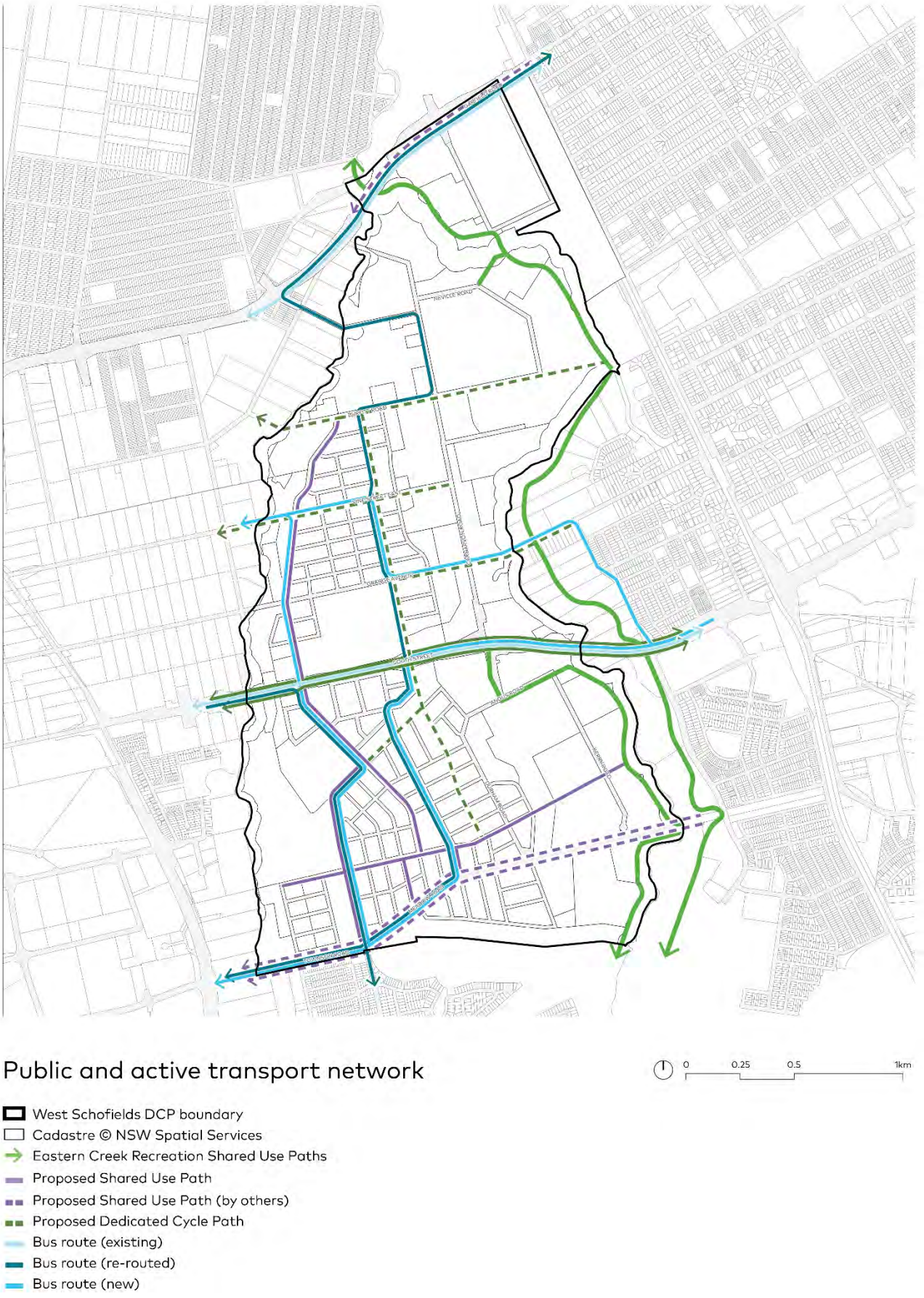

Figure 13: Public and active transport network

3.3 Car and bicycle parking rates

Table 3, **Table 4**, and **Table 5** below override any equivalent control on car and bicycle parking rates in the BCC Growth Centre Precincts DCP.

Table 3: Residential car parking rates (maximums)

Development	Unit	Maximum parking rate
Dwelling House	1-2 bedroom	1
	3+ bedroom	2
Dual Occupancy	1-2 bedroom	1
	3+ bedroom	2
Medium-Density Residential	1-2 bedroom	1
	3+ bedroom	1.5
	Visitor	0.2 per unit
High-Density Residential	1-2 bedroom	1
	3+ bedroom	2
	Visitor	0.2 per unit

Table 4: Employment car parking rates (maximums)

Development	Unit	Maximum parking rate
Office Premises and Business Parks	Per 100m^2 GFA	2.5
Business Premises	Per 100m^2 GFA (if GFA <200m^2)	3.33
	Per 100m^2 GFA (if GFA >200m^2)	4.55
General Industrial	Per 100m^2 GFA (for portion <7500m^2)	1.33

Development	Unit	Maximum parking rate
	Per 100m² GFA (for portion >7500m²)	0.5
	Per 100m² GFA office component	2.5
Warehouse/Distribution Centre	Per 100m² GFA	0.4
	Per 100m² GFA office component	1.43
Bulky Goods Retail	Per 100m² GFA	2.22
Restaurant or Cafe	Per 100m² GFA	10
	Every 3 employees	1

Table 5: Bicycle parking rates (minimums)

Development	Per	Minimum bicycle spaces
Residential		
Apartment Developments (Manor houses, residential flat buildings, shop-top housing)	Apartment	1 per 3 dwellings
	Visitor	1 per 12 dwellings
Employment		
Commercial/Industrial	Floorspace	For employees: 1 per 200 m² of GFA

3.4 Deep soil, tree canopy cover and street trees

3.4.1 Objectives

a. To maintain and enhance canopy cover to address urban heat, contribute to local amenity, reduce air pollution, support biodiversity and improve community health and wellbeing.

b. To ensure development provides sufficient deep soil to support healthy root system development and enable canopy trees to reach maturity.

c. To retain and protect existing trees, as far as is possible. Of particular importance are trees that provide potential habitat, shade and amenity.

d. For development to contribute to improving the diversity and abundance of locally endemic and native flora and fauna that adds to the area's natural characteristics.

e. To support and enhance the health of trees through appropriate irrigation (such as passive irrigation through WSUD approaches, or irrigation using non-potable water sources).

3.4.2 Controls – deep soil

1. Create contiguous deep soil zones within and between property boundaries to maximise tree planting / consolidate deep soil areas by establishing them right up to abutting boundary walls and fence lines.
2. Deep soil zones are to be provided in accordance with **Table 7**.
3. Minimum deep soil dimensions and criteria use the following deep soil definition:

   Deep soil is a landscaped area connected horizontally to the soil system and to the local ground water system beyond. It is unimpeded by any building or structure above or below ground with the exception of minor structures. Deep soil zones are to have a minimum dimension of 3m – this allows sufficient space for the planting and healthy growth of new trees that provide canopy cover and assist with urban cooling and infiltration of rainwater to the water table. Deep soil also allows for the retention of existing trees.*

   ** Minor structures are defined as*

   a) path, access ramp or area of paving with a maximum width up to 1.2m

   b) essential services infrastructure (such as stormwater pipes) with a maximum diameter up to 300mm

c) *landscape structures (such as lightweight fences, light poles or seating) requiring a footing with a maximum size of up to 300mm x 300mm in cross section.*

The 3m dimension in deep soil refers to 3m in every horizontal direction (length and width). This means deep soil areas are a minimum 9m2 (3m x 3m).

3.4.3 Controls – tree canopy

1. Private land should adopt the canopy cover % benchmark or tree planting rate in **Table 7**.
2. Tree planting is to be in accordance with Appendix D – Prescribed trees and preferred species of the BCC Growth Centre Precincts DCP.
3. Tree sizes should be aligned with **Table 6**.
4. Development should retain (where possible) and regenerate established vegetation and ensure new and existing vegetation protects and enhances biodiversity.

3.4.4 Controls – street trees

1. Street tree planting is to be in accordance with **Table 8**. Development shall not reduce the amount of canopy coverage provided.
2. Street trees should have appropriate soil volumes, subsoil drainage and setbacks from buildings, footpaths, road/kerb and gutters and services to provide sufficient space for root and canopy development.
3. Street trees are to be designed to be passively irrigated through the stormwater drainage system and maximise stormwater losses through evapotranspiration.
4. Street tree planting should be provided and integrate green and blue infrastructure in accordance with the NSW Government's *Movement and Place* framework.
5. Street trees are to be provided in a manner that minimises risk to utilities and services and comply with Council's Engineering Design and Construction specifications for installation of appropriate root barriers (where required).
6. Where possible, driveways should be designed to enable the doubling-up with neighbouring driveways, to enable longer uninterrupted sections of verge and deep soil zones.

Table 6: Tree size at maturity

Tree category	Minimum diameter spread	Minimum canopy area
Small tree	6m	28m^2
Medium tree	8m	50m^2
Large tree	12m	113m^2

Table 7: Urban tree canopy and deep soil minimum requirements for private land

Development Type	Lot Size	Canopy Cover*	Deep Soil	Tree Planting Rate*
Mixed Use	All lots	Development should be assessed on case-by-case basis, considering both the Apartment Design Guidelines and proposed setbacks. At a minimum, proponents should demonstrate maximised tree planting in deep soil zones, a no-net loss of canopy, and a contribution to strategic canopy targets.		
Detached Dwellings	<300 m^2	20%	20%	For every 200 m^2 of site area, or part thereof at least one small tree
	300 m^2 – 600 m^2	25%	25%	For every 250 m^2 of site area, or part thereof at least one medium tree
	>600 m^2	30%	30%	For every 350 m^2 of site area, or part thereof at least 2 medium trees or one large tree
Attached Dwellings, Dual Occupancies, Terraces (applied on each proposed dwelling)	< 150 m^2	15%	15%	At least one small tree
	150 m^2 – 300 m^2	20%	20%	For every 200 m^2 of site area, or part thereof at least one small tree
	> 300 m^2	25%	25%	For every 225 m^2 of site area, or part thereof at least one medium tree
Multi-Dwelling Housing	< 1,000 m^2	20%	20%	For every 300 m^2 of site area, or part thereof at least one medium tree
	1,000 m^2– 3,000 m^2	25%	25%	For every 200 m^2 of site area, or part thereof at least one medium tree

Development Type	Lot Size	Canopy Cover*	Deep Soil	Tree Planting Rate*
	> 3,000 m^2	30%	30%	For every 350 m^2 of site area, or part thereof at least 2 medium trees or one large tree
Apartments	See Objective 3E of the Apartment Design Guide.			
Urban Services *(Zone E3 Productivity Support)*	All lots	35%	25%	For every 300 m^2 of site area, at least 2 medium trees or one large tree
At-Grade Car Park	One medium tree should be planted in every fifth car parking space provided. The tree is to be in a planted zone of 13 m^2 – the equivalent of a car parking bay area. Trees should be evenly distributed in a chequerboard fashion to increase shading.			

***Development can meet urban tree canopy requirements by planting trees in line with the tree planting rate or by planting a combination of trees that achieve the minimum tree canopy percentage cover. The required number of trees that will meet minimum tree canopy percentage cover can be calculated by using the assumed canopy area of small, medium and large trees in Table 6.**

Table 8: Urban tree canopy requirements for public land

Public Domain Type	Description	Canopy Cover
Residential Streets (12 m – 20 m reserve)	Existing residential street with overhead powerlines	40%
	Existing residential street with underground powerlines	50%
	New residential street with underground powerlines	70%
Employment Streets (20 m – 25 m reserve)	New employment street with underground powerlines	60%
Open Space (< 5 hectares)	Without sports fields/courts	45%
	With sports fields/courts*	45%

Street tree spacing:

- **Within street settings with overhead power lines, small trees should be spaced at 7 m centres.**
- **Within street settings without overhead power lines, medium trees should be spaced at 10 m centres.**
- **Allow a 2 m offset between edge of driveways and centre of the tree on residential streets, and a 4 m offset from driveways on industrial streets.**

***Open space with fields/courts:**

- **Minimum 45% canopy cover target only applies to areas outside the courts and fields. Where possible, the remaining area should exceed the 45% minimum to compensate for any reduced canopy**

3.5 Urban heat management

3.5.1 Objectives

a. To ensure built form and open spaces (both public and private) are designed with measures that reduce the impact of high and extreme heat stress days on residents, workers, and visitors.

b. To manage urban heat island effects to provide a high level of comfort for residents, workers, and visitors throughout the year, with a focus on hot days and the summer period.

c. To reduce the contribution of development to the urban heat island effect through a suite of complementary design components.

3.5.2 Controls – public and private open space

1. Evaporative cooling is enabled through implementation of design initiatives and features, including through irrigation of private and public open spaces (preferably using harvested stormwater and/or recycled water) with 50% of grassed areas and 100% of trees irrigated.
2. Where possible, pavements are used which are permeable and have high albedo, resulting in less solar absorption. When using permeable pavers, it must be demonstrated that there is no impact on the salinity or sodicity of underlying soils.
3. For all residential developments, at least 50% of site landscape hard surfaces should be either cool pavements with a Solar Reflectance Index (SRI) of ≥50 or porous pavements, or a combination of both.
4. Public seating to have adequate shading.

3.5.3 Controls – building design

1. Orientate buildings to take advantage of prevailing winds, natural ventilation, and solar access.
2. Integrate green infrastructure into buildings, such as built-in planter boxes, green walls, and irrigation in open spaces.
3. Utilise design features such as low heat conductive materials, appropriate insulation, light coloured roofs and wider eaves or external shading devices on northern and western facades, to reduce passive internal heating of the building.
4. Placement of HVAC units is to consider the impact of heat rejection on habitable rooms and communal open spaces, including those of neighbouring properties.
5. To further minimise energy use, buildings can also use sub floor ventilation, and provide outdoor clothes drying facilities.

3.6 Open space, community facilities and recreation networks

The following objectives and controls apply to the land identified in **Figure** 14**: Open space network** and **Figure 16: Community facilities** and guide the development of public open space and community facilities in the precinct.

3.6.1 Objectives

1. To support the design and delivery of open spaces and public domain areas, community facilities, and recreation networks that:
    a. are inclusive, multifunctional, accessible, attractive, safe, equitable and comfortable,
    b. are well connected and encourage pedestrian and cycling access both within the precinct and to surrounding areas,
    c. protect and enhance local biodiversity, integrate existing vegetation, introduce new plantings of primarily locally endemic species, and provide connectivity with broader ecological networks,
    d. provide community facilities that serve as central gathering places, deliver essential services, and accommodate planned population growth in the precinct, and
    e. are financially sustainable to construct and maintain.

3.6.2 Controls

1. Open space must generally be in accordance with Figure 14: Open space network.
2. Open space and recreation networks are to be designed to:
    a. Provide diverse play spaces for various age groups.
    b. Include provision of parking, lighting, and waste management facilities where relevant and in a quantity that is proportional to the intended design and use of the spaces.
    c. Incorporate interpretative signage (local history, Aboriginal culture, environmental education).
    d. Align with the *Landscape design guidelines for development* suite of documents by Blacktown City Council, and adopted Section 7.11 contributions plan.
    e. Integrate remnant vegetation and link with riparian corridors where appropriate.
    f. Align with street borders and house orientation to promote passive surveillance.
    g. Integrate into existing regional active transport networks, and be designed to integrate into future active transport networks, such as those planned as part of the Garfield Road upgrade, Townson to Burdekin Road Connection, and between the North West Growth Area and the Western Sydney Parklands.

3. Open space, community facilities and recreation networks are to be designed utilising the *Connecting with Country Framework* (Government Architect NSW, 2023).
4. Fencing adjoining public open space should be low and transparent promoting surveillance, amenity and connectivity.
5. Riparian corridors can incorporate pedestrian paths and cycleways, and include themed elements such as boardwalks, eco-pathways, and educational tracks.
6. Regional parklands should incorporate pedestrian paths and cycleways, fitness trails, and passive recreation facilities, and can include themed elements such as boardwalks, eco-pathways, and educational tracks.
7. Interfaces between riparian corridors, open spaces, drainage basins and ponds, and road reserves are designed to provide clear visual demarcation of uses while providing a consistent design approach.

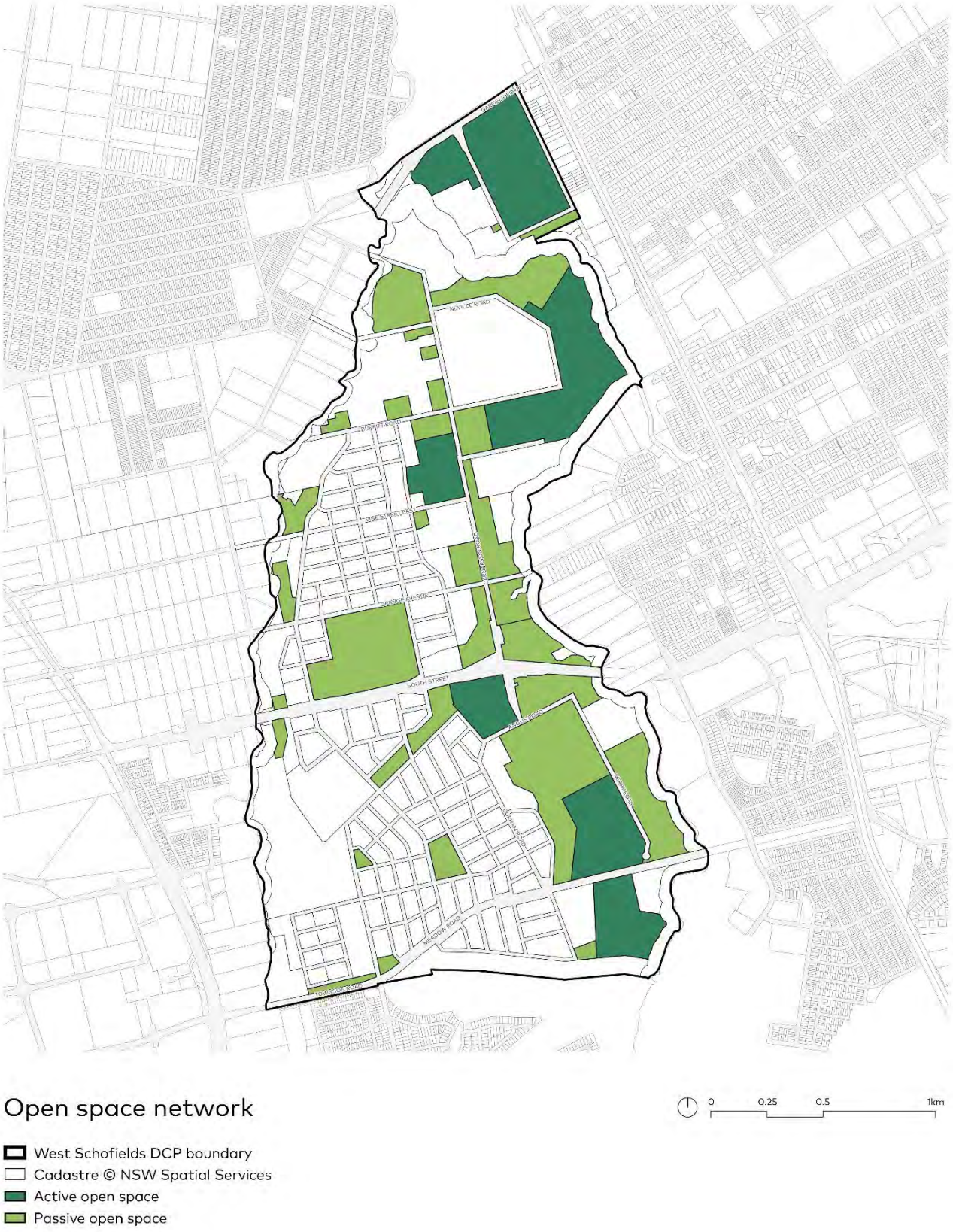

Figure 14: Open space network

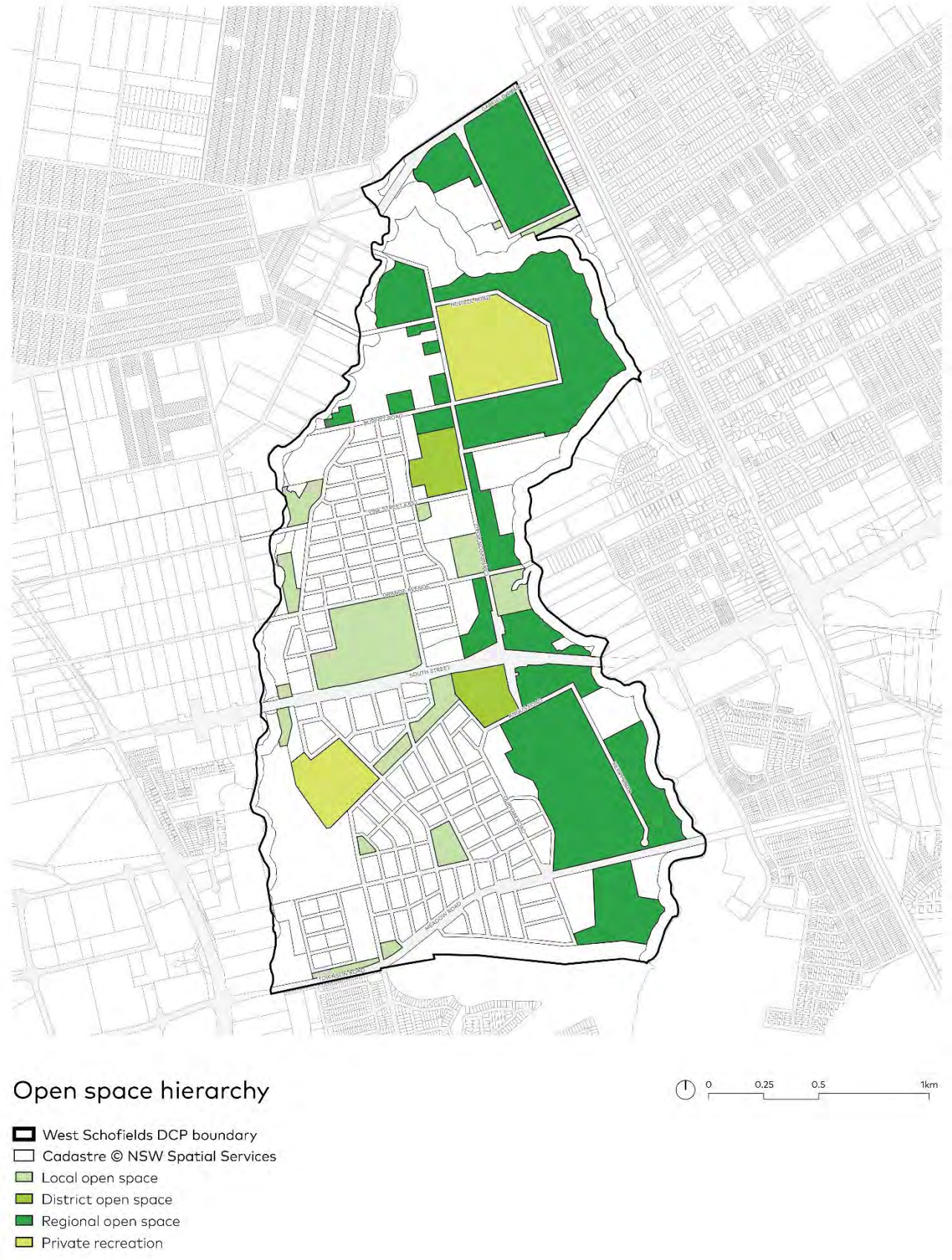

Figure 15: Open space hierarchy

Figure 16: Community facilities

3.7 Sustainability

3.7.1 Objectives

a. Improve indoor and outdoor air quality by minimising the release of air pollutants associated with the on-site combustion of gas.

b. Reduce construction and operational costs by removal of the need to provide gas infrastructure and ongoing connection charges.

3.7.2 Controls

1. All new residential developments, and mixed-use developments including a residential component, must only use electricity for all energy requirements associated with normal operation.

2. Where a mixed-use development includes a food and beverage premises, a gas connection may be provided exclusively for those premises, provided that:

    a. only the food and beverage premises are provided the gas connection, and all other components of the development are all-electric, and

    b. the premises are designed with an embedded electrical infrastructure to enable future electrification.

3. Rooms of residential developments where residents are likely to spend large amounts of time (such as bedrooms, studies, lounge rooms, living rooms, and dining rooms) are encouraged to each have a ceiling fan installed.

Note: The provision of these clauses is consistent with Blacktown City Council's *Low carbon emissions Blacktown City plan*, as adopted by the Council at their Ordinary Meeting held on 21 February 2024.

4 Development in the residential zones

This part provides additional controls to those set out in Part 4 Development in the residential zones of the BCC Growth Centre Precincts DCP.

Table 9 to **Table 13** override tables 4-2 to 4-5 and 4-9 to 4-10 within the BCC Growth Centre Precincts DCP 2010 for land subject to this schedule. **Figure 17** to **Figure 20** should be read in conjunction with **Table 9** and **Table 10** – both the controls in the relevant figure and its corresponding table are to be met.

For all parts of this section, the following notes apply:

- A car space may include a garage, carport or other hardstand area constructed of materials suitable for car parking and access. The required car parking spaces specified above may be provided using a combination of these facilities, including use of the driveway (within the property boundary only) as a parking space.
- A driveway crossover refers to the section of driveway from the edge of the road surface to the boundary of a property, i.e. the portion of the driveway located within the road reserve.

4.1 Minimum 450 m² lots – detached dwellings

The controls that apply to detached dwellings on lots with a minimum area of 450 m² are shown in **Figure 17**. Additional controls are contained in **Table 9**.

Typical Lot Layout -
Detached Dwelling, Min. 450m2 Lots Zones
*(*also applies to detached lots with double garages)*

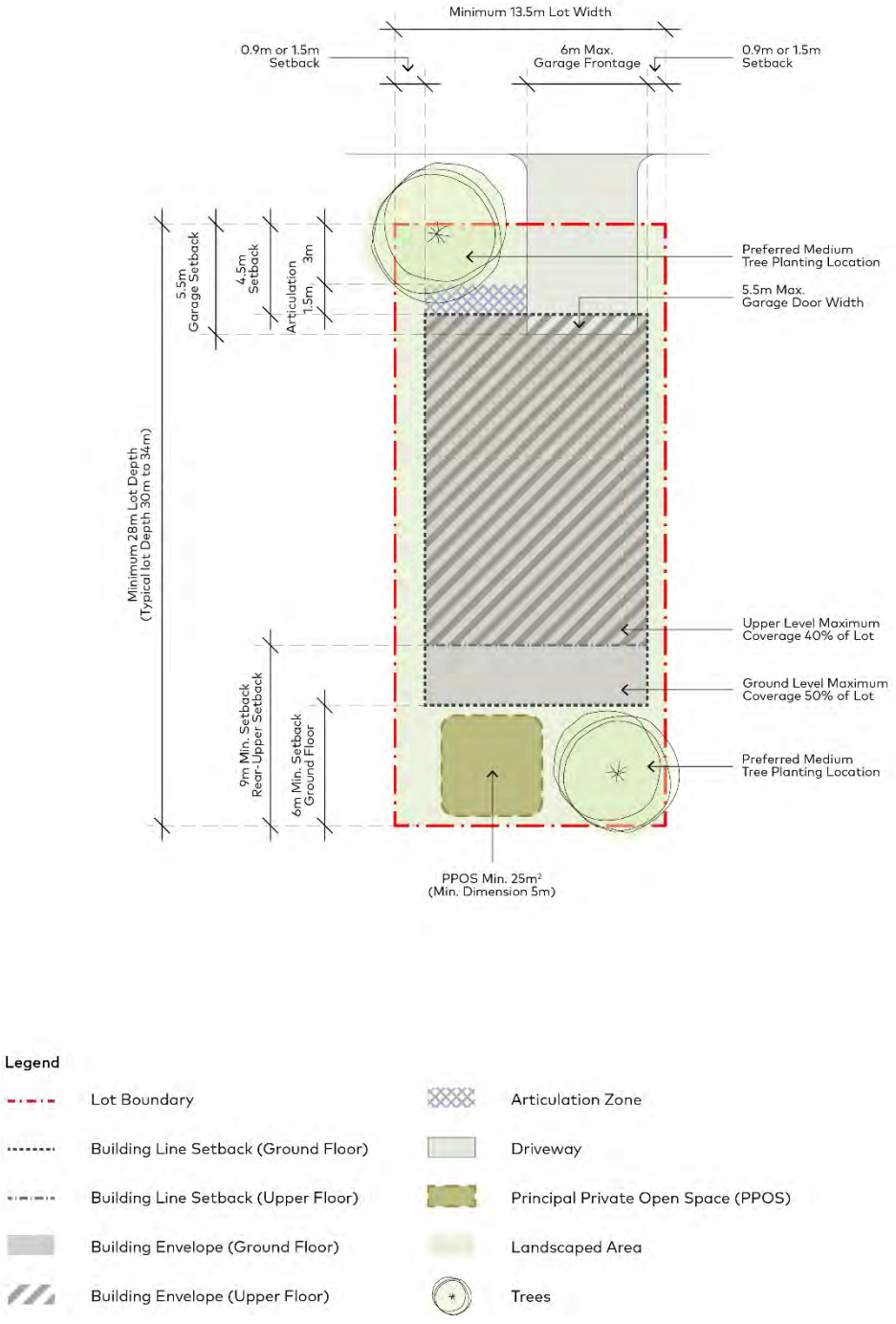

Figure 17: Controls for a minimum 450 m² lot with a detached dwelling

Table 9: Additional controls for a minimum 450 m² lot with a detached dwelling

Elements		Controls	
Setbacks	Side	0.9m minimum one side, 1.5m minimum other side 2.4m minimum total	
Articulation zone	Size & scale	45% maximum of building frontage width	
Landscaping	Overall area	45% minimum	% of total lot area
	Permeable	30% minimum	
	Impermeable	15% maximum	
Principal Private Open Space (PPOS)	Solar access	50% of the area of the required PPOS (of both the proposed development and adjoining properties) should receive at least 3 hours of sunlight between 9 am and 3 pm at the winter solstice (21 June)	
	Location & Qualities	Preferred location shown in **Figure 17**	
		Directly accessible from at least one habitable room in the dwelling, excluding bedrooms – i.e. a living area.	
		Area is to be unobstructed	

4.2 Minimum 450 m^2 lots – detached dwellings on corner lots

The controls that apply to detached dwellings on a corner lot with a minimum area of 450 m^2 is shown in **Figure 18**. Where specific controls are not included in **Figure 18**, the additional controls in **Table 9** above apply.

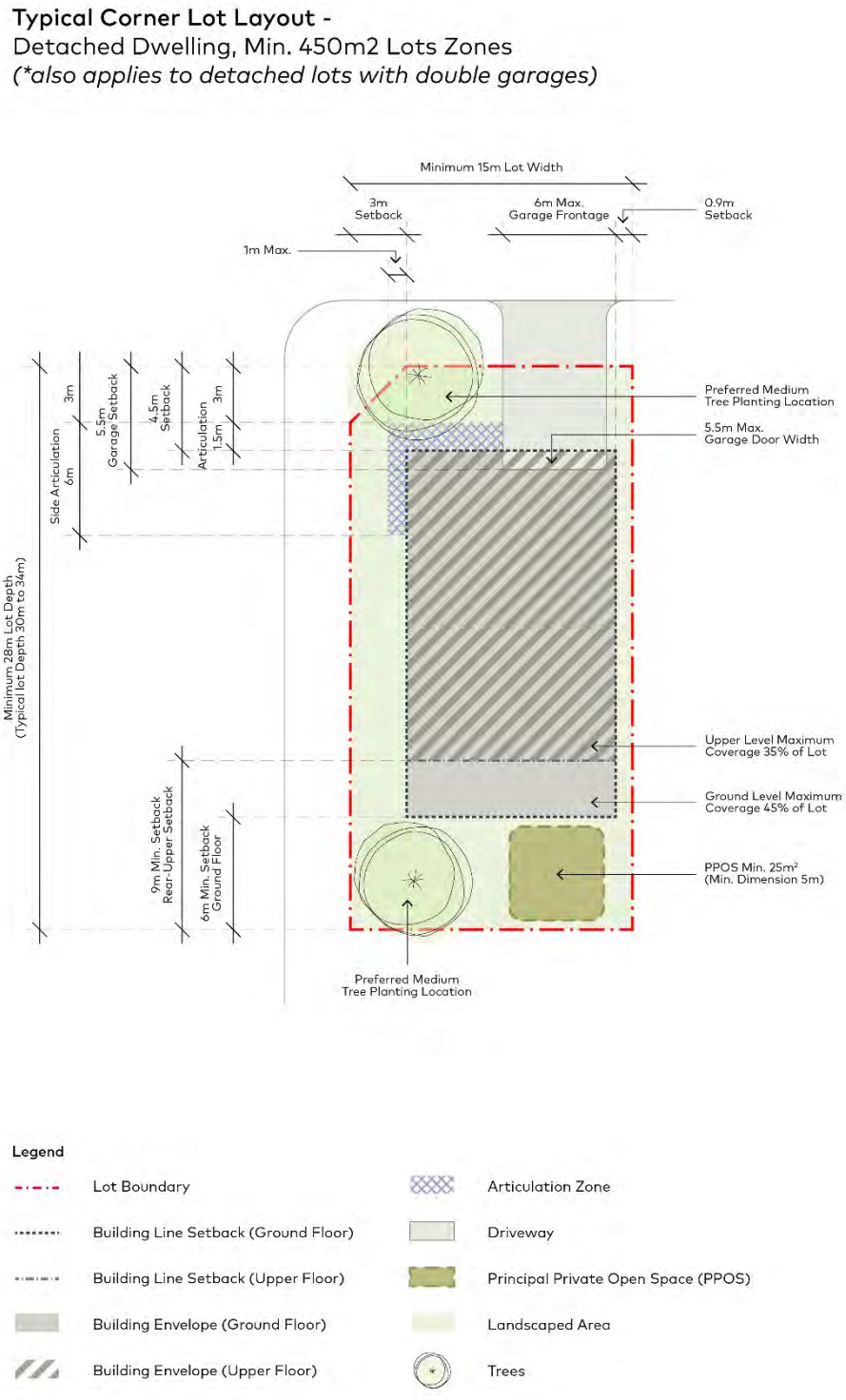

Figure 18: Controls for a minimum 450 m^2 corner lot with a detached dwelling

4.3 Minimum 330 m² lots – detached dwellings

The controls that apply to detached dwellings on lots with a minimum area of 330 m² are shown in **Figure 19**. Additional controls are contained in **Table 10.**

Typical Lot Layout -
Detached Dwelling, Min. 330m2 Lots Zones
*(*also applies to front-loaded detached lots in denser zones)*

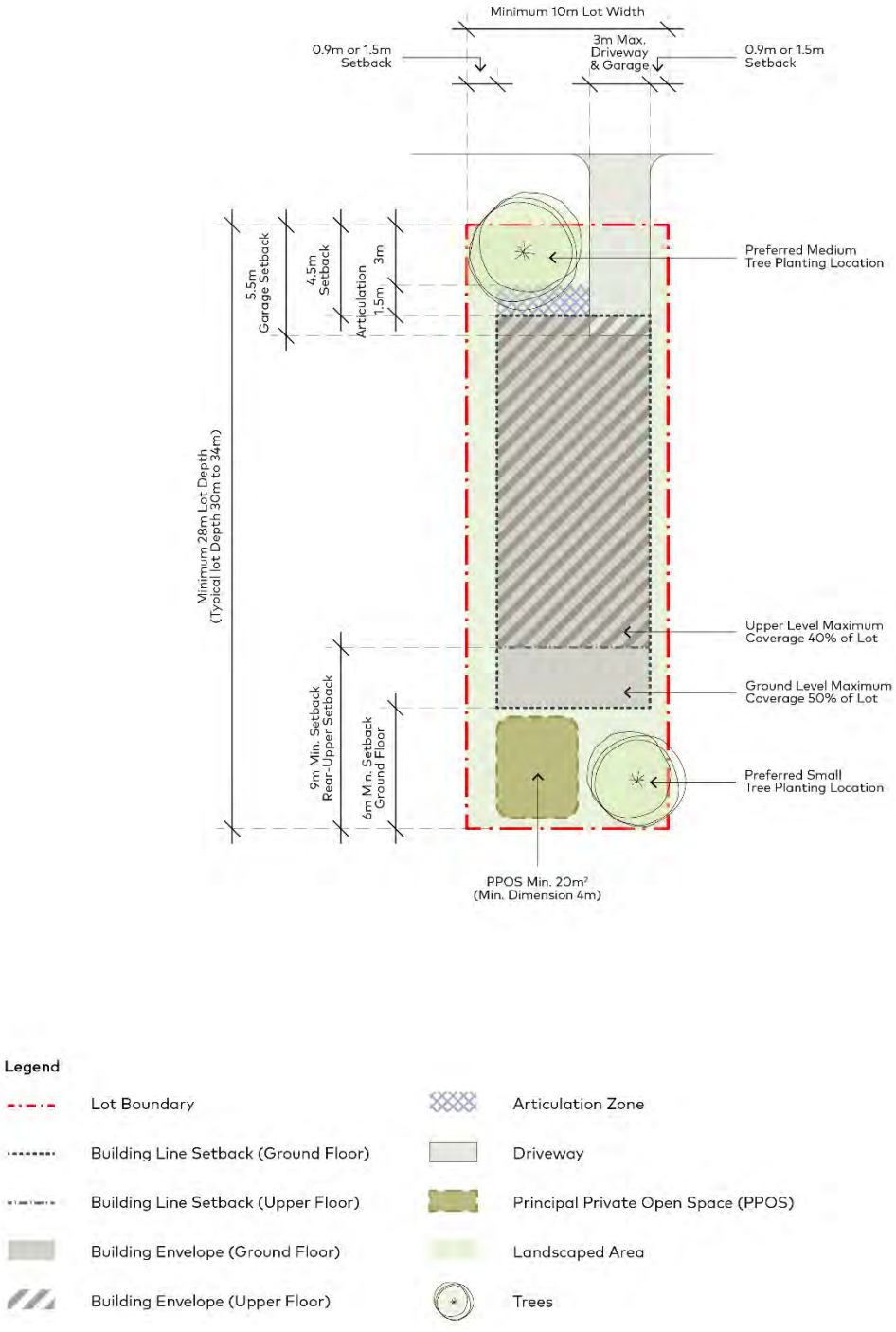

Figure 19: Controls for a minimum 330 m² lot with a detached dwelling

Table 10: Additional controls for a minimum 330 m² lot with a detached dwelling

Elements		Controls	
Setbacks	Side	0.9m minimum one side, 1.5m minimum other side 2.4m minimum total	
Articulation zone	Size & scale	45% maximum of building frontage width	
Landscaping	Overall area	45% minimum	% of total lot area
	Permeable	26% minimum	
	Impermeable	19% maximum	
Principal Private Open Space (PPOS)	Solar access	50% of the area of the required PPOS (of both the proposed development and adjoining properties) should receive at least 3 hours of sunlight between 9am and 3pm at the winter solstice (21 June)	
	Location & Qualities	Preferred location shown in **Figure 19**.	
		Directly accessible from at least one habitable room in the dwelling, excluding bedrooms – i.e. a living area.	
		Area is to be unobstructed.	

4.4 Minimum 330 m^2 lots – detached dwellings on corner lots

The controls that apply to detached dwellings on a corner lot with a minimum area of 330 m^2 is shown in **Figure 20**. Where specific controls are not included in **Figure 20**, the additional controls in **Table 10** above apply.

Typical Corner Lot Layout -
Detached Dwelling, Min. 330m2 Lots Zones
*(*also applies to front-loaded detached lots in denser zones)*

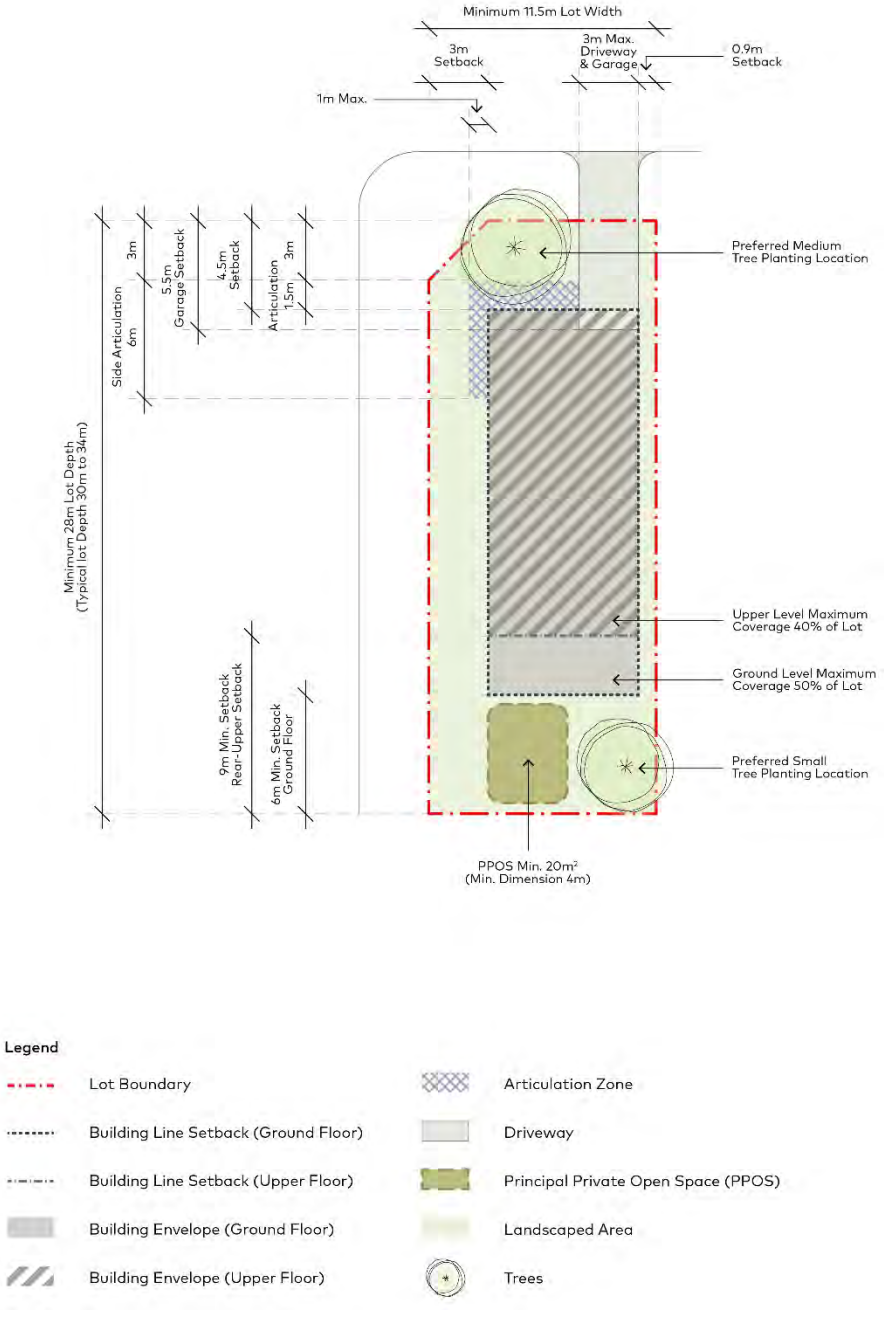

Figure 20: Controls for a minimum 330 m^2 corner lot with a detached dwelling

4.5 Attached or abutting dwellings

1. Attached dwelling sites will have direct frontage to a public road.
2. Attached or abutting dwellings are not permitted on battle-axe lots.
3. Garages for attached dwellings will be located at the rear of the lot.
4. Where attached dwellings have frontage to a connector street, all vehicle access and parking is to be located at the rear of the lot.
5. Driveways, manoeuvring areas, parking areas and garages will be located away from bedrooms.
6. Traffic calming measures should be provided to ensure a safer vehicle and pedestrian environment where attached or abutting dwellings are located.
7. Each dwelling will provide a minimum storage area of 8m^3 either within the dwelling or garage. This space is to be provided exclusively for storage purposes and will be provided in addition to any garage space.
8. Attached or abutting dwellings are to be designed in accordance with the controls in **Table 11**.

Table 11: Summary of controls for attached or abutting dwellings

Element	Control	
Front setback (minimums)	4.5m to building façade line 3.5m to building façade fronting open space 3.0m to articulation zone 2.0m to articulation zone fronting open space	
Side setback (minimums)	Zero Lot, Attached or Abutting Boundary (benefited lot) Ground floor: 0m Upper floor: 0m	Detached Boundary 0.9m. If lot burdened by zero lot boundary, side setback will be within easement: 0.9m (single storey zero lot wall) 1.2m (double storey zero lot wall)
Maximum length of zero lot line on boundary	Attached/abutting house: 18m (excludes rear loaded garages) upper levels only. No limit to ground floor.	Zero lot house: 18m (excludes rear loaded garages)

Element	Control
Rear setback (minimum)	0.5m (rear loaded garages to lane, zero to articulation zone)
Corner lots secondary street setback (minimum)	1.0m with articulation
Solar access	At least 3 hours of sunlight between 9am and 3pm at the winter solstice (21 June) to at least 50% of the required PPOS of both the proposed development and the neighbouring properties.
	For alterations and additions to existing dwellings, no reduction in the existing solar access to PPOS of the existing neighbouring properties.
Deep soil and tree planting	As per Section 3.4 of this document
Garages and car parking	Rear loaded garage or car space only for lots of this type. Maximum garage width 3m (single) and 5.5m (double).

4.6 Multi-dwelling housing

1. Multi-dwelling housing will comply with the controls in **Table 12**.
2. Multi-dwelling housing sites will have direct frontage to a public road (i.e. not on battle-axe lots).
3. Multi-dwelling housing will provide a clear delineation between private areas (open space, private front and side yard areas, private car parking spaces) and communal open space and car parking.
4. A minimum of one in every 5 dwellings within multi-dwellings housing developments will be adaptable in accordance with *Australian Standard AS 4299-1995 – Adaptable Housing* (or the latest version thereof). The adaptable design will also apply to:
    a. car parking,
    b. main entry,
    c. an access path linking the main entry and car parking and the street,
    d. private open space, and
    e. outside utility spaces (clothes drying, garbage storage and the like).

5. A Landscape Plan produced by a suitably qualified person is to be submitted with every application for multi-dwelling housing.

Table 12: Summary of controls for multi-dwelling housing developments

Element	Controls
Site coverage (maximum)	50%
Landscaped area (minimum)	30% of site area
Principal Private Open Space (PPOS)	Minimum 16m^2 with minimum dimension of 3m. 10m^2 per dwelling if provided as balcony or rooftop with a minimum dimension of 2.5m
Front setback (minimums)	4.5m to building façade line 3.0m to articulation zone
Corner lots secondary street setback (minimum)	2m
Side setback (minimum)	Ground and upper floors: 0.9m
Rear setback (minimums)	4.5m (excluding rear lane garages) to ground floors 6m to upper floors 0.5m to rear lane where garage provided
Zero lot line	Not permitted on adjacent lot boundaries (except rear lane garages)
Internal building separation distance (minimum)	5m (unless dwellings are attached by a common wall)
Deep soil and tree planting	As per Section 3.4 of this document

Element	Controls
Garages and car parking	Car parking spaces to be behind building line or garages fronting the street to be set back a minimum of 1m from the building setback Where garages front the street, the maximum width of a garage door is 5.5m and each garage is to be separated by a dwelling façade or landscaped area Garages and car parking dimensions (minimums): • Covered: 3m x 5.5m • Uncovered: 2.5m x 5.2m • Aisle widths will comply with AS 2890.1

4.7 Residential flat buildings, manor homes, and shop-top housing

1. All residential flat buildings, manor homes and shop top housing will be consistent with the design quality principles outlined in *State Environmental Planning Policy (Housing) 2021* (which contains the former *State Environmental Planning Policy No 65 – Design Quality of Residential Apartment Development* (SEPP 65)) and the objectives, design criteria and design guidance outlined in the Apartment Design Guide (or equivalent).
2. Each apartment is to be provided with a principal private open space that meets or exceeds the minimums in **Table 13**.

Table 13: Principal private open space minimums for apartment dwellings

Dwelling type	Minimum area	Minimum depth
Studio	4 m^2	N/A
1 bedroom	8 m^2	2 m
2 bedroom	10 m^2	2 m
3+ bedroom	12 m^2	2.4 m
Apartment at ground level or on podium (or similar)	15 m^2	3 m

4.8 Landscaped areas and plantings for residential developments

4.8.1 Objectives

a. To provide amenity for residents and visitors, private open space, landscaped areas, and tree canopy coverage are to be provided in all residential developments.

b. To preserve and retain existing mature native vegetation wherever practicable.

c. To ensure a balance between built and landscaped elements in residential areas.

d. To create and support the desired street character.

e. To provide a mix of canopy trees, shrubs, and groundcover to manage effects of urban heat and support environmentally sensitive design.

4.8.2 Controls

1. The location of principal private open space (PPOS) is to be determined in detailed design. The location and alignment of the PPOS is to have regard to dwelling design, orientation, adjoining dwellings, landscape features, and topography.
2. The PPOS will be directly accessible from a main living room of a dwelling or alfresco area and have a maximum gradient of 1:10.
3. The PPOS is to be unobstructed by services or utilities, such as clotheslines, waste services, garbage bins, water tanks, sheds or other similar structures.
4. Synthetic or artificial grass is not to be included in permeable landscaped area calculations.

5 Centres development controls

This part provides additional controls to those set out in Part 5 Centres development controls of the BCC Growth Centre Precincts DCP.

5.1 West Schofields South – Local Centre

5.1.1 Desired Future Character Statement

The local centre for West Schofields will be located on the north side of Meadow Road, which forms part of the alignment for the future Townson to Burdekin Road Connection. The local centre will support the daily and weekly needs of the West Schofields community, provide a focal point for local activity, and include a community facility.

To create a village atmosphere the local centre should incorporate a range of small-scale shops anchored by a supermarket, with shop top housing above. To provide amenity and reduce trip generation, the local centre will connect and interact with the adjoining park, and a community facility which is desirably co-located with the local centre. A well-designed streetscape and landscaped areas will create vibrant and high-quality pedestrian amenity.

Townhouses, terraces and other medium density dwellings surround the local centre to encourage activity and vibrancy and the local centre will maintain visual cohesion with the surrounding low and medium density housing in terms of height, bulk and scale. The design and scale of the local centre will reinforce its support role in the hierarchy of centres for the region. Safe and direct pedestrian connections to the surrounding area will promote walkability within the neighbourhood.

Car parking will not detract from the amenity or aesthetic of the village centre and can be located to the side or incorporated beneath the shops as basement parking.

5.1.2 Objectives

a. To enable the delivery of a local town centre which will support the daily and weekly goods and services needs of the local community.

b. To encourage a layout of the local centre which connects with the adjoining local park.

c. To encourage cycling and walking to and around the local centre by creating a low-speed, pedestrian-friendly street network.

5.1.3 Controls

1. The West Schofields local centre is to be located generally in accordance with the area marked as 'Local Centre/Shop-top Apartments' on the final Indicative Layout Plan at **Figure 2**, and consistent with the design guidance shown in **Figure 21:** Desired future layout of the local centre.
2. As per **Section 3.2 Movement network** of this guide, the street network within the local centre area is to use the 'Destination High Street' street typology from the *Western Sydney Street Design Guidelines, Second Edition* (Western Sydney Planning Partnership, April 2025), which is provided at **Appendix A**.
3. The bulk and scale of buildings is to be compatible with the surrounding residential development.
4. There should be no adverse impact on the amenity of the surrounding residential precinct because of development within the local centre.
5. Shop-top apartments are to provide passive surveillance over the neighbouring park and the public areas of the local centre.
6. Active frontages are to be provided on all frontages marked on **Figure 21**.
7. Publicly accessible cycle racks should be provided at the rate of 1 bicycle space per 300 m^2 of retail Gross Floor Area (GFA). They should be located throughout the local centre in places near major entries, and in areas which are well lit and have good nearby foot traffic and passive surveillance, to provide security.
8. A community facility is to be provided consistent with the location, size, and design considerations set out in **Figure 21**. It is to also:
    a. Have a strong ground floor presence, including an accessible and prominent primary entry, and large active facades that provide a connection between the facility and the surrounding public domain outside.
    Note: *A facility can either be provided all on the ground floor or vertically over more than one level, but regardless this control is to be met.*
    b. Apply Crime Prevention Through Environmental Design (CPTED) principles.

Note: *The community facility is to be designed in conjunction with council, to meet their specifications for community facilities. The specific use/s of the facility (e.g. library, community meeting rooms, workshop/maker spaces, gallery spaces, performance spaces, etc.) will be determined by council based on the needs of the current and expected future surrounding population.*

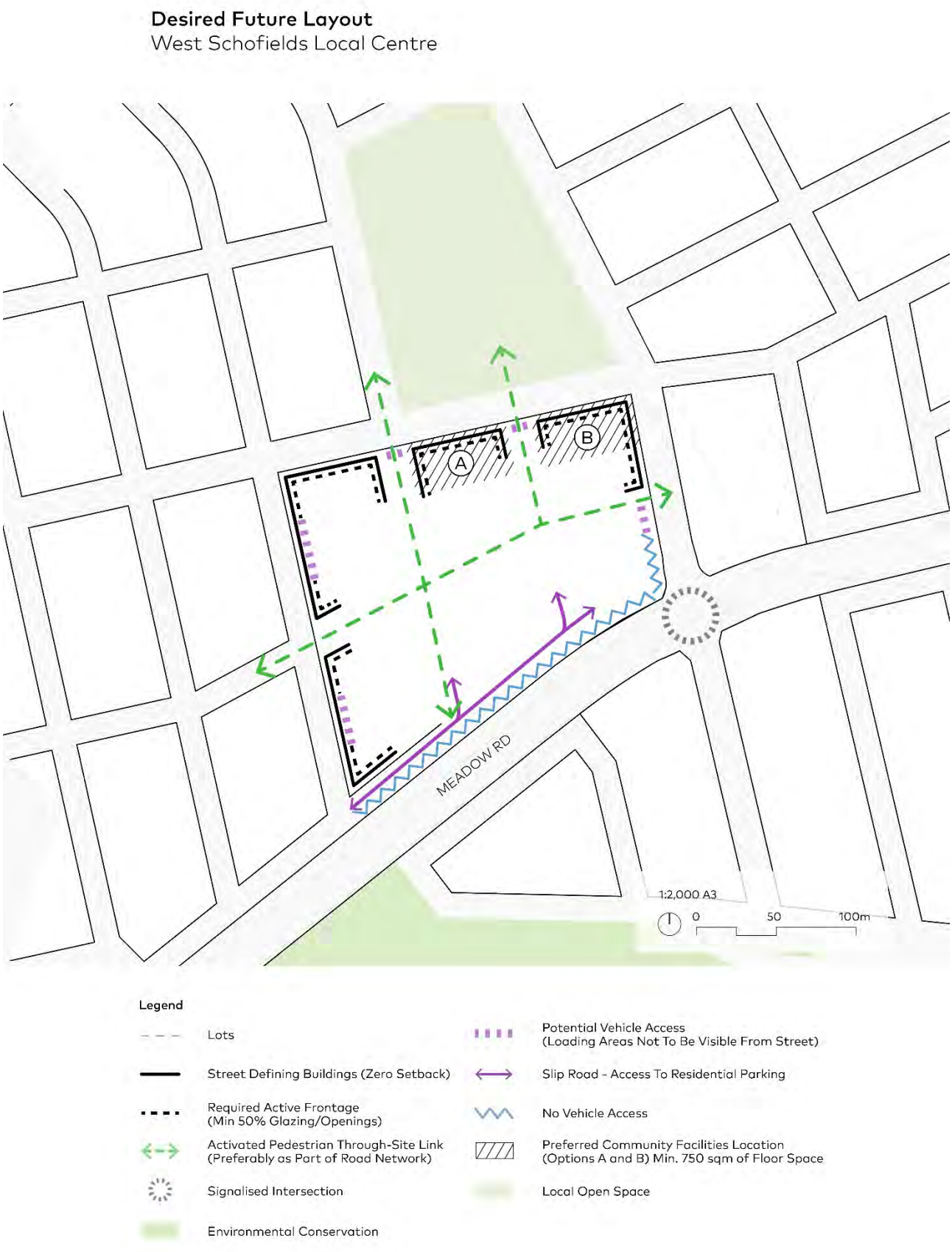

Figure 21: Desired future layout of the local centre

5.2 West Schofields North – Neighbourhood Centre

5.2.1 Desired Future Character Statement

The neighbourhood centre in the northern part of West Schofields will be a small set of shops that support the daily needs of the surrounding community. It will increase convenience and activity for the residents in the part of West Schofields that is north of South Street, by providing shops within walking distance to meet their small shopping needs. Potential retail offerings could include a convenience store, café, other eatery, or services related to the nearby sports fields.

5.2.2 Objectives

a. To enable the delivery of a local neighbourhood centre which will support the daily goods and services needs of the local community.

b. To encourage a neighbourhood centre which is of a bulk, scale, and design which responds to its context of the adjoining active and passive open space and low-density residential, and enhances the amenity of those spaces.

c. To encourage walking and cycling to the neighbourhood centre by integrating it with the surrounding active transport network.

5.2.3 Controls

1. The West Schofields local centre is to be located generally in accordance with the area marked as 'Neighbourhood Centre' on the final Indicative Layout Plan at **Figure 2**, and consistent with the design guidance shown in **Figure 22:** Desired future layout of the neighbourhood centre.
2. The bulk and scale of buildings is to be compatible with the surrounding residential development.
3. There should be no adverse impact on the amenity of the surrounding residential precinct because of development within the local centre.
4. The neighbourhood centre should present active frontages to the surrounding open space areas, as shown in **Figure 22**.
5. A community facility is to be provided consistent with the location, size, and design considerations set out in **Figure 22**, and the relevant controls in **Section 5.1.3** above.

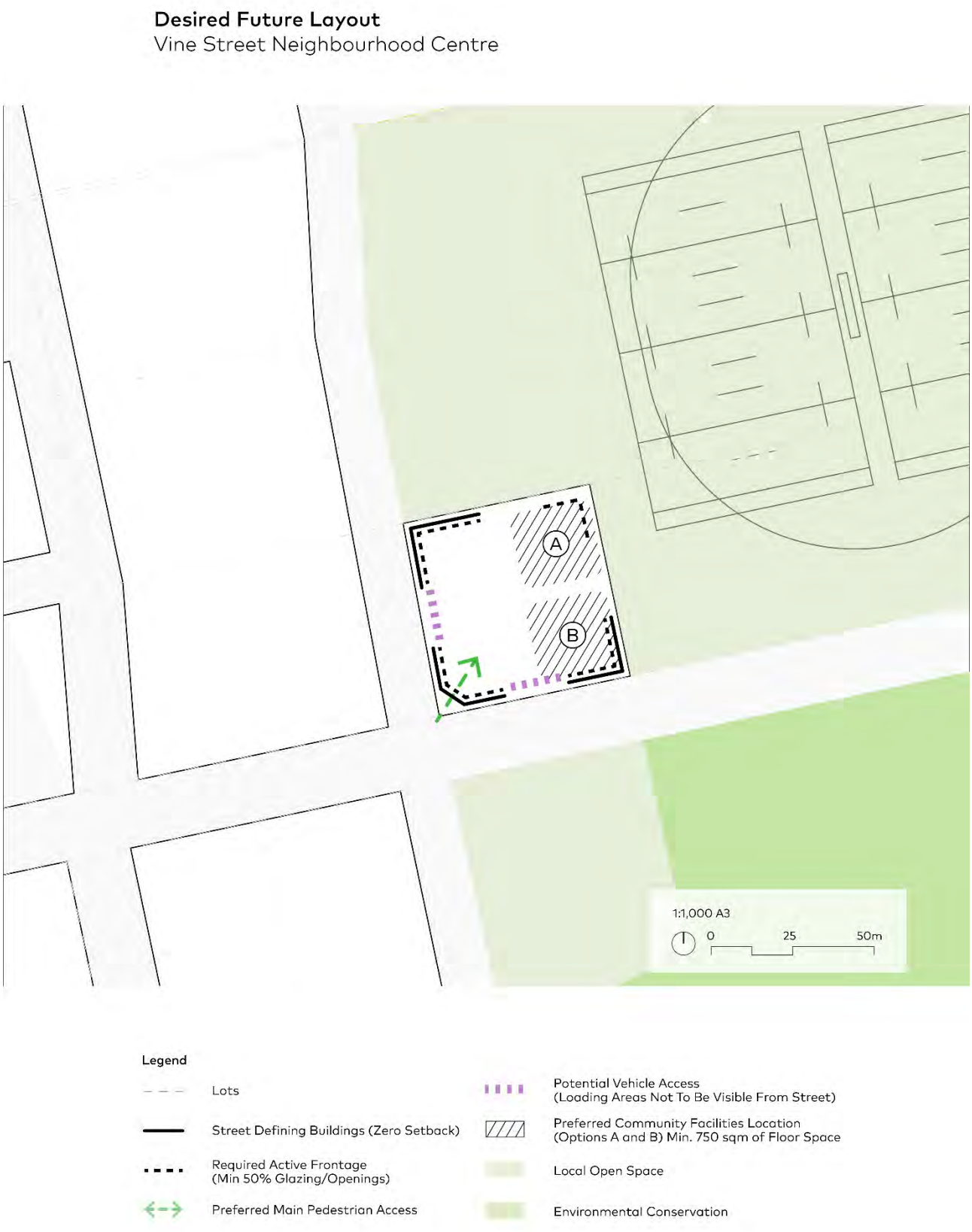

Figure 22: Desired future layout of the neighbourhood centre

6 Employment lands subdivision and development controls

This part provides additional controls to those set out in Part 6 Employment lands subdivision and development controls of the BCC Growth Centre Precincts DCP.

6.1 Urban services centre – Desired Future Character Statement

The urban services centre will be a lively and diverse precinct with a range of low-impact employment uses. It will provide an area for a variety of businesses that supply important goods and services to meet the needs of the surrounding residents and workers, but which need more space than can be accommodated in a retail centre. This could include businesses such as mechanics, hardware and garden centres, small-scale food and drink manufacturers (such as coffee roasters, cheese makers, and microbreweries and microdistilleries), large-format retail, light industries, and recreation facilities.

Wide streets and the urban service centre's strategic position along South Street provides easy access for delivery vehicles and for customers coming from both within West Schofields and the broader north-west Sydney region. The centre's location between South Street and the electricity easement creates a level of containment that will enable the precinct to develop a distinct locational identity, while providing a buffer between the centre and surrounding residential areas.

6.2 Additional controls

1. A 7.5 m setback is to be provided from lot boundaries which adjoin South Street. This setback is to be landscaped in accordance with the controls in **Section 2.7**.
2. Car and bicycle parking is to be provided in accordance with the rates set in **Section 3.3**.

7 Site specific controls

7.1 Residential development adjacent to transmission easements

In addition to the objectives and controls contained in Section 4.3.1 Residential development adjacent to transmission easements of the BCC Growth Centre Precincts DCP, the following additional controls apply to land containing or adjacent to easements for electricity.

7.1.1 Additional controls

1. Where development is proposed on land containing or adjacent to easements, applicants are to consult with the organisation responsible for the management of the easement as part of the process of preparing subdivision or other development plans. Any written requirements of the infrastructure organisation are to be submitted with the Development Application, and the Development Application documentation is to demonstrate how the requirements have been addressed in the design.
2. Road crossings of the easement are to be minimised, to be generally in the locations shown on the Precinct Indicative Layout Plan and are to be designed in accordance with any requirements issued by the organisation responsible for the management of the infrastructure.
3. Earthworks (excavation or filling) and landscaping within easements are subject to conditions and requirements of the infrastructure organisation and other regulatory controls in Blacktown City Council Growth Centres DCP 2010, as amended.
4. Subdivision of easements is to be minimised.
5. Requirements of the infrastructure organisation in relation to access to easements for inspections and maintenance are to be addressed in the design of the development. Access to the easement from public land (e.g. roads, open space or drainage land) is preferable.

7.2 Development near former landfill sites

There are 3 known former landfill sites within the West Schofields precinct:

- **22-82 Neville Road, Schofields**
  - Referred to as the 'Neville Road former landfill'
  - The landowner at time of writing is Veolia Environmental Services (Australia) Pty Ltd
  - The site covers lots 58, 62, 66, and 69 of DP1358.
- **Grange Avenue Reserve, Schofields:**
  - Referred to as the 'Grange Avenue former landfill'
  - The landowner is Blacktown City Council
  - Currently used as a publicly accessible reserve
  - The site covers lots 7-12, section G of DP193074, and lots 204-211 of DP1204436.
- **75 Townson Road, Schofields:**
  - Referred to as the 'Townson Road former landfill'
  - The landowner at time of writing is CSR Building Products Limited
  - The site is located within the northern section of lot 3 of DP232574.

There is potential that contamination from these sites has spread to surrounding areas. To ensure human and environmental safety, additional testing and studies is required for new development proposals on or near to these sites.

7.2.1 Objectives

a. To ensure that land in proximity to former landfill sites within the precinct can be safely used for the desired purposes without impacting on human or environmental health.

7.2.2 Controls

1. Development consent must not be granted for development on the Neville Road or Grange Avenue former landfill sites, or land within 250 metres of the property boundaries of these sites (as shown on **Figure 23**), unless the consent authority is satisfied that the former landfill site and/or surrounding lands can be made suitable for the proposed land uses. This includes structures and users of those structures such as subsurface utilities, excavations and developments with basements and that the structures and users of the structures can be protected from exposure to contamination including hazardous ground gases. A "Section B" site audit statement prepared by a NSW EPA accredited site auditor must be provided to the consent

authority to certify the former landfill and/or surrounding land can be made suitable for the proposed uses.

The consent authority must be satisfied that any protection measures and/or land use restrictions proposed to be incorporated into the design of any future development to mitigate risks can be legally enforced including how any protection measures can be prevented from being compromised after the development occurs, for example by intrusive works under exempt and complying development provisions.

Mitigation measures and/or land use restrictions may not be required if further assessment demonstrates they are not necessary to ensure the former landfill and/or surrounding land are suitable for the proposed uses. The assessment should include:

a. confirmation of background conditions and the influence of any non-landfill hazardous gas sources

b. continuous gas monitoring of the site over a sufficient period to confidently capture worst case barometric fluctuations

c. modelling of the preferential ground gas migration pathways under likely worst case barometric fluctuations

d. assessment of the installation and monitoring of offsite wells to verify modelled distances

e. the need for any hazardous ground gas 'pathway intervention' devices to mitigate offsite risks.

The consent authority must ensure all further assessments, remedial/management works, and validation works are reviewed by a NSW EPA accredited site auditor to ensure the work complies with current regulations and guidelines and meets the standard appropriate for the proposed land uses. A "Section A" site audit statement prepared by a NSW EPA accredited site auditor must be provided to the consent authority after the remedial/management works and validation works have been completed to certify the landfill and/or surrounding lands are suitable for the proposed uses.

2. Development consent must not be granted for development on the Townson Road former landfill site or land within 250 metres of the Townson Road former landfill boundary (as shown on **Figure 23**) unless the consent authority is satisfied that the former landfill site and surrounding lands can be made suitable for the proposed land uses. This includes structures and users of those structures such as subsurface utilities, excavations and developments with basements and that the structures and users of the structures can be protected from exposure to contamination including

hazardous ground gases. The consent authority must be satisfied the following has been provided or will be provided prior to development of the land:

a. a “Section B” site audit statement by a NSW accredited site auditor which certifies a Remedial Action Plan for the proposed hazardous ground gas ‘pathway intervention’ device around the entire perimeter of the former landfill footprint, as well as any other remedial or mitigation measures and/or development restrictions required, will ensure the land surrounding the former landfill is suitable for the proposed sensitive land use.

b. a “Section B” site audit statement by a NSW accredited site auditor which certifies a Remedial Action Plan for the former landfill will ensure the former landfill will be suitable for the proposed recreational uses.

c. preparation and submission to the consent authority for approval an Environmental Management Plan which has been reviewed and certified as appropriate by a NSW accredited site auditor for the ‘in perpetuity’ management of the landfill site to ensure the suitability of the site for recreational uses and any adjoining sensitive land uses continues. The consent authority must be satisfied the Environmental Management Plan can be legally enforced including how any protection measures can be prevented from being compromised after the development occurs, for example by intrusive works under exempt and complying development provisions.

d. if required, preparation and submission to the consent authority for approval an Environmental Management Plan which has been reviewed and certified as appropriate by a NSW accredited site auditor for the management of any mitigation measures located on the land surrounding the former landfill to ensure the suitability of the land for the proposed use. The consent authority must be satisfied the Environmental Management Plan can be legally enforced including how any protection measures can be prevented from being compromised after the development occurs, for example by intrusive works under exempt and complying development provisions.

The consent authority must ensure all further assessments, remedial/management works, and validation works are reviewed by a NSW EPA accredited site auditor to ensure the work complies with current regulations and guidelines and meets the standard appropriate for the proposed land uses. “Section A” site audit statements prepared by a NSW EPA accredited site auditor must be provided to the consent authority after the remedial/management works and validation works have been

completed to certify the landfill and surrounding lands are suitable for the proposed uses.

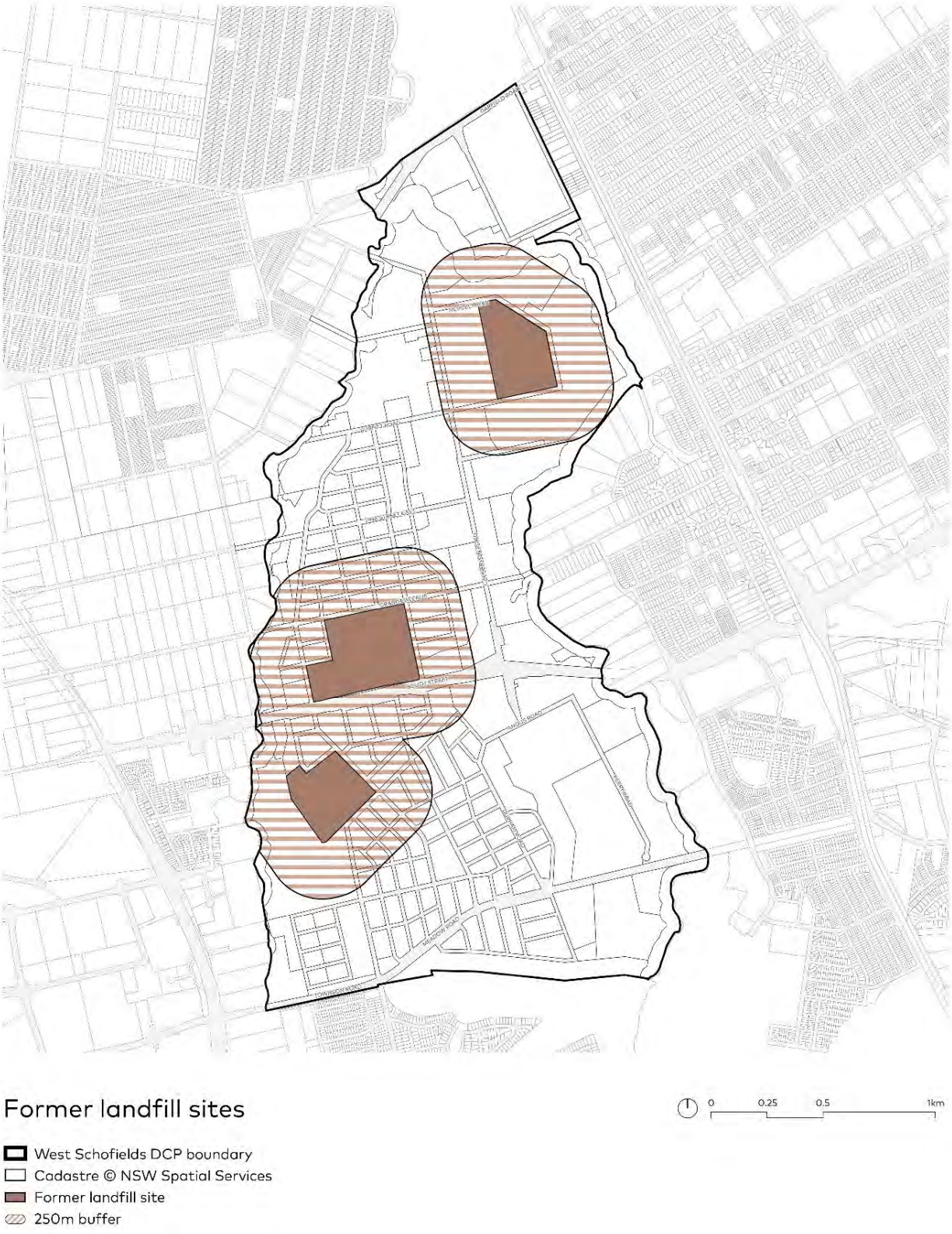

Figure 23: Former landfill sites

7.3 Development near noisy roads

Refer to Section 4.2.9 Visual and acoustic privacy of the BCC Growth Centre Precincts DCP for objectives and controls.

7.3.1 Additional Objectives

a. To minimise noise impacts in the vicinity of current or future predicted busy roads, as identified in **Figure 24**.

7.3.2 Additional Controls

1. Where development is proposed within the area marked on **Figure 24** as 'Likely noise impacts', it should be designed to satisfy the internal noise requirements of the *State Environmental Planning Policy (Transport and Infrastructure) 2021*. The design should:
    a. Consider both current and predicted future traffic noise impacts.
    b. Identify noise mitigation measures to be implemented at both subdivision and construction stage, noting that noise walls are not permitted in residential zones (as per control 10, section 4.2.9 of the BCC Growth Centre Precincts DCP). Noise walls are also strongly discouraged in other land use zones and are to be used as a last resort for noise mitigation. If an application proposes noise walls, it must demonstrate why other forms of noise mitigation are not sufficient and/or feasible.
    c. Include provision for ventilation that meets the requirements of the Building Code of Australia where windows are required to be closed to meet internal noise levels. Note that in these situations, windows that would otherwise normally be operable should still be operable, to give future users the option to either open a window or use other forms of ventilation to bring fresh air into the room.
    d. If the proposed development adjoins a road with an annual average daily traffic (AADT) volume of more than 20,000 vehicles, the application will need to also demonstrate compliance with the *Development near rail corridors and busy roads – Interim guideline* (NSW Department of Planning, 2008). It is anticipated this will be applicable only to development adjoining Garfield Road, South Street, and the Townson to Burdekin Road Connection, however prior to the lodgement of a development application the existing and forecast AADT for roads adjoining a development site should be considered and discussed with Council to determine the applicability of the above control.

2. For employment uses, consideration should be given at the design stage to building layout, to ensure that noisy activities are located away from noise sensitive areas.
3. For developments of community facilities, childcare centres, and other sensitive uses, an acoustic assessment should be undertaken to evaluate noise impacts and methods to manage those impacts.

Note: These controls apply to the areas shown as 'Likely noise impacts' on **Figure 24** as predictive modelling has shown that they will likely be affected by daytime $L_{Aeq\ (15hr)}$ noise levels great than 60 dB(A) at the first floor of a building in 2046, based on forecast future vehicle volumes on existing and planned roads in the West Schofields precinct.

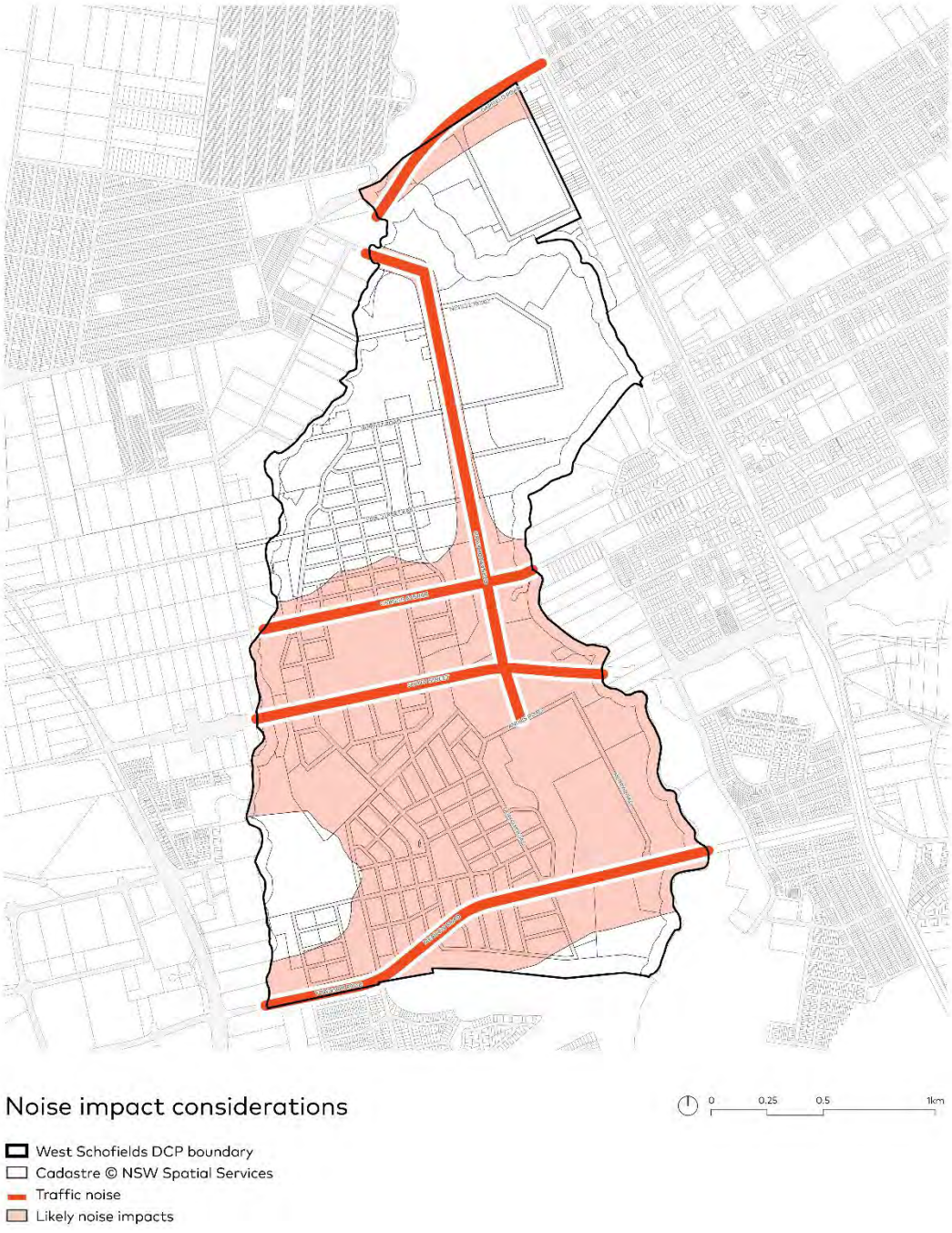

Figure 24: Noise impact considerations

Appendix A
Indicative Street Designs

All street designs in this section are sourced from the *DCP Amendment Template – Streets Chapter* document which accompanies the *Western Sydney Street Design Guidelines, Second Edition* (both documents are April 2025, by the Western Sydney Planning Partnership).

Note for all street designs: As per control 5.3.4 (6), where possible, driveways should be designed to enable the doubling-up with neighbouring driveways, to enable longer uninterrupted sections of verge and deep soil zones

Destination High Streets

Table 14: Destination High Streets performance criteria

Road element	Performance criteria
Road reserve	≥ 20m
Typical AADT	≤ 10,000
Freight access	Service and delivery vehicles
Posted speed	30-40km/h
Design speed	Same as posted speed
Design vehicle	B85 car
Check vehicle	Single unit truck/bus (12.5m)
Bus capable	Yes
Vehicle travel lanes	2x 3.2m (+ 0.3m buffer for bus capability)
Parking provision	Varies

Road element	Performance criteria
Parking arrangement	2.3m indented parking bays
Walking	≥ 3.0m footpaths on both sides
Cycling	Within travel lane
Traffic calming	≤ 80m spacings
WSUD	Passive irrigation (low flow), Swale (high flow)
Tree canopy cover	70% (nom.) – refer NSW Greener Neighbourhoods Guide
Permeability	≥35%

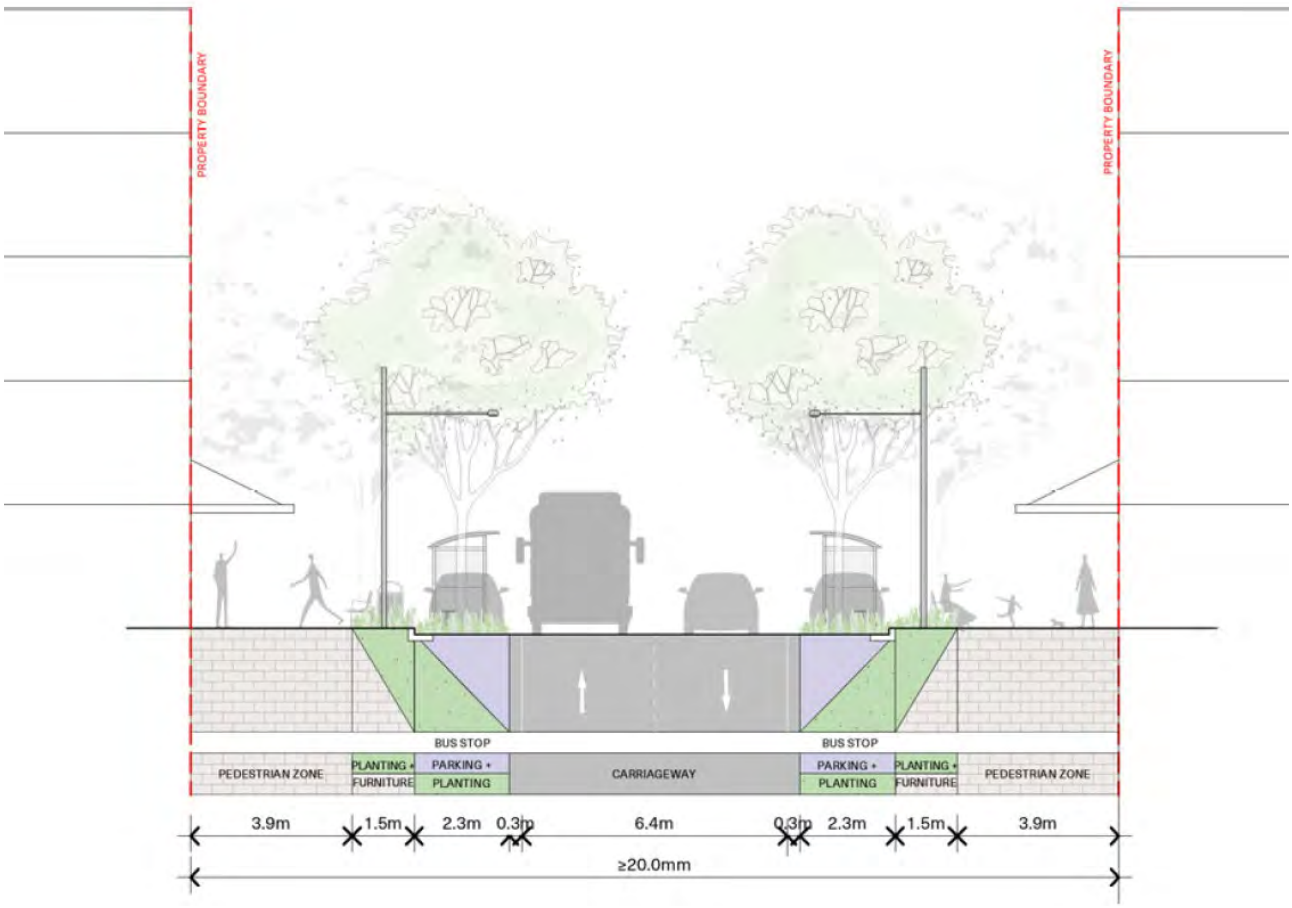

Figure 25: Destination High Street typical cross section

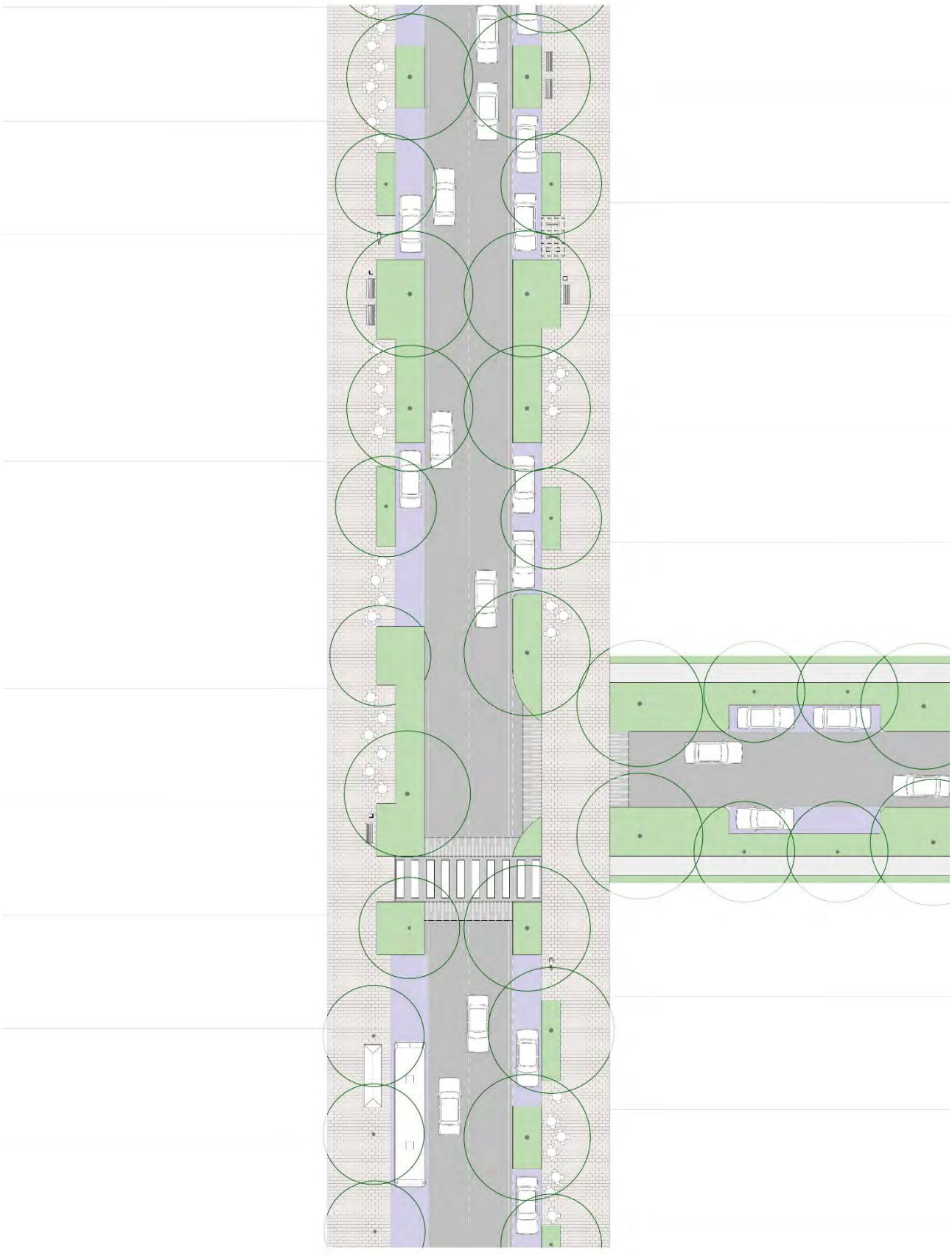

Figure 26: Destination High Street typical plan

Connector Streets

Table 15: Connector Streets performance criteria

Road element	Performance criteria
Road reserve	≥21.5m
Typical AADT	2,000 - 5,000
Freight access	Service and delivery vehicles
Posted speed	40-50km/h
Design speed	Same as posted speed
Design vehicle	8.8m service vehicle, 12.5m bus (if on bus route)
Check vehicle	12.5m bus/truck
Bus capable	Yes
Vehicle travel lanes	2x 3.2m (+ 0.3m buffer for bus capability)
Parking provision	Varies
Parking arrangement	2.3m indented parking bays
Walking	≥1.5m footpaths on both sides; or 1x ≥1.5m footpath + 1x ≥3.0m shared path
Cycling	≥2.5m separated cycleway; or 1x ≥3.0m shared path
Traffic calming	≤80m spacings
WSUD	Passive irrigation (low flow), Swale (high flow)
Tree canopy cover	70% (nom.) – refer NSW Greener Neighbourhoods Guide
Permeability	≥35%

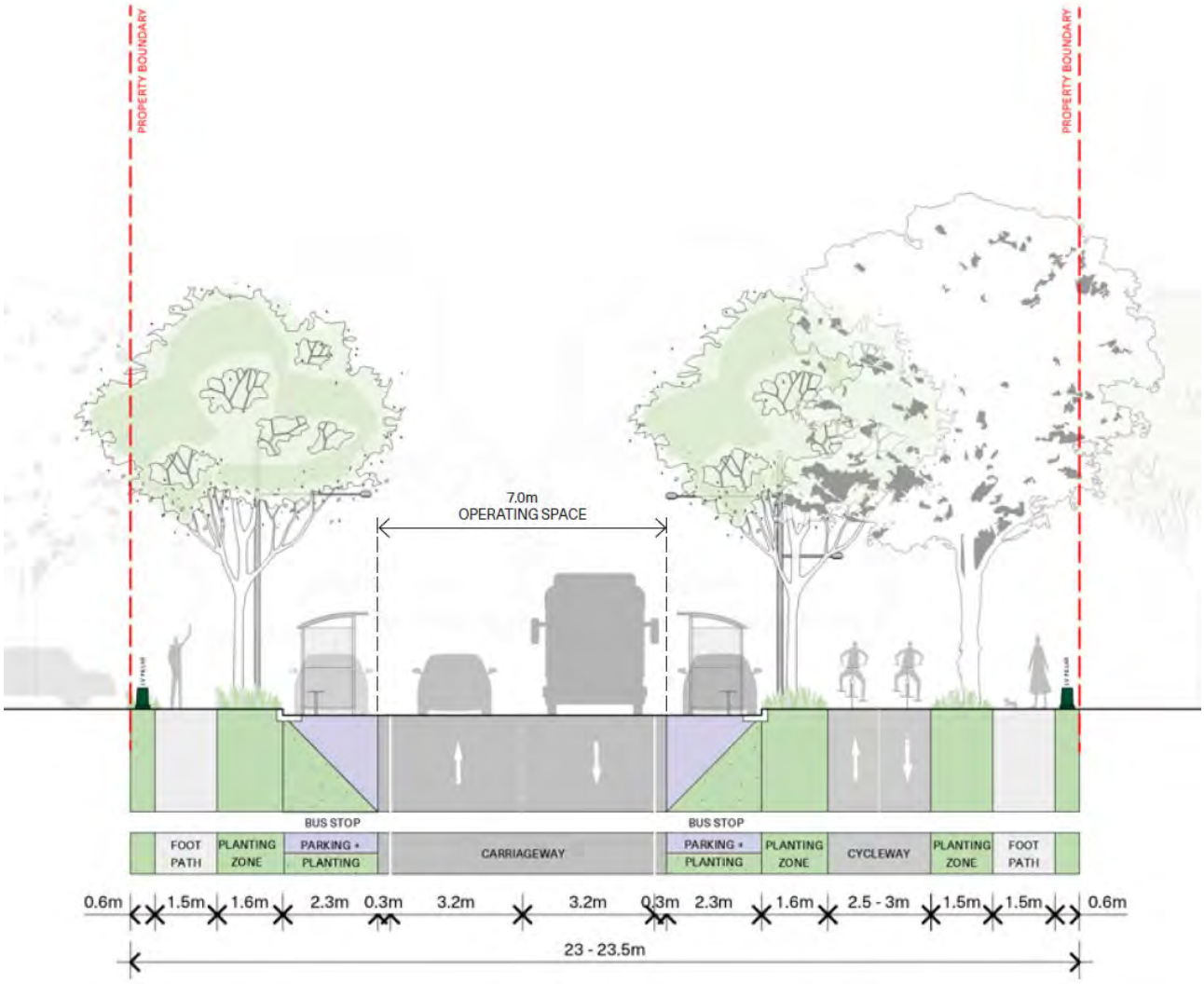

Figure 27: Connector Street (with separated cycleway) typical cross section

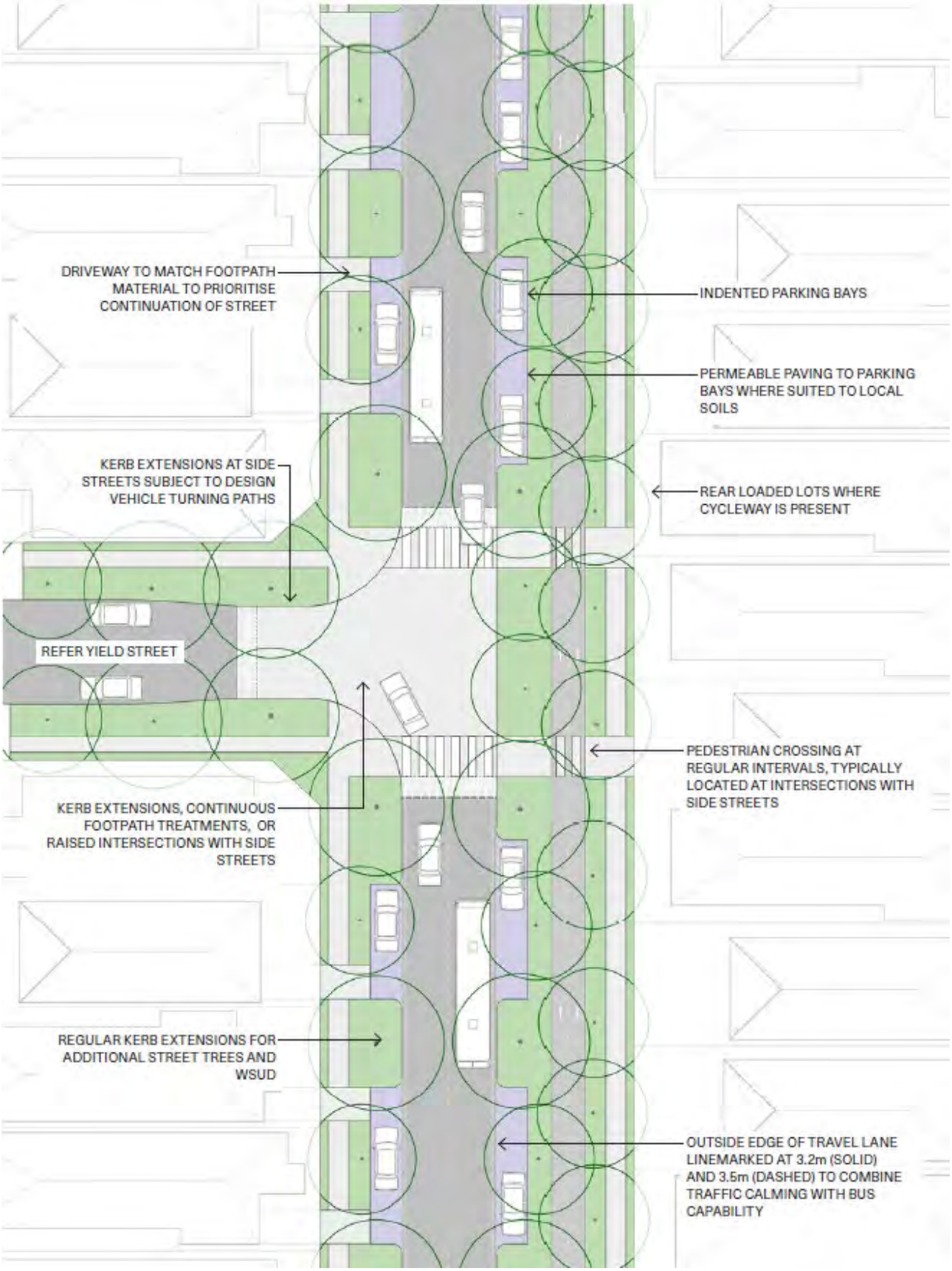

Figure 28: Connector Street (with separated cycleway) typical plan

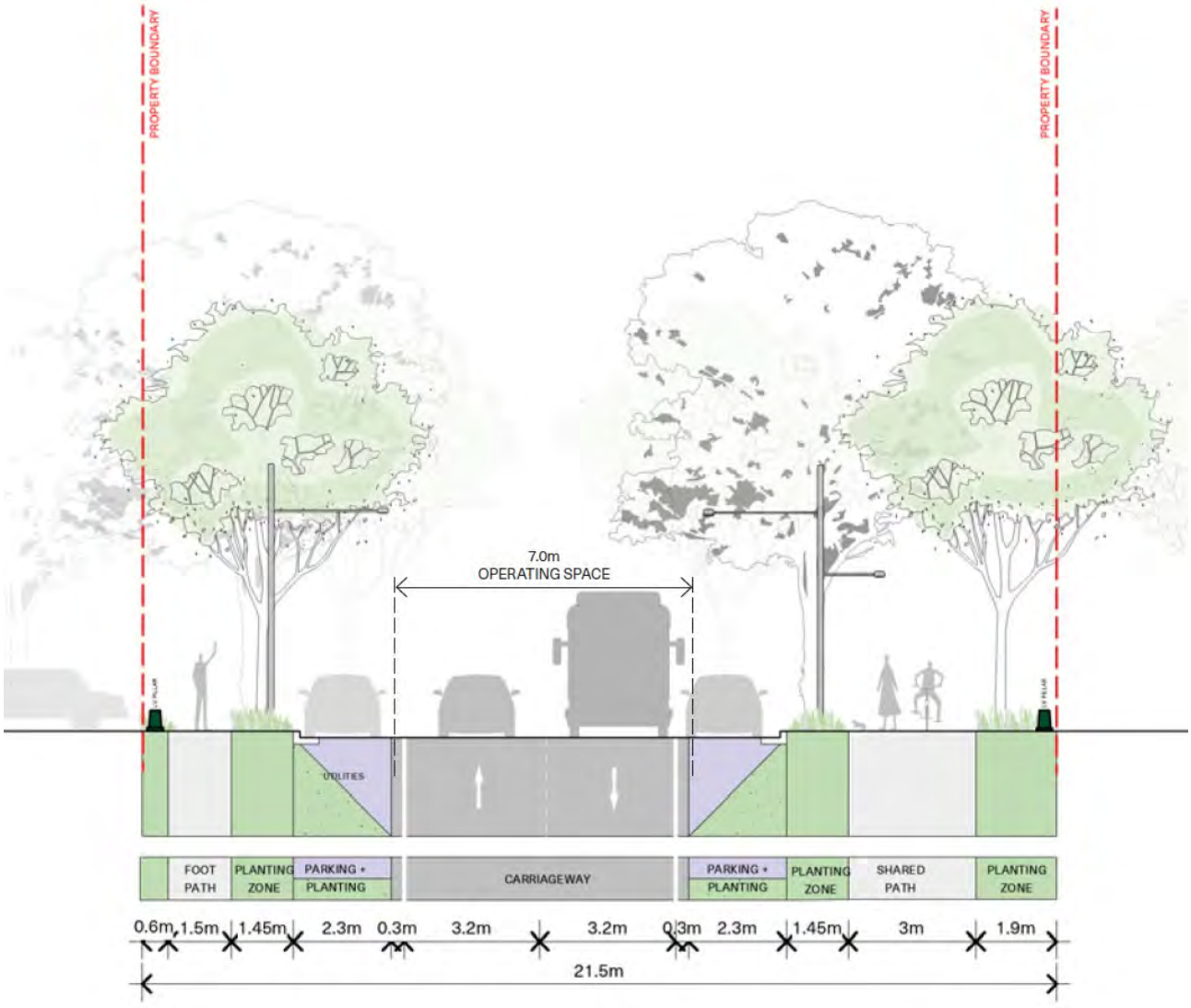

Figure 29: Connector Street (with shared path) typical cross section

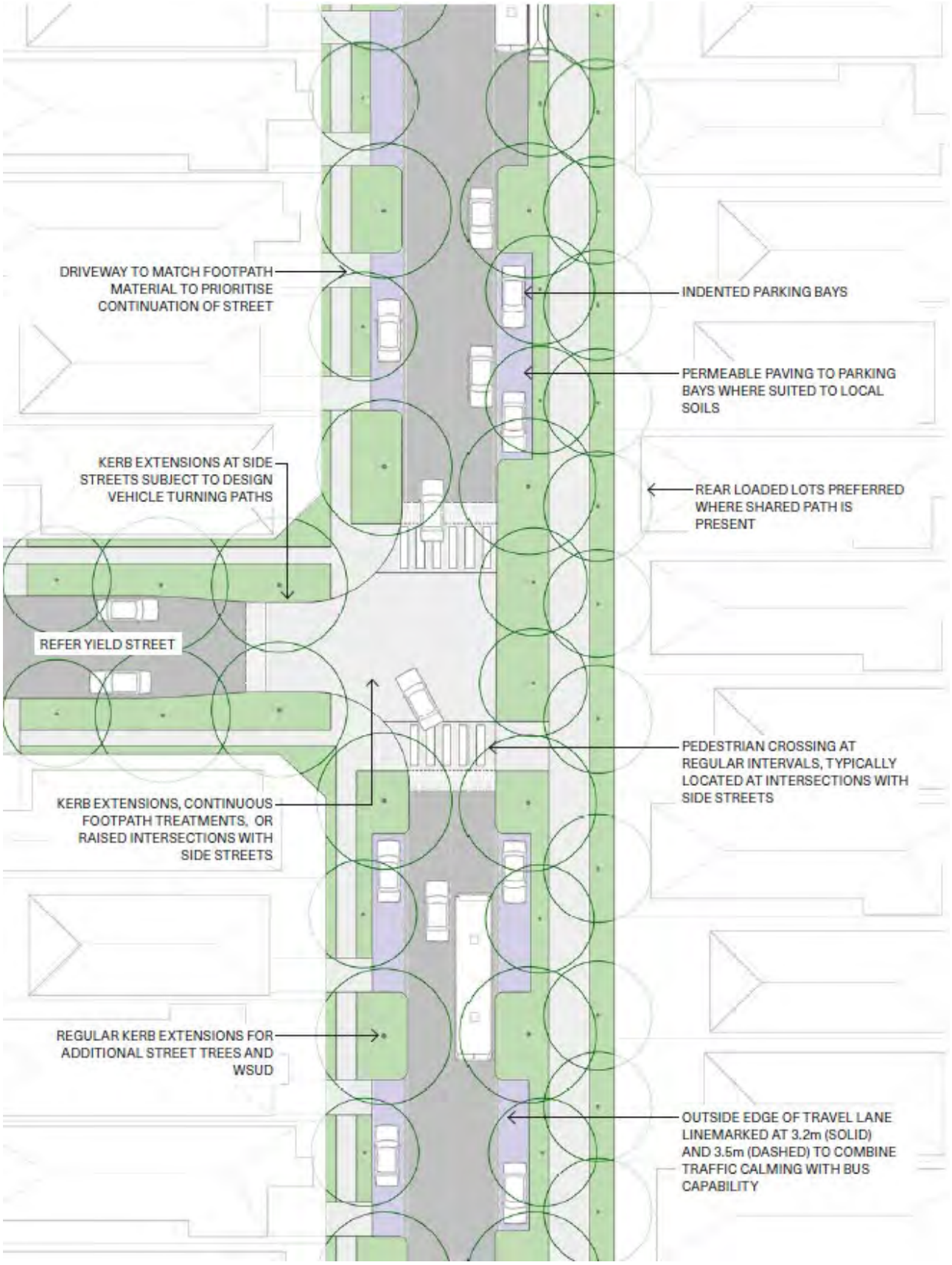

Figure 30: Connector Street (with shared path) typical plan

Neighbourhood Streets

Table 16: Neighbourhood Streets performance criteria

Road element	Performance criteria
Road reserve	≥18m
Typical AADT	500 - 2,000
Posted speed	30-40 km/h
Design speed	Same as posted speed
Design vehicle	5.3m passenger car
Check vehicle	8.8m service vehicle, 12.5m bus (if on bus route)
Bus capable	Varies
Vehicle travel lanes	2 x 3.0m (3.2m on bus routes)
Parking provision	≤0.75 per lot
Parking arrangement	2.1m indented parking bays
Walking	≥1.5m footpaths on both sides
Cycling	Quietway - refer TfNSW Cycleway Design Toolbox
Traffic calming	≤80m spacings
WSUD	Passive irrigation (low flow), Swale (high flow)
Tree canopy cover	70% (nom.) – refer NSW Greener Neighbourhoods Guide
Permeability	≥35%

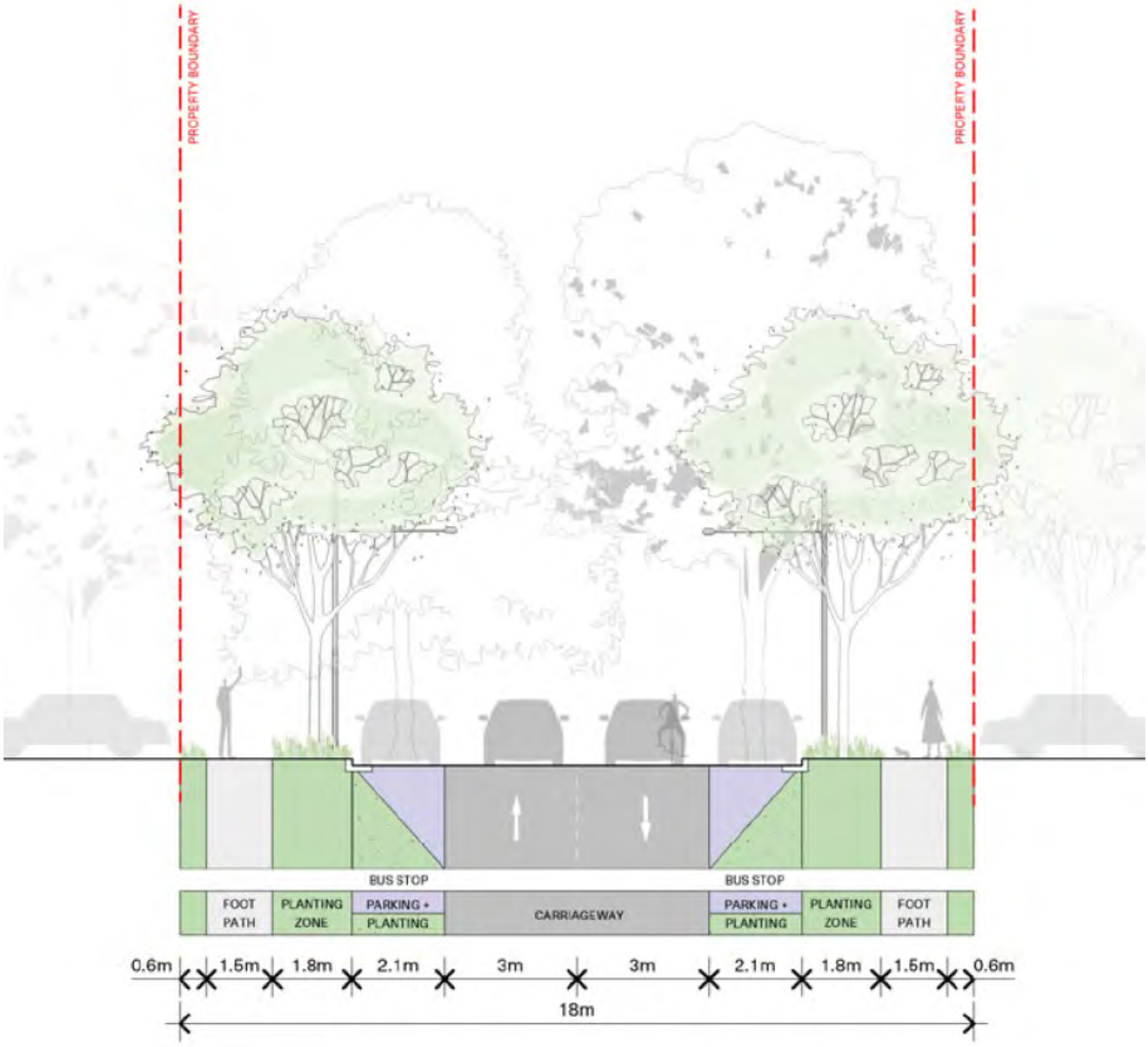

Figure 31: Neighbourhood Street typical cross section

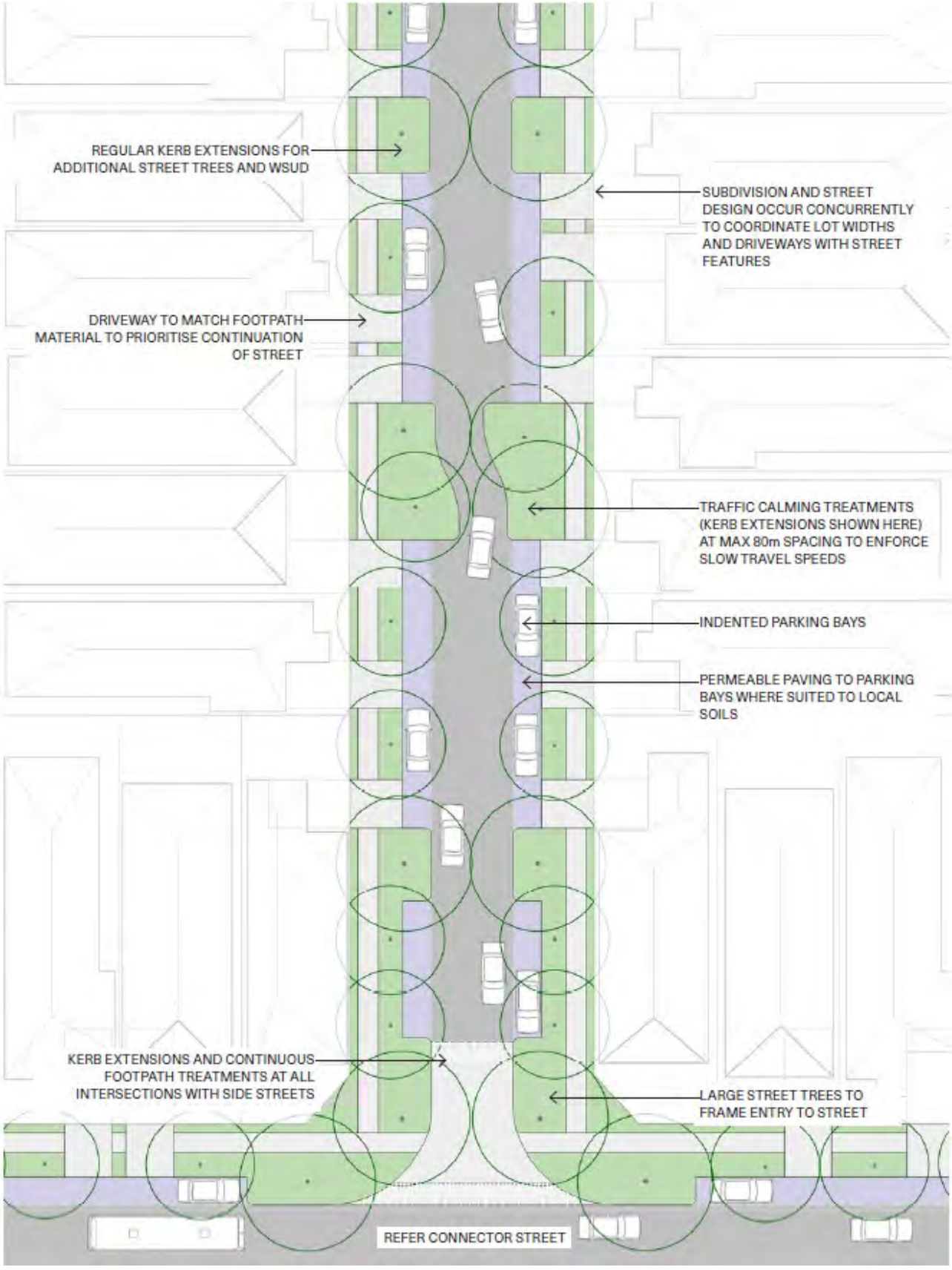

Figure 32: Neighbourhood Street typical plan

Yield Streets

Table 17: Yield Streets performance criteria

Road element	Performance criteria
Road reserve	≥ 16m
Typical AADT	500 – 2,000
Posted speed	20-40km/h
Design speed	Same as posted speed
Design vehicle	5.3m passenger car
Check vehicle	8.8m service vehicle
Bus capable	No
Vehicle travel lanes	=7.6m kerb-to-kerb two-way carriageway
Parking provision	≤ 0.75 per lot
Parking arrangement	Kerbside within carriageway to enforce yield for vehicles (no indented bays)
Walking	≥1.5m footpaths on both sides
Cycling	Quietway – refer TfNSW Cycleway Design Toolbox
Traffic calming	≤ 80m spacings
WSUD	Passive irrigation (low flow), Swale (high flow)
Tree canopy cover	70% (nom.) – refer NSW Greener Neighbourhoods Guide
Permeability	≥ 35%

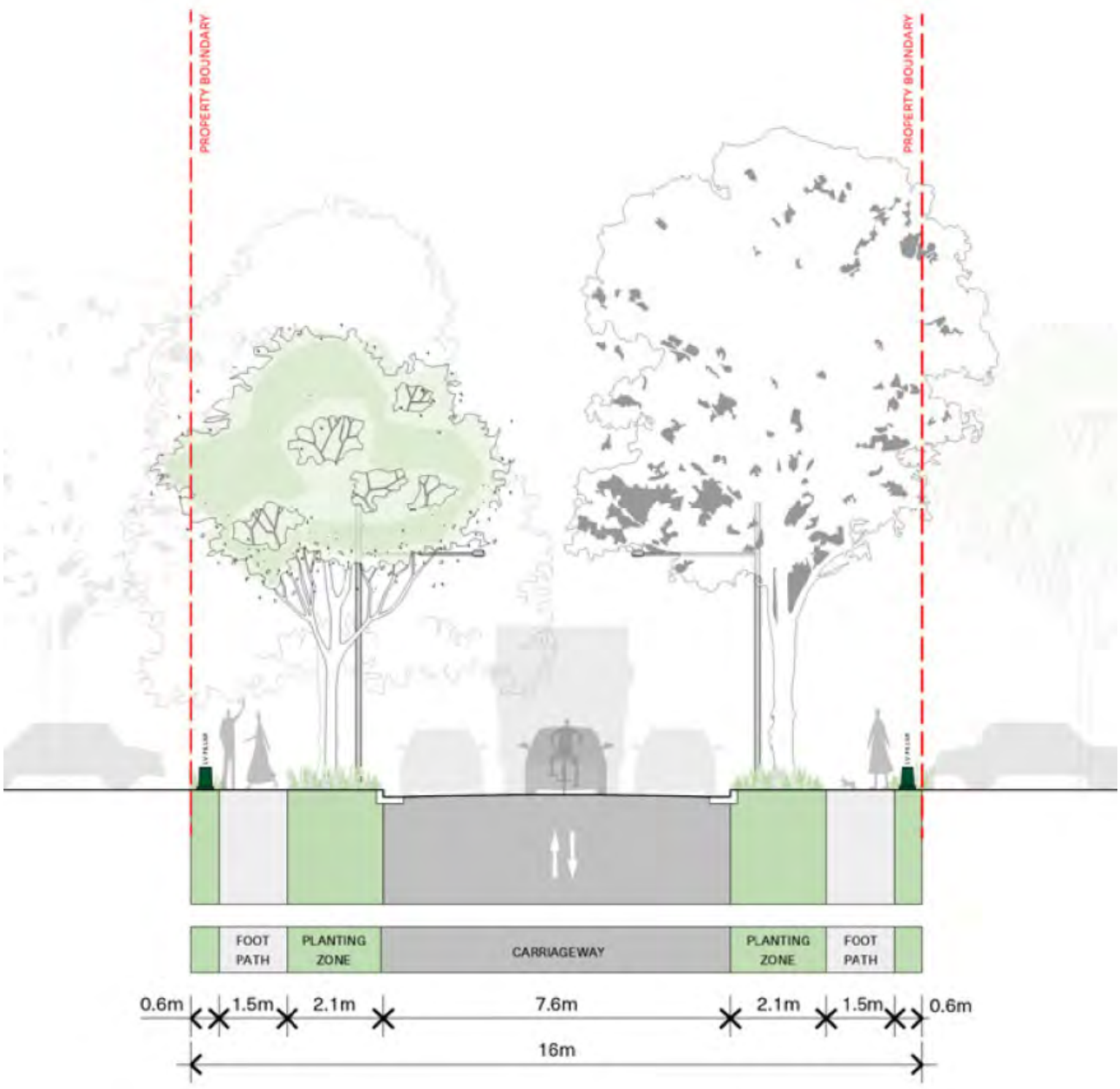

Figure 33: Yield Street typical cross section

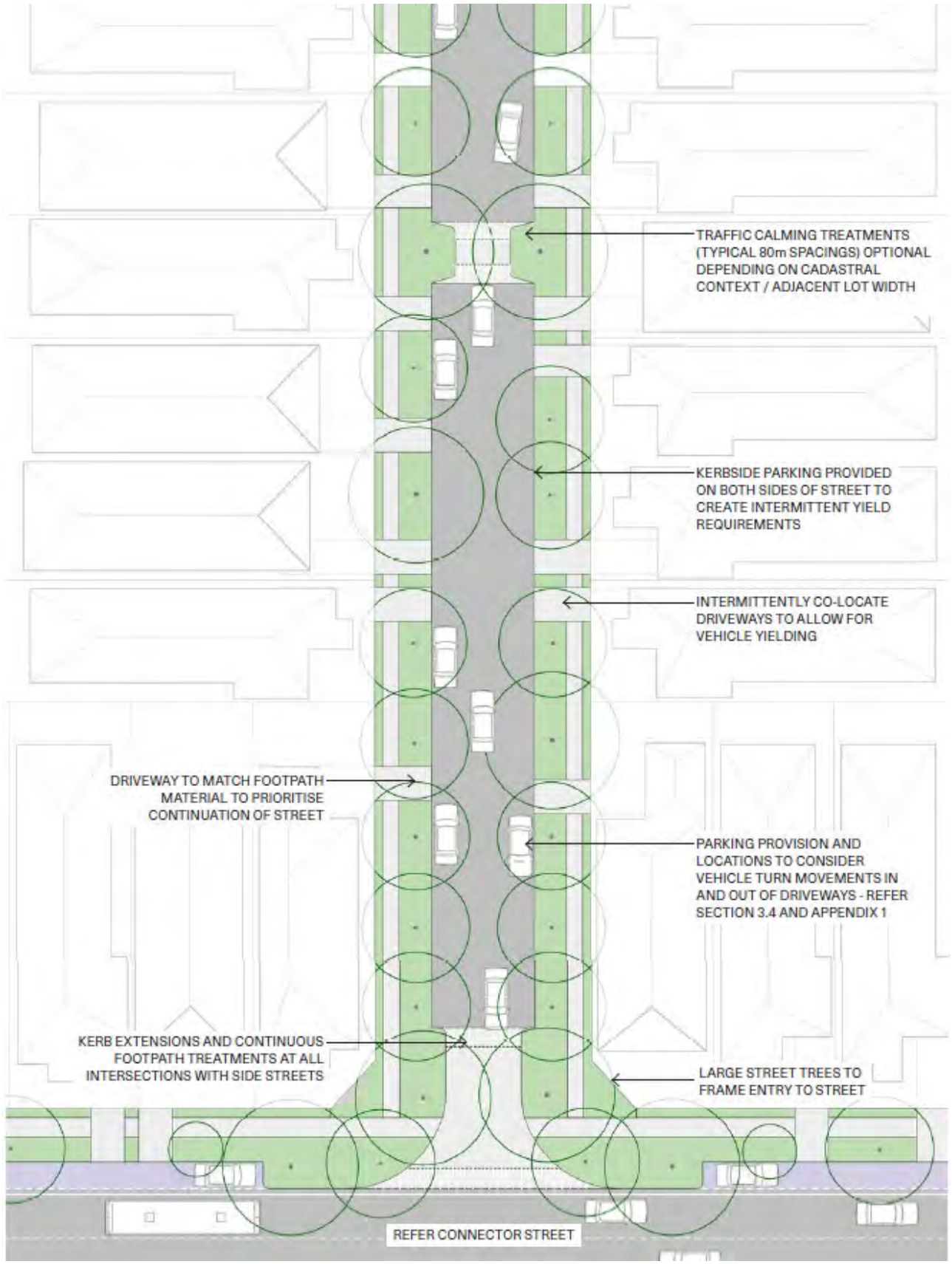

Figure 34: Yield Street typical cross section

Enterprise Streets

Table 18: Enterprise Streets performance criteria

Road element	Performance criteria
Road reserve	≥ 21.5m
Typical AADT	1,000 - 4,000
Freight access	Service and delivery vehicles
Posted speed	40-50km/h
Design speed	Same as posted speed
Design vehicle	19m semi-trailer
Check vehicle	19m semi-trailer
Bus capable	Yes
Vehicle travel lanes	2 x 3.2m (+ 0.3m buffer for bus capability)
Parking provision	Varies
Parking arrangement	2.3 - 3.0m indented parking bays (widen if needed for design vehicle such as freight/delivery vehicles to park without encroaching in travel lane)
Walking	1x ≥1.5m footpath + 1x ≥3.0m shared path
Cycling	1x ≥3.0m shared path
Traffic calming	≤80m spacings
WSUD	Passive irrigation (low flow), Swale (high flow)
Tree canopy cover	60% (nom.) – refer NSW Greener Neighbourhoods Guide
Permeability	≥35%

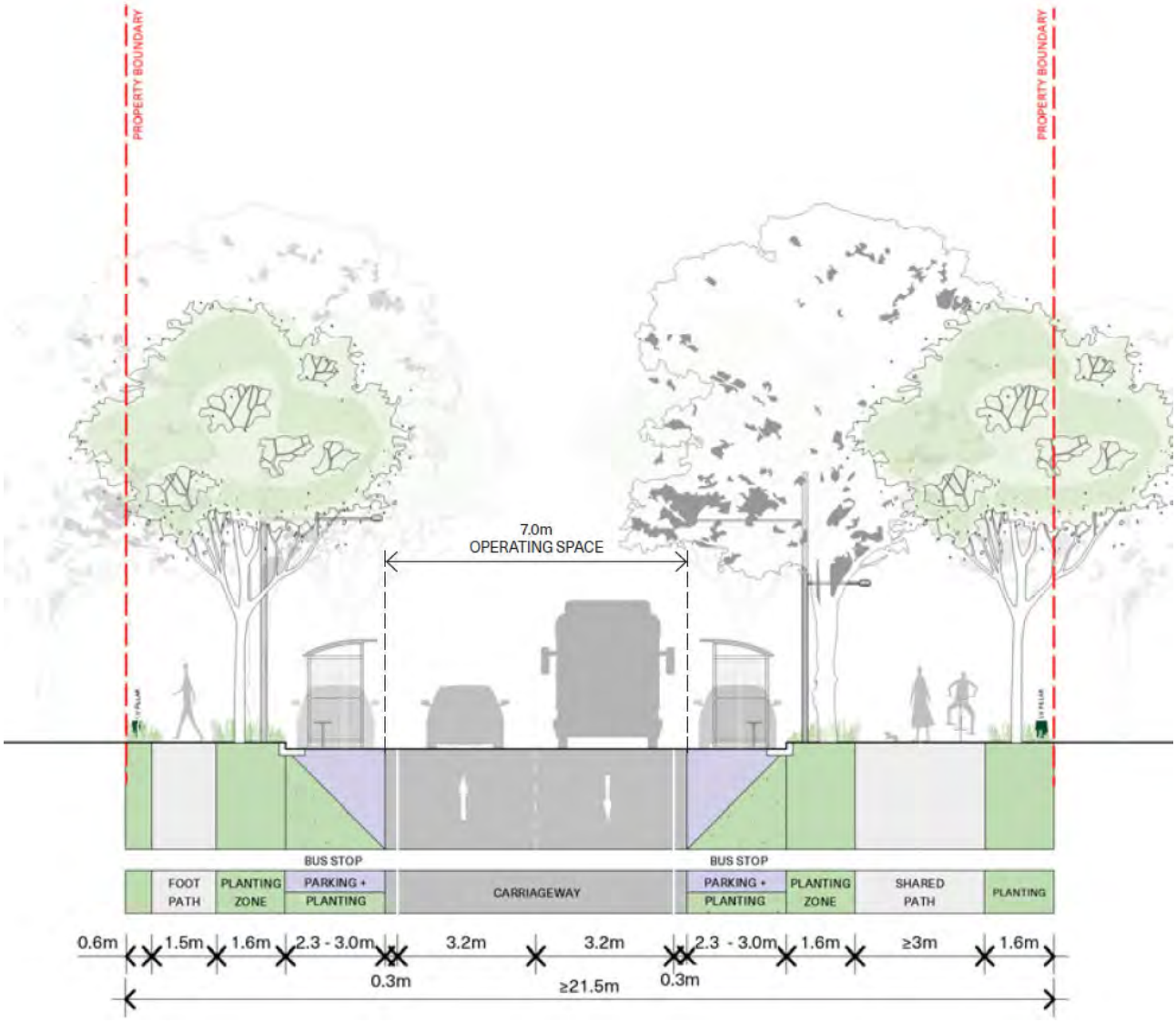

Figure 35: Enterprise Street typical cross section

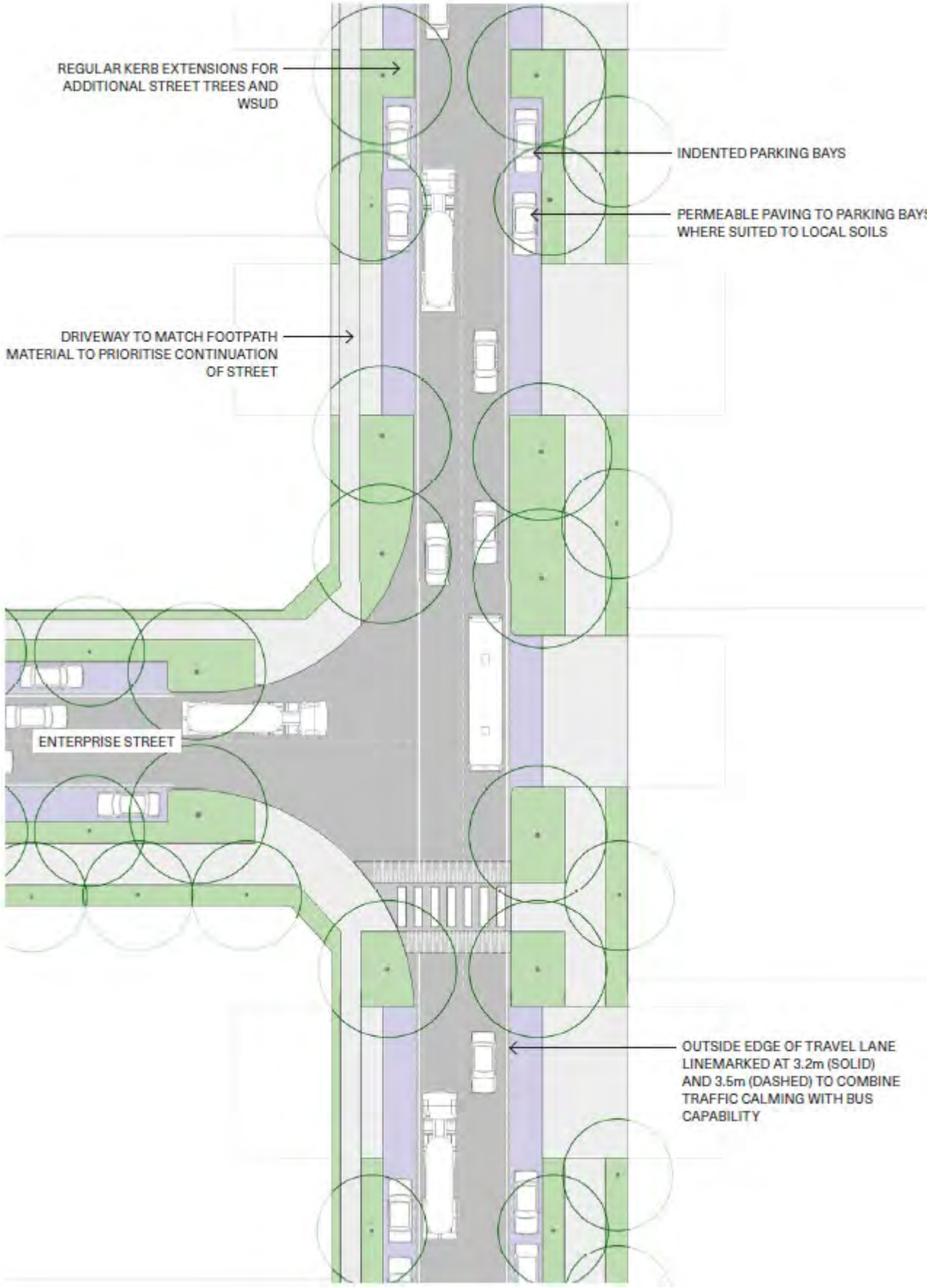

Figure 36: Enterprise Street typical plan

Appendix B
West Schofields Precinct Water Cycle Management Assessment

West Schofields Precinct

Water Cycle Management Assessment

Department of Planning, Housing and Infrastructure

RR-04-2229-01

September 2025

Contact Information

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Document Control

Ver	Effective Date	Description of Revision	Prepared by:	Reviewed by:
00	16 August 2025	Draft Issue	JPS	LCC
01	17 September 2025	Issue for Public Exhibition	JPS	LCC

Prepared For: Department of Planning, Housing and Infrastructure

Project Name: West Schofields Precinct

Rhelm Reference: J2229

Document Location: RR-04-2229-01

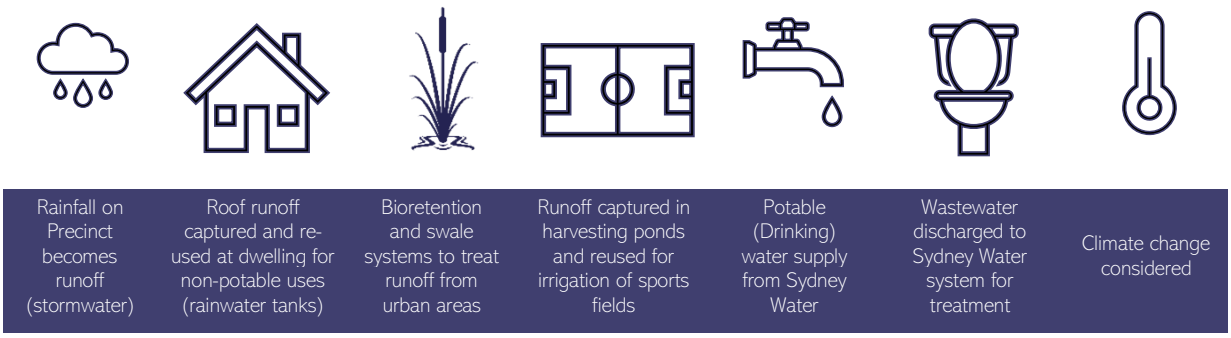
Executive Summary

The West Schofields precinct (the **precinct**) has been identified for development to increase the number of homes and support job growth as part of Sydney's North West Growth Area (NWGA).

Rhelm has undertaken a water cycle management assessment based upon the Indicative Layout Plan (ILP) developed by Cox Architects. The focus of this water cycle management assessment for the precinct is surface water; however, reference is made to groundwater, noting that groundwater is covered in studies by others for the precinct. Within the West Schofields precinct, surface water considerations span the consideration of stormwater, in terms of both its quantity and quality. Note that drinking water and wastewater will be provisioned for in the precinct by Sydney Water Corporation.

This assessment involves the analysis of how rainfall runoff behaves across the precinct both now and under the proposed future arrangements. It identifies the range of measures required to meet the water management objectives set out below.

The conceptual strategy is set out below.

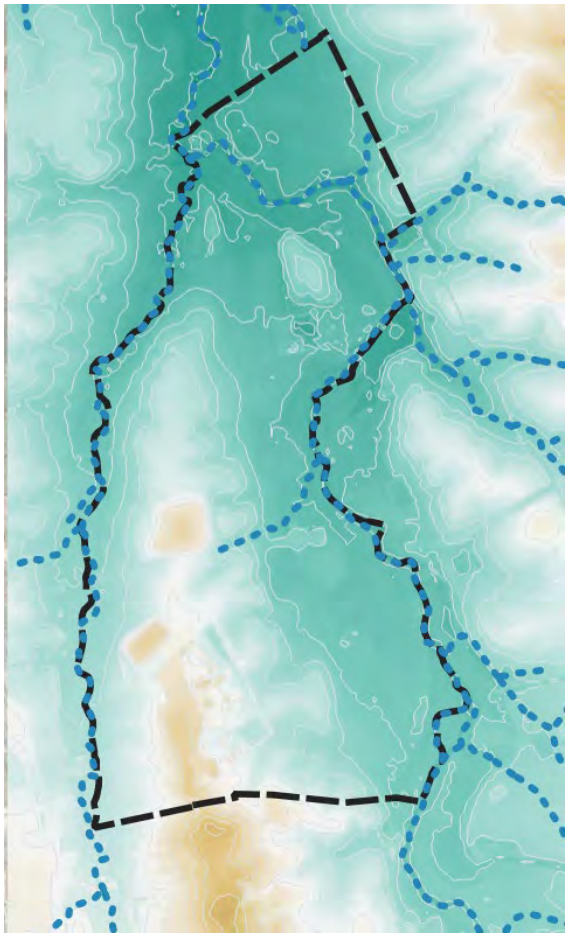


Precinct Overview

The precinct is located in the Blacktown City Council local government area (LGA) and comprises 576 Ha of land bounded by Garfield Road West to the north, Bells Creek to the west and Townson Road to the south. The eastern boundary is comprised of Railway Terrace and Eastern Creek.

The precinct is located within the Hawkesbury-Nepean Catchment, which is a regulated catchment and the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (B&C SEPP) applies. In particular, the B&C SEPP requires consideration of surface water flow and surface water quality.

A range of other guidance is relevant to water cycle management which has been considered in the preparation of this assessment.



Bells Creek and Eastern Creek are the most significant watercourses within the precinct, and both drain in a northward direction. Tributaries of these watercourses are also located within the precinct. The confluence of the creeks is located at the northern limit of the precinct, just upstream of Garfield Road West.

Numerous small waterbodies (generally farm dams) are also scattered throughout the precinct.

The topography of the precinct includes a ridgeline, aligned north to south approximately through the centre of the precinct, which results in the precinct draining both eastward (toward Eastern Creek) and westward (toward Bells Creek).

Eastern Creek is a tributary of South Creek (converging approximately 5 km north of the precinct), which in turn is a tributary of the Hawkesbury River (Dyarubbin) and joins the Hawkesbury River at Windsor.

The precinct is affected by mainstream flooding from both Eastern Creek and Bells Creek as well as backwater flooding from Dyarubbin. Consideration has been made of the implications of flood behaviour in this water cycle assessment.

Data and Literature Review

A comprehensive data and literature review was undertaken to collate the available data relevant to the study, and to review applicable design guidelines to inform the development of the water cycle management strategy. The review considered data from:

- Blacktown City Council,
- Department of Planning, Housing and Infrastructure,
- Bureau of Meteorology, and
- Technical reports and models relevant to the precinct.

Stormwater Quality Management Objectives

The core objective for the management of stormwater quality is the protection of the receiving environments.

This is expressed in a range of targets, including:

- Neutral or Beneficial Effect (NorBE)
- Blacktown City Council load reduction targets
- Wianamatta-South Creek Guidelines.

An existing scenario MUSIC model was established to define baseline stormwater volumes and pollutant loading of site discharge for comparison against post-development conditions as part of a neutral or beneficial effect on water quality (NorBE) assessment.

A stormwater treatment train comprising the following features was established to manage the pollutant loading from the fully developed site under the adopted development scenario:

- Rainwater tanks (distributed network at lot-scale),
- Conventional pit and pipe drainage network (to safely convey stormwater in minor events)
- Gross pollutant traps (at the inflow point to each bioretention basin),
- Bioretention basins (nine basins in total), and
- Grassed swales (to convey and treat flow from public spaces and sports fields),
- Stormwater harvesting ponds (six ponds, co-located in areas where sports fields are proposed).

Key Outcome - Results of the MUSIC modelling indicate that the proposed treatment train sufficiently reduces pollutant loads to a level that is consistent with the objectives of the *State Environmental Planning Policy (Biodiversity and Conservation)* 2021, the *Growth Centres Development Control Plan* (DCP) 2010 (updated in 2021) and the *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (Wianamatta-South Creek Guidelines) (DPE, 2022).

Stormwater Quantity Management Objectives

The primary stormwater quantity management objective for the precinct is to mimic natural hydrology as much as practical, both for flood events and day to day environmental flow conditions.

Detention – Key Outcomes

For the purpose of land allocation within the current ILP for the purposes of drainage, it has been assumed that on-site detention (OSD) basins will be required to mitigate increases in post-development flows up to and including the 1% AEP event. However, depending on the outcomes of the regional flood modelling, the OSD basins may be able to be reduced in size or removed completely, reducing the area of drainage land and increasing the quantum of open space/recreational land.

Stream Forming and Environmental Flows – Key Outcomes

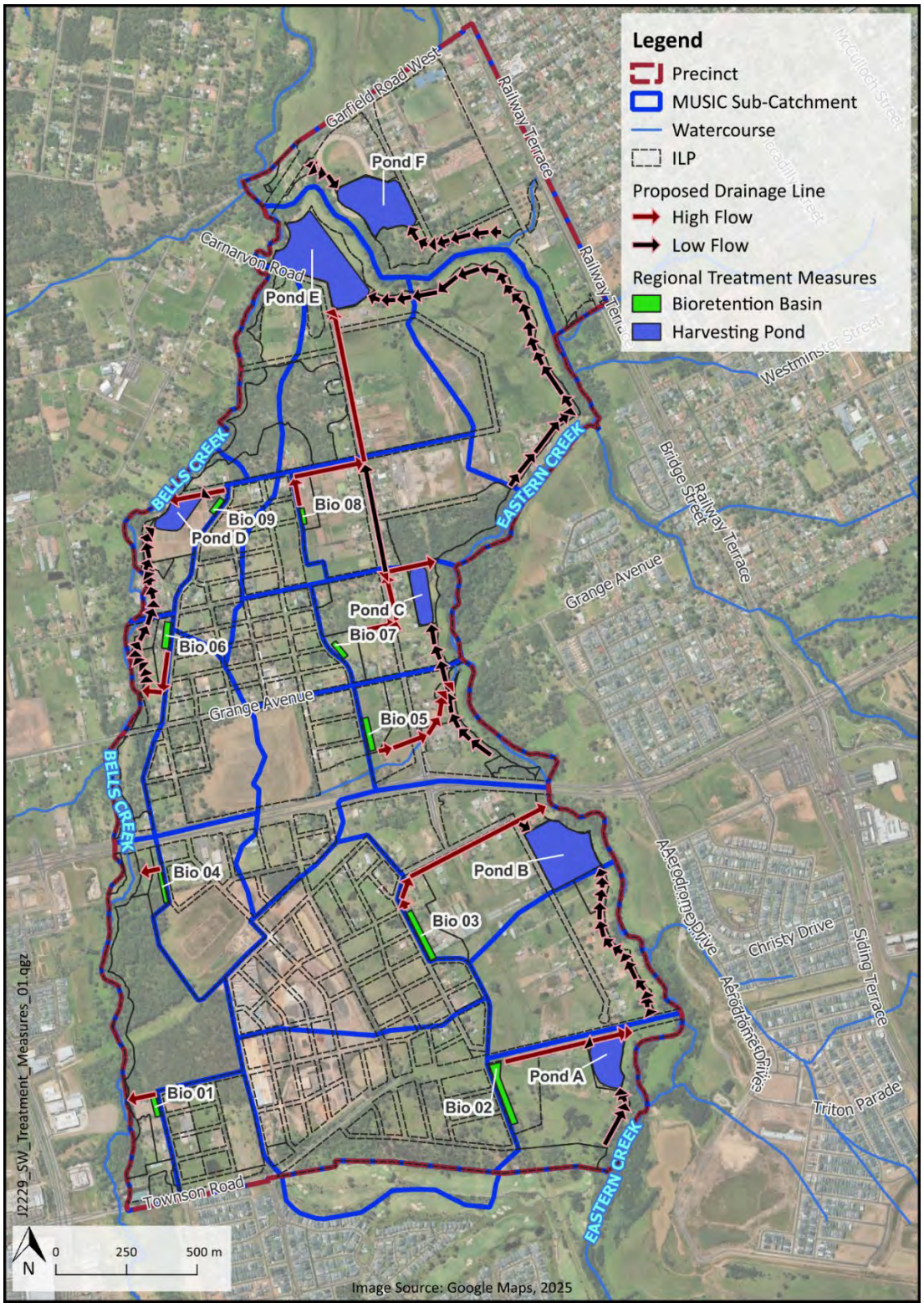
The site Stream Erosion Index (SEI) was calculated using the results of a preliminary DRAINS/XP-RAFTS hydrologic model and was found to meet the 'ideal' 1:1 ratio in the Growth Centres DCP 2010 for all key discharge locations.

MUSIC water balance modelling for selected wet, dry and average rainfall years was undertaken to determine the reliability of proposed stormwater harvesting ponds at meeting predicted demands. Results of this assessment found that all proposed harvesting ponds will meet over 70% of stormwater re-use demands in average rainfall years and over 50% of demands in dry years. A number of ponds were found to meet near 100% of demands across the range of conditions.

Flow durations curves were produced for the existing and post-development precinct, as well as a natural catchment of equivalent area, for comparison against the flow duration targets stipulated in the Wianamatta-South Creek Guidelines (DPE, 2022). The post-development curves were found to adequately mimic that of a natural catchment.

Strategy Overview

Key elements of the water cycle management strategy are overlaid on the existing conditions aerial imagery below.



West Schofields Precinct Water Cycle Management Strategy Overview

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Acronyms and Abbreviations

AHD	Australian Height Datum
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
BCC	Blacktown City Council
BoM	Bureau of Meteorology
DCCEEW	Department of Climate Change, Environment, Energy and Water (NSW)
DCP	Development Control Plan
DPE	Department of Planning and Environment (now DPHI and DCCEEW)
DPIE	Department of Planning, Industry and Environment (now DPHI and DCCEEW)
DPHI	Department of Planning, Housing and Infrastructure
EY	Exceedances per Year
Ha	Hectares
IFD	Intensity-Frequency-Duration
ILP	Indicative Layout Plan
LEP	Local Environment Plan
LGA	Local Government Area
LiDAR	Light Detention and Ranging
m^2	Square metres
m^3	Cubic metres
kL	Kilolitres
ML	Megalitres
m/s	Metres per second
m^3/s	Cubic metres per second
mAHD	metres to Australian Height Datum
mm	Millimetres
m/s	Metres per second
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NorBE	Neutral or Beneficial Effect
NSW	New South Wales
OEH	Office of Environment and Heritage (now DCCEEW)
OSD	On Site Detention
TN	Total Nitrogen
TP	Total Phosphorus

TSS	Total Suspended Solids
WSUD	Water sensitive urban design

1 Introduction

1.1 Background and Purpose

The West Schofields Precinct (the **precinct**) has been identified for development to increase the number of homes and support job growth as part of Sydney's North West Growth Area (**NWGA**).

Rhelm Pty Ltd (**Rhelm**) have been engaged by the Department of Planning, Housing and Infrastructure (the **Department**) to prepare a water cycle management strategy to support development of a precinct plan and development guidelines for the precinct.

This assessment addresses:

- Stormwater quality management, and
- Stormwater quantity management.

1.2 Study Area

The precinct comprises 542 Ha of land bounded by Garfield Road West to the north, Bells Creek to the west and Townson Road to the south (**Figure 1-1**). The eastern boundary is comprised of Railway Terrace and Eastern Creek. The entirety of the precinct is located within the Blacktown City Council local government area (**LGA**).

Bells Creek (Strahler second order) and Eastern Creek (Strahler fourth order) are the most significant watercourses within the precinct, and both drain in a northward direction. Tributaries of these watercourses are also located within the precinct. The confluence of the creeks is located at the northern limit of the precinct, just upstream of Garfield Road West. Numerous small waterbodies (generally farm dams) are also scattered throughout the precinct.

Eastern Creek is a tributary of South Creek (converging approximately 5 km north of the precinct), which in turn is a tributary of the Hawkesbury River and joins the Hawkesbury River at Windsor. The Hawkesbury River flows to the ocean.

The topography of the precinct includes a ridgeline, aligned north to south through the centre of the precinct, which results in the precinct draining both eastward (toward Eastern Creek) and westward (toward Bells Creek).

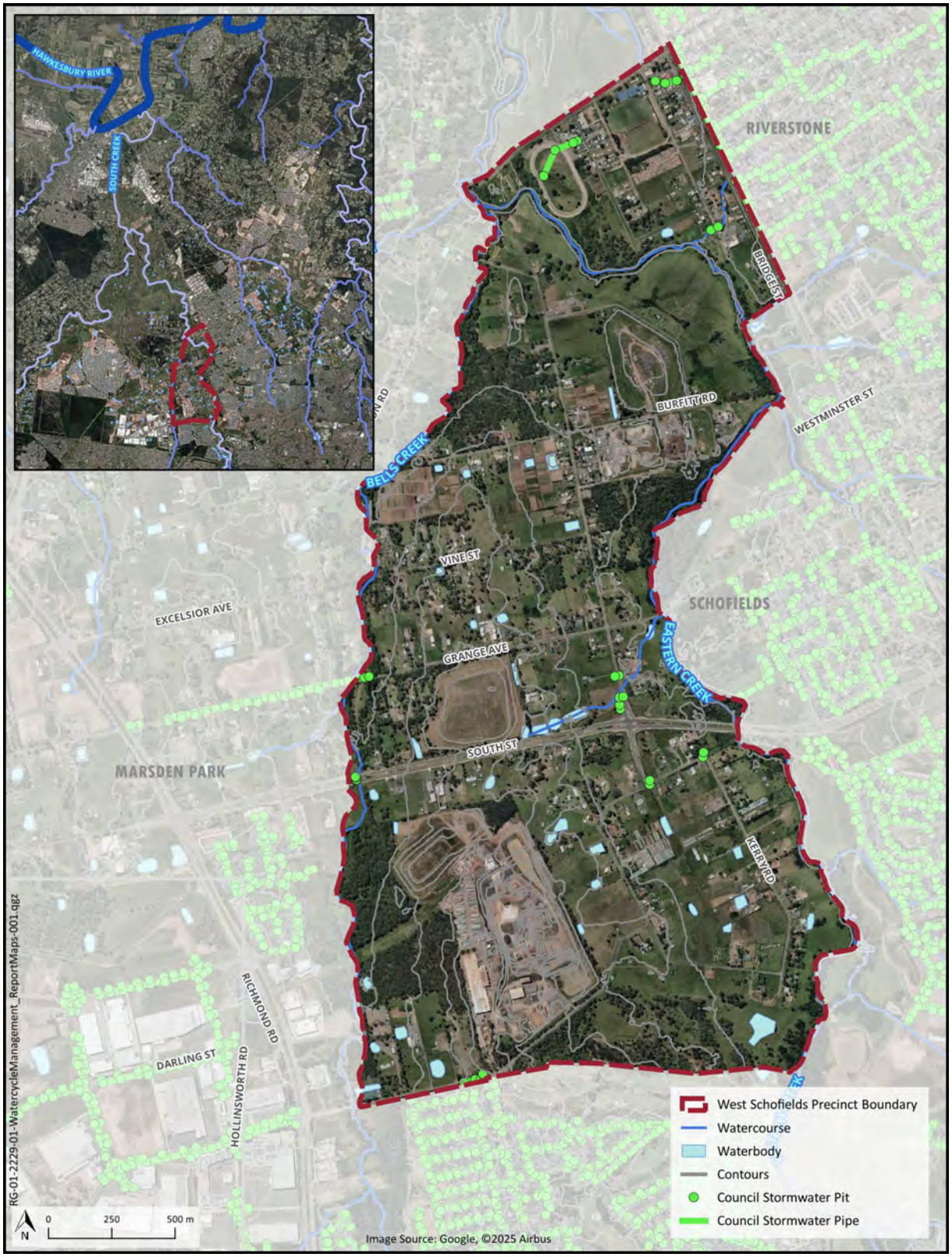


Figure 1-1 Precinct Context

2 Data Review

2.1 Site Inspection

A bus tour of the precinct (13 February 2025) was attended by Rhelm and completed to give the wider project team familiarity with the topography, land use, and character of the area. The tour only allowed for a limited inspection of key areas and did not involve an inspection of any significant drainage features.

A further site inspection (14 March 2025) was undertaken by Rhelm of drainage infrastructure (including existing bridges and culverts crossing Eastern and Bells Creek), topographic features, and observations of existing land use. Photographs from the site inspection are provided as **Appendix A**.

2.2 Riparian Corridor Assessment (by Others)

Riparian corridors have many uses including enhancing water quality, conveying and directing flood flows, and providing a buffer between developments and waterways.

Assessment of existing riparian corridors within the precinct has been completed as part of the precinct planning process by others.

2.3 Previous Studies and Reports

Previous studies undertaken for the locality relevant to the precinct water cycle management assessment are summarised below.

2.3.1 Water Management, Flood Modelling and Riparian Corridor Study Report (Cardno, 2015)

Analysis of water management, flooding and riparian corridors for then Department of Planning and Environment (DPE) was completed in 2015 to inform planning and rezoning of multiple growth centres, including the precinct (Cardno, 2015). The study confirmed the hydrolines and Strahler stream ordering of watercourses, thus allowing for the mapping of the riparian protected zones (riparian corridors) throughout the precinct.

Eastern Creek and Bells Creek were identified as the main streams within the precinct. The Strahler stream order data was provided for this water cycle management assessment.

The water management component aimed to address both water quantity and quality. The water quantity objectives were as follows:

- Limit post development peak flow rates to pre-development values for flows up to the 50% AEP and the 1% AEP. For best management practice do not exceed peak flows for the full range of AEP up to the 1% AEP.
- For flood evacuation routes, the 0.2%AEP (1 in 500 AEP) level of service needs to be maintained/ achieved.
- No residential allotments are to be below the 1% AEP flood planning level (1% AEP flood level plus 0.5m freeboard)

The water quality objectives were to achieve a minimum percentage reduction of the post development average annual pollutant loads as follows:

- 90% reduction in gross pollutants
- 85% reduction in total suspended solids
- 65% reduction in total phosphorous

- 45% reduction in total nitrogen.

As well as achieving a duration of stream-forming flow no greater than 3.5 times the pre-developed duration, the study recommended a combination of online and offline detention basins as well as lot based on-site detention, street scale, and regional scale water treatment measures.

2.3.2 Flooding, Water Cycle Management and Riparian Corridor Assessment (Calibre, 2018)

Calibre (2018) reports on an updated flooding, water cycle management and riparian corridor assessment to inform planning for the precinct.

The water cycle management plan describes how backwater inundation from the Hawkesbury-Nepean River system was considered to be the primary flooding mechanism at the precinct. Thus, it was agreed with Council there would be no requirement for detention of flow from the precinct.

The key objective of the water cycle management component was to suitably manage the quality of stormwater runoff from the development via reducing post-development pollutant loads to pre-development levels and adopting the following stormwater management targets:

- 85% reduction in total suspended solids (TSS)
- 65% reduction in total phosphorus (TP)
- 45% reduction in total nitrogen (TN)
- 90% reduction in gross pollutants
- 90% reduction in hydrocarbons.

The assessment proposed stormwater harvesting for sports fields irrigation. Preliminary water quality modelling was completed using MUSIC to inform basin sizing.

The riparian corridor mapping determined Eastern Creek is a fourth order creek and Bells Creek is a second order stream under the Strahler stream ordering system.

2.4 Flood-related Studies

Existing flood-related hydrologic and hydraulic modelling data for assessing water quantity is provided in the flood impact and risk assessment for the precinct (Rhelm, 2025).

2.5 Existing Water Quality Modelling Data

A summary of available water quality modelling data relevant to the precinct is provided in **Table 2-1**.

Table 2-1 Existing Water Quality Modelling Data

Data Source	Data Type	Relevance to the Assessment
Flooding, Water Cycle Management and Riparian Corridor Assessment (Calibre, 2018)	MUSIC	A preliminary water quality model was developed by Calibre to inform treatment device design for the precinct. The model was developed in accordance with the Blacktown City Council guidelines. Given the significant changes in water quality targets subsequent to the Calibre (2018) modelling as well as changes to the precinct ILP, new MUSIC models have been developed as part of the subject water cycle management assessment (refer **Section 5**).

2.6 Waterway Health Data

2.6.1 Water Quality Data

Blacktown City Council provided water quality data (received 25 March 2025) collected by Council for monitoring sites in Eastern Creek and Bells Creek.

The Eastern Creek monitoring site is located downstream of Garfield Road West. The Bells Creek monitoring site is located at the Carnarvon Road crossing.

The data provided was from the analysis of samples collected between July 2013 and June 2024, and includes the following analytes:

- Electrical conductivity (µS/cm)
- pH (measured insitu)
- Dissolved oxygen (% sat)
- Turbidity (NTU)
- Total Nitrogen (mg/L)
- Total Phosphorus (mg/L)
- Total Suspended Solids (mg/L)
- Ammonia as N (mg/L)
- Nitrite + Nitrate as N (NOx) (mg/L)
- Total Kjeldahl Nitrogen (mg/L)
- Chlorophyll-a (mg/m^3)
- Temperature (°C).

Average values of key analytes recorded in Bells Creek and Eastern Creek are provided in **Table 2-2**. The data indicate that the creeks are impacted by land use practices within the catchment, with relatively high average nutrient concentrations and turbidity and relatively low dissolved oxygen conditions (reported as percent saturation, with values lower than 90% being below the threshold for good water quality). The data generally shows a slight downward trend in suspended solids and nutrient concentrations within Bells Creek and Eastern Creek over time.

Table 2-2 Average of key water quality analytes (All Data from 2013 - 2024)

	Average of Electrical conductivity (µS/cm)	Average of Total Suspended Solids (mg/L)	Average of pH (in situ)	Average of Dissolved Oxygen (% sat)	Average of Turbidity	Average of Total Nitrogen	Average of Total Phosphorus
Bells Creek	1022	37	7.41	58	63	1.35	0.15
Eastern Creek	1373	30	7.44	55	59	2.44	0.28

2.6.2 Rapid Riparian Assessment

Digital spatial data containing a riparian corridor condition classification from a 2024 survey was provided by Blacktown City Council (received 25 March 2025). Classifications are shown in **Figure 2-1**. The data indicates quite variable conditions across the precinct, ranging from very poor (in one section of Bells Creek) to good (reaches of Eastern Creek).

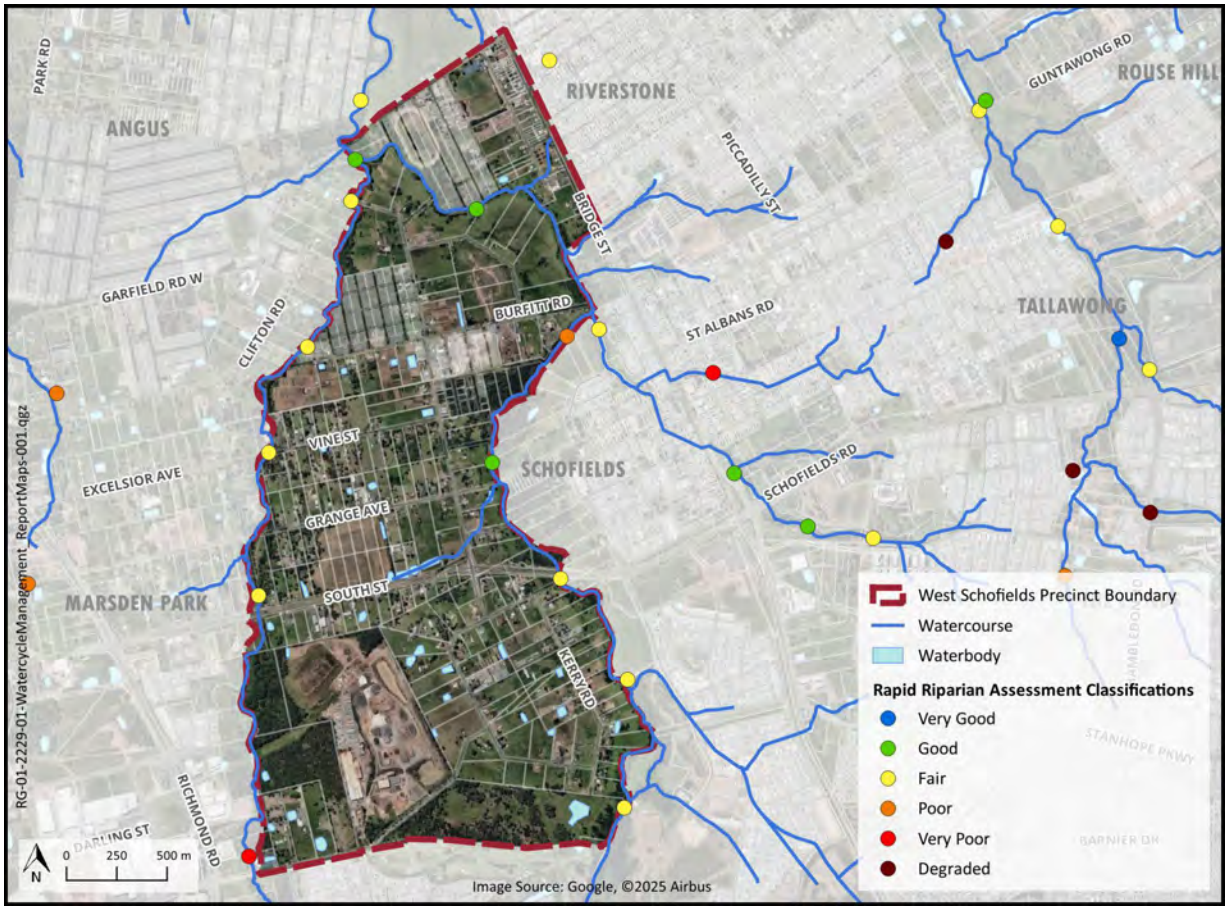


Figure 2-1 Rapid Riparian Assessment Classifications (Source: Blacktown City Council, 2024)

2.7 Catchment Data

2.7.1 Sub-catchment Mapping Data

Sub-catchment mapping has been completed to inform the development of previous hydrologic models and also for the MUSIC modelling undertaken as part of this assessment (refer **Section 5**).

2.7.2 Land Zoning and uses

Existing land zoning within the precinct is predominantly RU4 – Primary Production Small Lots with two smaller areas zoned Public Recreation (**Figure 2-2**). The southern RE1 area is a former landfill.

The existing actual land uses across the precinct that forms the 'baseline' conditions for this assessment are observed to be largely rural residential areas, forested areas and some riparian areas, with the exception of the existing brick production facility in the south-western portion of the precinct owned by CSR.

There are also some existing waste management facilities within the precinct. For example, the premises at 132 Burfitt Road is located within the precinct and is licensed under the *Protection of the Environment Operations Act 1997* (POEO Act). The property is known as the *North West Recycling Centre* owned and operated by Greenwaste Only Pty Ltd.

Facilities licenced under the PoEO Act are generally regulated with respect to stormwater discharges.

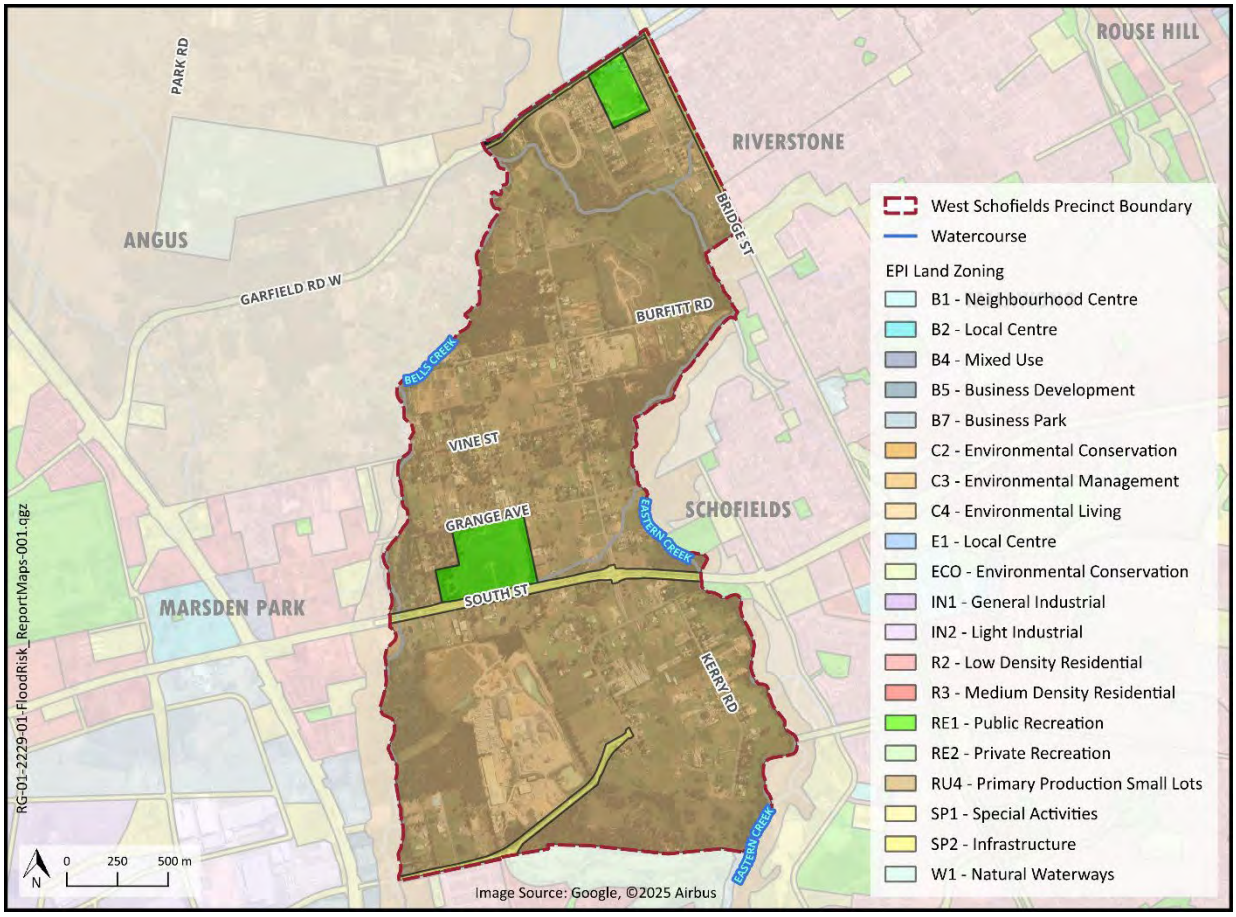


Figure 2-2 Existing Land Zoning (sourced from the Blacktown LEP)

2.7.3 Soils and Geology Data

Publicly available soil and geology data was sourced from the NSW Government's eSPADE (version 2.2). In summary, the precinct has the following characteristics:

- *Australian soil classification*: Predominately kurosols with patches of natric kurosols (soils with a proportion of exchangeable sodium in a sub-horizon). Kursols have a strong texture contrast in their profile with a strongly acid B horizon (**Figure 2-3**).
- *Soil landscapes*– Blacktown (residual), South Creek and Berkshire Park (alluvial) (**Figure 2-3**).
- *Hydrologic Soil Group*: Slow infiltration.
- *Acidification hazard*: Predominately moderate to severe limitations, with a portion defined as very severe limitations.
- *Water erosion hazard*: Predominately moderate limitations, with a portion defined as severe limitations.
- *Waterlogging hazard*: Predominantly very slight to negligible limitations, with a portion defined as severe limitations.
- *Wind erosion hazard*: Very slight to negligible limitations.
- *Acid sulfate soil risk probability*: No known occurrence.

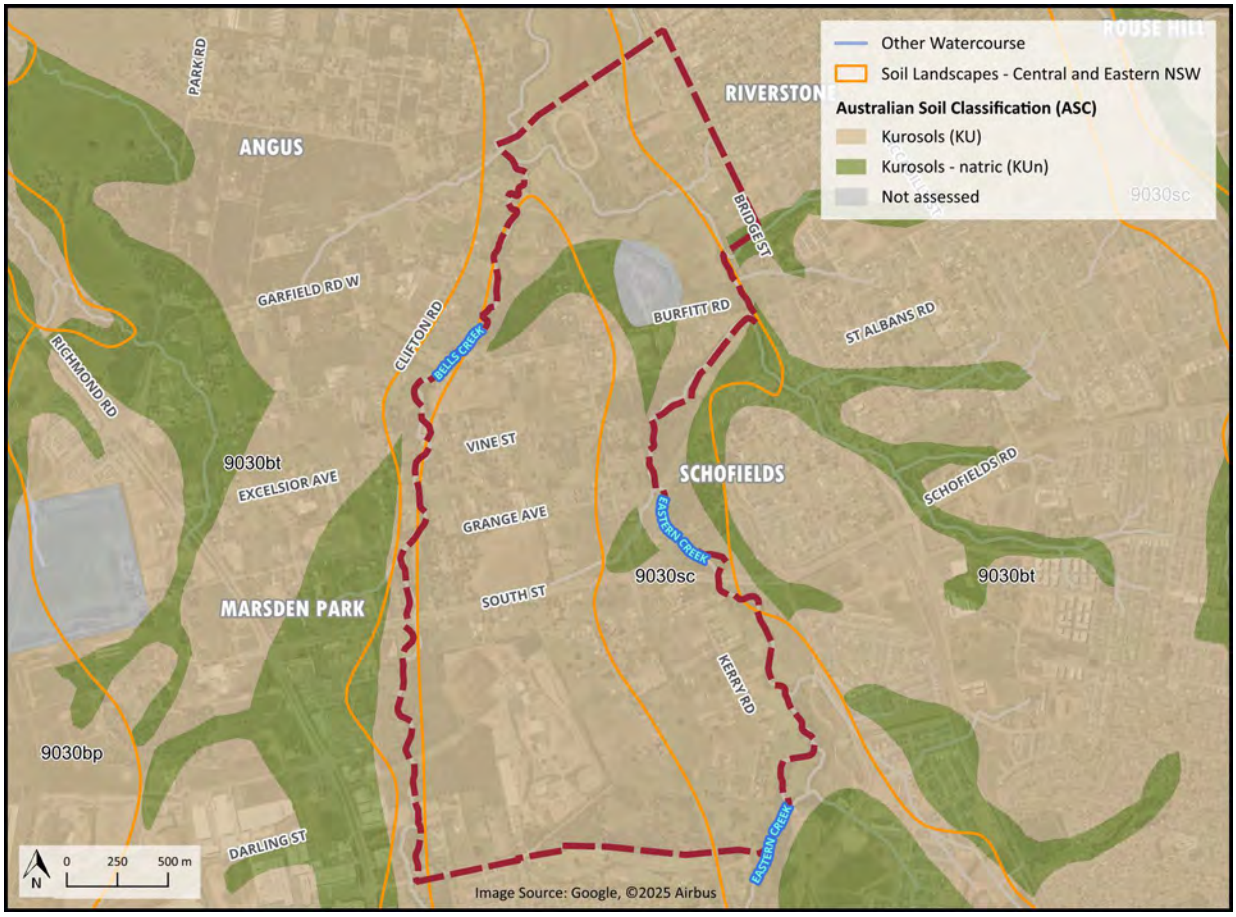


Figure 2-3 Australian Soil Classification and Soil Landscape mapping

A single soil profile (survey number: 1000314) is available for the precinct, located near Garfield Road West **(Figure 2-4**). The profile is reported to have been imperfectly drained and consisted of varying layers of sandy clays. The sample indicates salting present. This is consistent with the soil type and presents limitations for the use of some types of water management approaches, such as infiltration, which is not recommended in saline environments.

This information has been used to inform the water balance modelling reported in **Section 5**.

Figure 2-4 Soil Profile Location (Source: eSPADE Profile Database)

2.7.4 Terrain Data

LiDAR data covering the subject site and surrounds was obtained from the Geoscience Australia Elevation Dataset (known as ELVIS). The LiDAR data was captured in June-July 2019 and has a 1m resolution with a vertical accuracy of +/-0.3m and a horizontal accuracy of +/-0.8m. It is noted that more contemporary LiDAR became available over the course of preparing this assessment, however, given the purpose for which the data is used, the 2019 LiDAR is considered to be adequate.

2.8 Meteorological Data

Meteorological data has been sourced from the Bureau of Meteorology (BoM) publicly available climate data. This is described below.

2.8.1 Rainfall Data

Daily rainfall data relevant to the study area has been sourced from the 'Richmond – UWS Hawkesbury' meteorological station (station number: 067021). This station is located approximately 15 km from the precinct and contains the longest timeseries of recorded rainfall data of the nearby stations (139 years).

Rainfall statistics for this gauge from BoM are summarised in **Table 2-3**. These statistics show that:

- Mean annual rainfall is 804 mm
- Annual rainfall has ranged from 268 – 1718 mm
- Highest daily rainfall recorded was 309 mm in May 1889.

Table 2-3 Monthly Climate Statistics for Station 067021 (Source: BoM)

Statistic Element (for Years 1881-2023)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Mean rainfall (mm)	96.5	94.5	94	67.3	55.9	60.5	45.6	42	42.1	57.4	73.6	75.1	804
Highest rainfall (mm)	375.7	442.4	569	338.9	529	360.6	285.6	465.3	180.1	217.8	449.6	327	1718.2
Date of Highest rainfall	1972	1990	2022	1946	1889	1950	1904	1986	1892	2004	1961	1947	1950
Lowest rainfall (mm)	7.4	3	3	1.6	1.1	0.8	0	0	0	1.3	2.5	0	268
Date of Lowest rainfall	1929	1939	1965	1980	2008	1883	1972	1946	1957	1968	1915	2019	1944
Decile 1 monthly rainfall (mm)	21.6	11	17.4	11.6	7.5	5.3	5.2	4	8.4	12.7	14.8	14.2	527.4
Decile 5 (median) monthly rainfall (mm)	74.2	74.3	66.5	50.7	30.6	38.6	27.8	24	33.4	43.5	66.2	55.6	796
Decile 9 monthly rainfall (mm)	188	190.1	188.6	131.7	121.3	152	108	86.2	86.2	127.4	139	158.2	1076
Highest daily rainfall (mm)	198.6	175.2	209	160	309.4	101.6	138.4	210	103.4	94.8	131.8	88.1	309.4
Date of Highest daily rainfall	11/01/1949	10/02/1992	4/03/2022	16/04/1946	28/05/1889	1/06/1897	27/07/1952	6/08/1986	2/09/1970	20/10/1987	18/11/1961	10/12/1920	28/05/1889
Mean number of days of rain	11.2	11.2	11.5	9.7	9	10	8.4	7.9	8.2	9.1	10.2	10.2	116.6
Mean number of days of rain >= 1 mm	7.7	7.5	7.8	6.3	5.5	5.7	4.6	4.8	5.3	6.1	7.2	7.3	75.8
Mean number of days of rain >= 10 mm	2.6	2.7	2.5	1.8	1.3	1.6	1.1	1.1	1.1	1.7	2.4	2.3	22.2
Mean number of days of rain >= 25 mm	1	1	1	0.6	0.4	0.6	0.4	0.3	0.2	0.5	0.7	0.7	7.4

2.8.2 Evapotranspiration Data

The mean monthly evapotranspiration within the precinct was sourced from BoM's gridded average evapotranspiration (refer **Table 2-4**). These statistics demonstrate:

- Mean monthly evapotranspiration is 98 mm, equivalent to 1171 mm per year.
- Mean monthly evapotranspiration ranges from 40 to 163 mm

Table 2-4 Mean monthly evapotranspiration (Source: BoM)

Month	Evapotranspiration
January	163
February	125
March	120
April	79
May	51
June	40
July	41
August	58
September	79

Month	Evapotranspiration
October	121
November	142
December	152

3 Development Controls and Guidelines

There are a range of state and Council water-related guidelines for consideration. A summary of state and local planning policies and guidelines relevant to the precinct is provided below.

The most stringent water quality and water quantity standards are proposed be adopted, where conflicting design targets are identified.

3.1 Relevant NSW Government Policies and Plans

3.1.1 State Environmental Planning Policy (Precincts—Central River City) 2021

The precinct is located within Sydney's North West Growth Area (NWGA) and the State Environmental Planning Policy (Precincts—Central River City) 2021 (PCRC SEPP) is applicable. The SEPP is an environmental planning instrument (EPI) which controls land use and development within the precinct.

This SEPP has no directly relevant clauses relating to water-cycle management.

3.1.2 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The precinct is located within the Hawkesbury-Nepean Catchment which is a regulated catchment and the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (B&C SEPP) applies.

Clause 6.6 of the policy stipulates several water cycle management related conditions:

6.6 Water quality and quantity

(1) In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the following—

(a) whether the development will have a neutral or beneficial effect on the quality of water entering a waterway,

(b) whether the development will have an adverse impact on water flow in a natural waterbody,

(c) whether the development will increase the amount of stormwater run-off from a site,

(d) whether the development will incorporate on-site stormwater retention, infiltration or reuse,

(e) the impact of the development on the level and quality of the water table,

(f) the cumulative environmental impact of the development on the regulated catchment,

(g) whether the development makes adequate provision to protect the quality and quantity of ground water.

(2) Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied the development ensures—

(a) the effect on the quality of water entering a natural waterbody will be as close as possible to neutral or beneficial, and

(b) the impact on water flow in a natural waterbody will be minimised.

3.1.3 Local Planning Direction

The Minister for Planning has released local planning directions under section 9.1(2) of the *Environmental Planning and Assessment Act 1979*.

Local Planning Direction 3.10 pertains to water catchment protection with the following direction:

1. *When preparing a planning proposal, the planning proposal authority must be satisfied that the planning proposal achieves the following:*
    a. *is consistent with the objectives of this direction,*

b. *is consistent with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, as published by Water Quality Australia, and any water quality management plan prepared in accordance with those guidelines,*

c. *includes documentation, prepared by a suitably qualified person(s), indicating whether the planning proposal:*

   i. *is likely to have an adverse direct, indirect or cumulative impact on terrestrial, aquatic or migratory animals or vegetation, and any steps taken to minimise such impacts*

   ii. *is likely to have an impact on periodic flooding that may affect wetlands and other riverine ecosystems*

   iii. *is likely to have an adverse impact on recreational land uses within the regulated catchment*

d. *identifies and considers the cumulative impact of the planning proposal on water quality (including groundwater) and flows of natural waterbodies and on the environment more generally, including on land adjacent to or downstream of the area to which this direction applies,*

e. *identifies how the planning proposal will:*

   i. *protect and improve environmental values, having regard to maintaining biodiversity, and protecting native vegetation, cultural heritage and water resources (including groundwater),*

   ii. *impact the scenic quality of the natural waterbodies and the social, economic and environmental interests of the community,*

   iii. *protect and rehabilitate land from current and future urban salinity, and prevent or restore land degradation,*

f. *considers any feasible alternatives to the planning proposal.*

2. *When preparing a planning proposal, the planning proposal authority must:*

   a. *consult with the councils of adjacent or downstream local government areas where the planning proposal is likely to have an adverse environmental impact on land in that local government area, and*

   b. *as far as is practicable, give effect to any requests of the adjacent or downstream council.*

3.1.4 Wianamatta-South Creek Stormwater Management Guidelines (2022)

The precinct is located in the Wianamatta-South Creek catchment where stormwater management plans for development are required to comply with *Technical guidance for achieving Wianamatta-South Creek stormwater management targets* (Wianamatta-South Creek Guidelines) (DPE, 2022).

Chapter 1 of the Wianamatta-South Creek Guidelines (DPE, 2022) presents two operational water quality target options for proposed development within the Wianamatta-South Creek catchment. These targets are as follows:

Option 1 – annual load reduction

- 90% reduction in TSS
- 80% reduction in TP
- 65% reduction in TN

- 90% reduction in gross pollutants

Option 2 – allowable mean annual load

- <80kg/ha/year of TSS
- <0.3kg/ha/year of TP
- <3.5kg/ha/year of TN
- <16kg/ha/year of gross pollutants

In addition to water quality targets, the Wianamatta-South Creek Guidelines (DPE, 2022) provide two stormwater flow target options. These are as follows:

Option 1 – mean annual runoff volume (MARV)

- MARV ≤2 ML/ha/y at the point of discharge to the local waterway
- 90%ile flow of 1,000–5,000 L/ha/day at the point of discharge to the local waterway
- 50%ile flow of 5-100 L/ha/day at the point of discharge to the local waterway
- 10%ile flow of 0 L/ha/day at the point of discharge to the local waterway

Option 2 – flow percentiles

- 95%ile flow of 3,000–15,000 L/ha/day at the point of discharge to the local waterway
- 90%ile flow of 1,000–5,000 L/ha/day at the point of discharge to the local waterway
- 75%ile flow of 100–1,000 L/ha/day at the point of discharge to the local waterway
- 50%ile flow of 5-100 L/ha/day at the point of discharge to the local waterway
- Cease to flow to be between 10% and 30% of the time.

3.2 Relevant Blacktown City Council Policies and Plans

3.2.1 Blacktown Local Environment Plan 2015

Clauses pertaining to water management in the Blacktown Local Environment Plan (LEP) include:

7.3 Riparian land and watercourses

(1) The objectives of this clause is to protect and maintain the following—

(a) water quality within watercourses,

(b) the stability of the bed and banks of watercourses,

(c) aquatic and riparian habitats,

d) ecological processes within watercourses and riparian areas.

(2) This clause applies to the following land—

(a) land that is a watercourse,

(b) land that is within 40 metres of the top of the bank of a watercourse.

(3) In deciding whether to grant development consent for development on land to which this clause applies, the consent authority must consider—

(a) whether or not the development is likely to have any adverse impact on the following—

(i) the water quality and flows within the watercourse,

(ii) aquatic and riparian species, habitats and ecosystems of the watercourse,

(iii) the stability of the bed and banks of the watercourse,

(iv) the free passage of fish and other aquatic organisms within or along the watercourse,

(v) any future rehabilitation of the watercourse and riparian areas, and

(b) whether or not the development is likely to increase water extraction from the watercourse, and

(c) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that—
(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or
(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

3.2.2 Blacktown City Council Growth Centre Precincts Development Control Plan (2010)

The Blacktown City Council Growth Centre Precincts Development Control Plan (DCP) regulates development within the Sydney growth areas with specific guidelines and parameters (BCC, 2022).

Clause 2.3.1 provides a number of water cycle management related development objectives. Clauses relevant to the subject assessment have been reproduced below.

Objectives

(a) to manage the flow of stormwater from urban parts of the Precinct to replicate, as closely as possible, pre-development flows;

Controls - General

3. Stormwater is to be managed primarily through the street network in accordance with Council's Water Sensitive Urban Design Development Control Plan.

4. Roads on primary drainage lines shown on the Key elements of the water cycle management and ecology strategy figure, in the relevant Precinct Schedule, are to be constructed in the locations shown, and are to be designed in accordance with specifications of Council in relation to management of stormwater flows and quality.

• prevent damage by stormwater to the built and natural environment,

• reduce nuisance flows to a level which is acceptable to the community,

• provide a stormwater system which can be economically maintained and which uses open space in a compatible manner,

• minimise urban water run-off pollutants to watercourses, and

8. Where practical, development shall attenuate up to the 50% AEP peak flow for discharges into the local tributaries, particularly Category 1 and 2 creeks. This will be achieved using detention storage within water quality features and detention basins.

9. The developed 1% AEP peak flow is to be reduced to pre-development flows through the incorporation of stormwater detention and management devices.

11. The trunk stormwater system is to be constructed and maintained by Council in accordance with the Riparian and Water Cycle Management Strategy at Appendix B, and to achieve water quality targets set by the Department of Environment, Climate Change and Water in Table 2-1.

Water quality and stream erosion targets specified in Table 2-1 of the Growth Centre Precincts DCP (2010) are reproduced below.

Stormwater management objective:

- 85% reduction in TSS
- 65% reduction in TP
- 45% reduction in TN

- 90% reduction in gross pollutants
- Stream erosion control ratio of 3.5-5.0:1

An 'ideal' stormwater outcome is also reported as an aspirational target:

- 95% reduction in TSS
- 95% reduction in TP
- 85% reduction in TN
- 100% reduction in gross pollutants
- Stream erosion control ratio of 1:1.

3.2.3 WSUD Developer Handbook – MUSIC Modelling and Design Guideline (2020)

Blacktown City Councils WSUD Developer Handbook – MUSIC Modelling and Design Guideline (2020) details the requirements for water quality modelling for the precinct. This guideline has been considered in this assessment.

4 Indicative Layout Plan

An Indicative Layout Plan (ILP) has been developed by Cox Architecture (Revision 6, dated 9 September 2025) with consideration of a range of constraints and opportunities (including water cycle management and flood risk management) and was developed in the context of several multidisciplinary collaborative workshops. This ILP has been used as a basis for post-development land use characteristics adopted in this water cycle management assessment.

The exhibited ILP is shown in **Figure 4-1**.

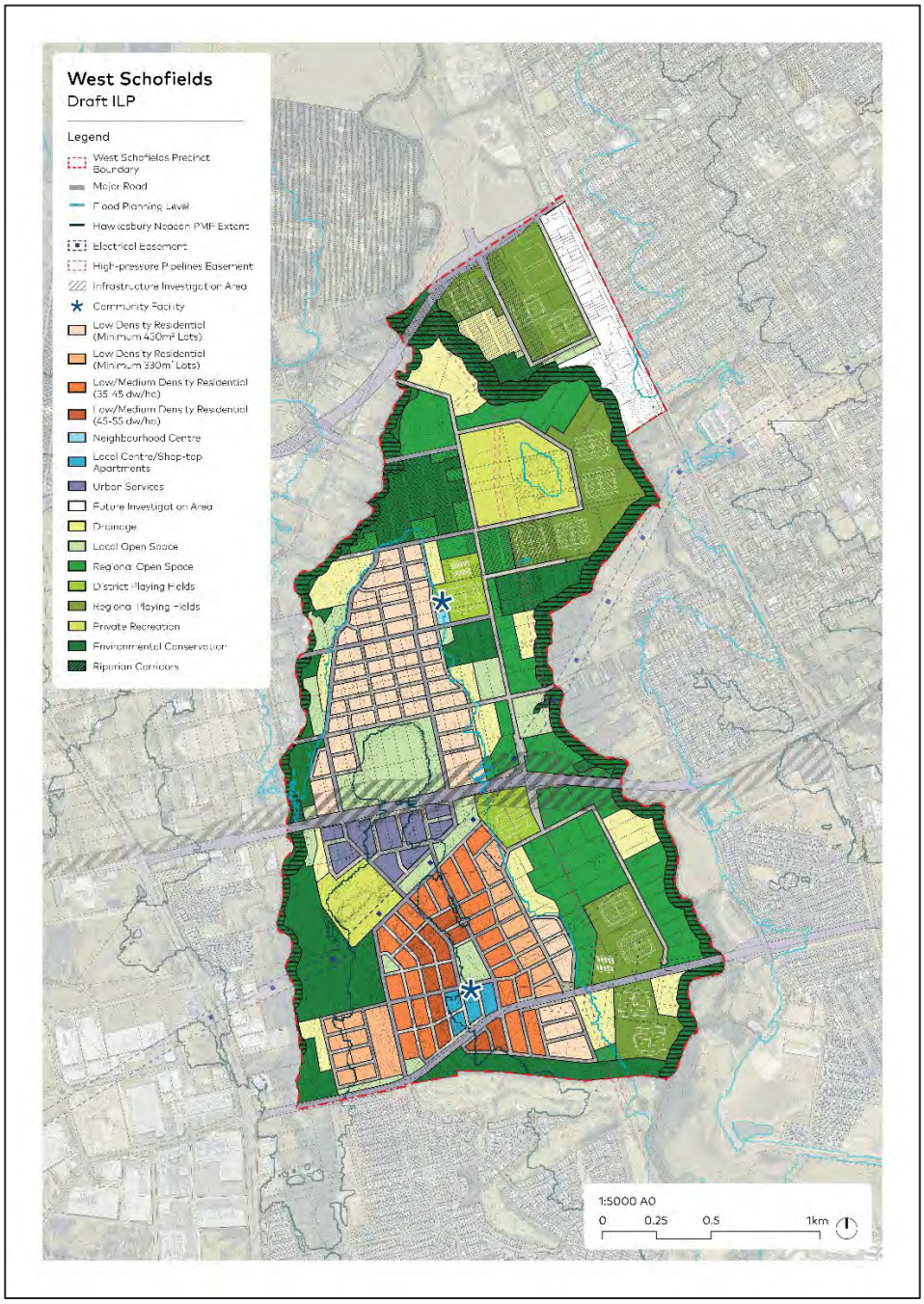


Figure 4-1 Indicative Layout Plan (Source: Cox, 2025)

5 Stormwater Quality Management

5.1 Stormwater Quality Targets

As outlined in **Section 3**, a number of different stormwater quality targets apply to the precinct. A summary of these different stormwater targets and their applicability to the precinct stormwater management strategy is provided in **Table 5-1**.

Table 5-1 Summary of Range of Stormwater Quality Targets

Target	Applicability to the Assessment
BCC Growth Centres DCP minimum reduction targets of: • 85% reduction in TSS • 65% reduction in TP • 45% reduction in TN • 90% reduction in gross pollutants	These are the considered the minimum requirement in terms of pollutant reduction targets applicable to the precinct.
BCC Growth Centres DCP aspirational reduction targets of: • 95% reduction in TSS • 95% reduction in TP • 85% reduction in TN • 100% reduction in gross pollutants	Although a desirable outcome in terms of catchment water quality, compliance with these targets is not mandated in the BCC Growth Centres DCP and is not considered economically viable given the quantum of stormwater management measures required to reduce pollutant loads by the target percentages.
Wianamatta-South Creek Guidelines (DPE, 2022) reduction targets of: • 90% reduction in TSS • 80% reduction in TP • 65% reduction in TN • 90% reduction in gross pollutants or Allowable mean annual load targets of: • <16kg/Ha/year gross pollutants • <80kg/Ha/year TSS • <0.3kg/Ha/year TP • <3.5kg/Ha/year TN	These have been adopted as the target reduction in pollutant loading in the development of the precinct water cycle management strategy.
Neutral or beneficial effect (NorBE) on water quality compared to existing conditions. The *Using MUSIC in the Sydney Drinking Water Catchment* (Water NSW, 2023) guidelines suggest aiming for the following MUSIC modelling results to demonstrate this will be achieved: • 10% reduction in TSS, TP and TN compared to existing conditions • Post-development pollutant concentrations less than pre-development for 50-98% of the time The additional reductions in pollutant loading are to account for uncertainties inherent in MUSIC modelling.	Achieving NorBE is necessary for compliance with the SEPP (Biodiversity and Conservation) 2021 (refer **Section 3.2**).

5.2 Existing Scenario MUSIC Modelling

A base case MUSIC model (version 6.3.0) was established to quantify existing pollutant loading from the precinct and relevant upstream catchments for the purpose of the NorBE assessment. Details of the base case MUSIC modelling are provided in the following sections.

5.2.1 Sub-Catchment Delineation

MUSIC sub-catchments upstream and within the precinct were delineated using 2019 LiDAR data (refer **Section 2.6.4**) and were based on the arrangement of drainage lines/overland flow paths.

Figure 5-1 shows the sub-catchment delineation adopted in the base case MUSIC model. Note that some areas outside of the precinct are located within the catchments for analysis.

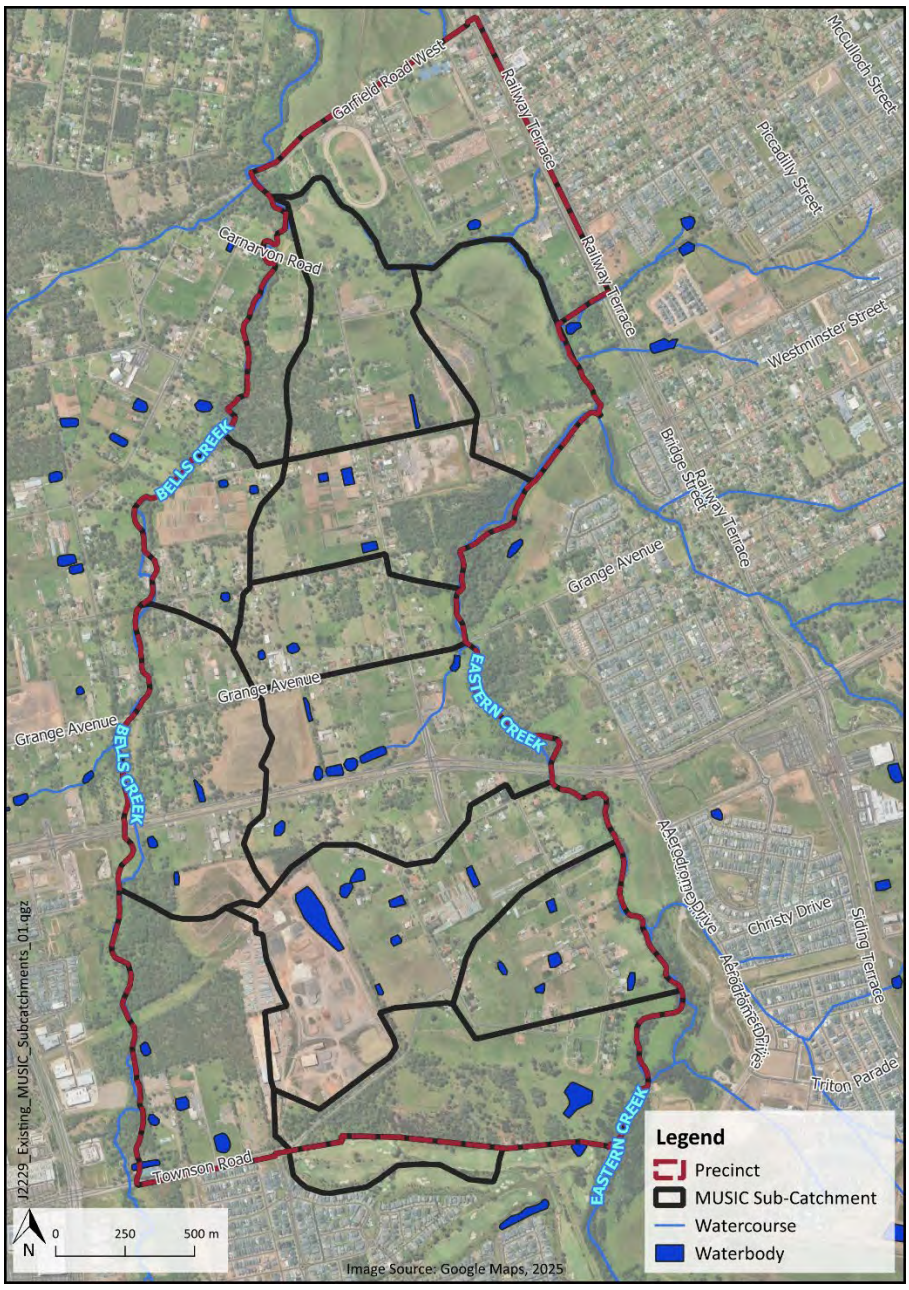


Figure 5-1 MUSIC Sub-Catchments – Existing Scenario

5.2.2 Base Information

As per the requirements of the WSUD Developer Handbook – MUSIC Modelling and Design Guideline (BCC, 2020), base meteorological data from Council's MUSIC-link (version 6.35) was adopted for the purpose of the water quality assessment. This utilises 6-minute rainfall pluviograph data from the Liverpool (Whitlam Centre) meteorological station (Station 067035) over a 9-year period from 1967 to 1976. This station is approximately 25km south of the precinct and reported a mean annual rainfall of 857 mm over the analysed time period.

The MUSIC-link base meteorological data also includes monthly average potential evapotranspiration (PET) data which equates to an annual rate of 1261mm/year.

Source node types within each sub-catchment were defined based on land use zoning, aerial imagery and site observations (**Figure 5-2**). Council's default MUSIC source nodes and parameters were adopted where appropriate. Alternate source node parameters from the NSW MUSIC Modelling Guidelines (BMT WBM, 2015) were used where no BCC nodes were available for the land use type (e.g. agricultural). Source node parameters for the existing scenario land use types are summarised in **Table 5-2**.

For areas of RU4 zoning where the land use appears to be a combination of rural and agricultural, noting that these have different pollutant generation properties in MUSIC, each land use type was assumed to cover 50% of the overall area.

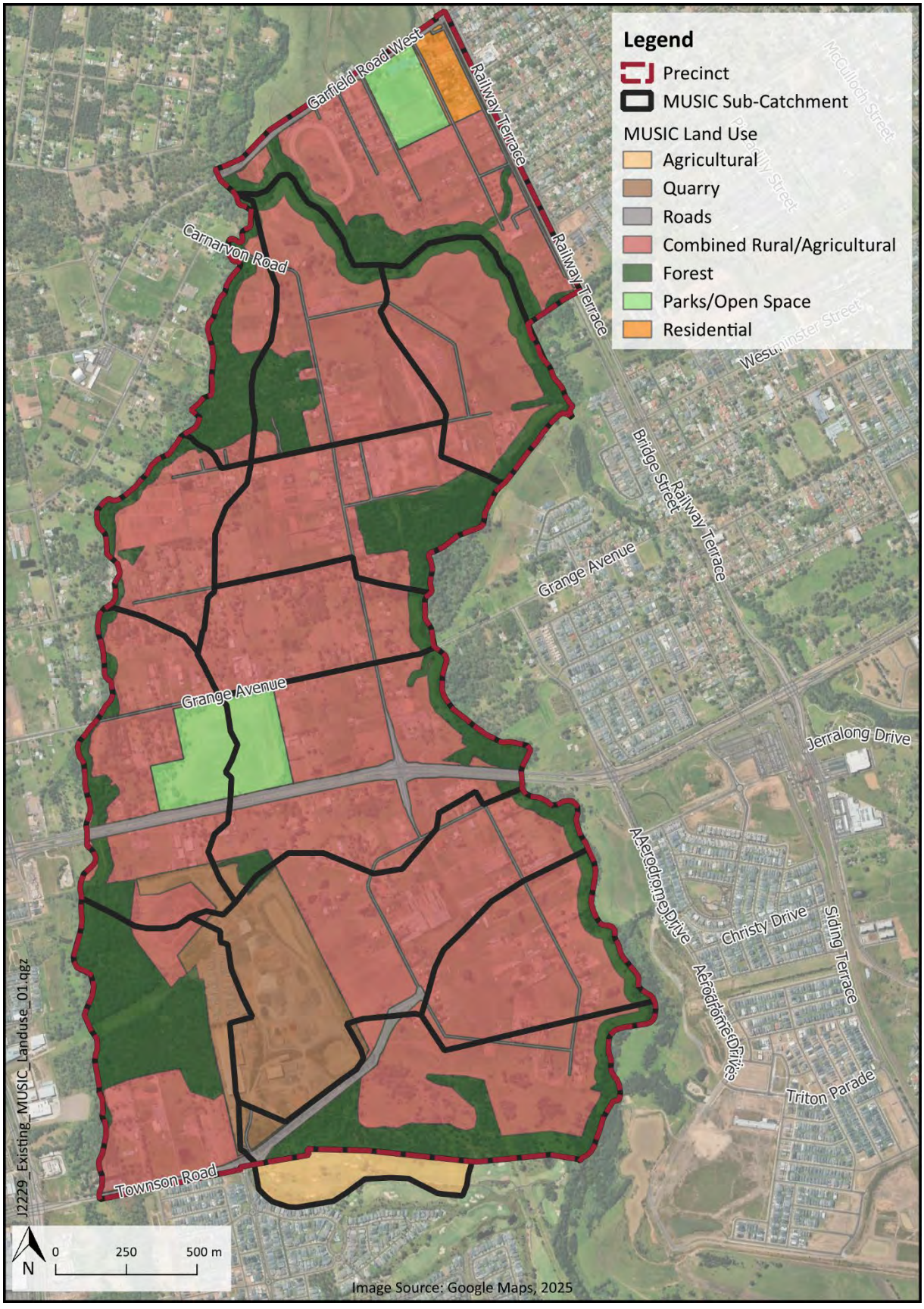


Figure 5-2 MUSIC Land Use – Existing Scenario

Table 5-2 Adopted MUSIC Source Node Parameters

		Land Use						
		Residential	**Quarries**	**Parks**	**Rural**	**Agriculture**	**Forest**	**Roads**
Percentage Impervious		50	10	5	5	5	0	85
Impervious Area Properties								
Rainfall Threshold (mm/day)		1.4						
Pervious Area Properties								
Soil Storage Capacity (mm)		170						
Initial Storage (% of Capacity)		30						
Field Capacity (mm)		70						
Infiltration Capacity Coefficient – a		210						
Infiltration Capacity Coefficient – b		4.7						
Groundwater Properties								
Initial Depth (mm)		10						
Daily Recharge Rate (%)		50						
Daily Baseflow Rate (%)		4						
Daily Deep Seepage Rate (%)		0						
Total Suspended Solids Generation (log mg/L)								
Base Flow	Mean	1.20	1.20	1.20	1.15	1.30	0.78	1.20
	Std Dev	0.17	0.17	0.17	0.17	0.13	0.13	0.17
Storm Flow	Mean	2.15	3.00	2.15	1.95	2.15	1.60	2.43
	Std Dev	0.32	0.32	0.32	0.32	0.31	0.20	0.32
Total Phosphorus Generation (log mg/L)								
Base Flow	Mean	-0.85	-0.85	-0.85	-1.22	-1.05	-1.22	-0.85
	Std Dev	0.19	0.19	0.19	0.19	0.13	0.13	0.19
Storm Flow	Mean	-0.60	-0.30	-0.60	-0.66	-0.22	-1.10	-0.30
	Std Dev	0.25	0.25	0.25	0.25	0.30	0.22	0.25
Total Nitrogen Generation (log mg/L)								
Base Flow	Mean	0.11	0.11	0.11	-0.05	0.04	-0.52	0.11
	Std Dev	0.12	0.12	0.12	0.12	0.13	0.13	0.12
Storm Flow	Mean	0.30	0.34	0.30	0.30	0.48	-0.05	0.34
	Std Dev	0.19	0.19	0.19	0.19	0.26	0.24	0.19

5.2.3 Treatment Nodes

No treatment nodes were used in the existing scenario MUSIC model. Whilst there are a number of existing waterbodies within the subject catchment, these are generally located offline and/or are small in scale. These features would be unlikely to provide substantial stormwater treatment under current conditions.

5.2.4 Results

Table 5-3 summarises the results of the existing scenario MUSIC water quality assessment for the overall precinct.

Table 5-3 Existing Scenario Pollutant Loads

Output	Catchment Outflow Loads
Flow (ML/yr)	1,430
Total Suspended solids (kg/yr)	305,000
Total Phosphorus (kg/yr)	442
Total Nitrogen (kg/yr)	2,580
Gross Pollutants (kg/yr)	12,100

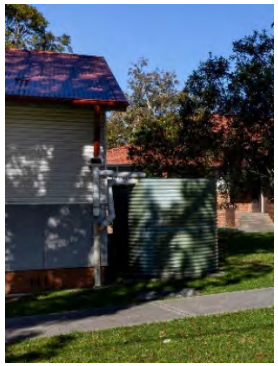
5.3 Stormwater Management Strategy

A stormwater treatment train was developed to target typical pollutants associated with urban runoff including gross pollutants, suspended sediment (TSS), nutrients (nitrogen and phosphorus) and hydrocarbons. In addition to stormwater treatment, the stormwater management strategy includes stormwater harvesting measures for the capture and re-use of stormwater to reduce potable water demands across the precinct.

Features of the proposed treatment train are summarised in **Table 5-4**. **Figure 5-3** shows the location of proposed regional treatment basins and connecting drainage lines.

Concept design drawings of proposed stormwater management measures will be developed following public exhibition of the ILP**.**

Table 5-4 Proposed Stormwater Treatment Train

Treatment Measures		Description[1]
On-lot measures	Rainwater tanks  *Image Source: NSW Department of Planning, Housing and Infrastructure / Edwina Richardson*	Rainwater tanks are proposed on each new allotment to capture rainwater for internal and external re-use.
At-source measures	Grassed swales  *Image Source: DCCEEW / Penny Vella*	Grassed swales are proposed to convey and treat runoff from public open space and sporting field areas, reducing the reliance on end of line treatment measures.

[1] Refer Section 5.4.3 for performance assumptions made for each measure

Treatment Measures		Description[1]
End of line measures	Gross pollutant traps (GPTs)  *Image Source: Civilmart*	GPTs are proposed on the downstream end of precinct stormwater drainage lines prior to bioretention basins. These are primary treatment measures targeting gross pollutants and coarse sediment. The GPTs will also contain oil baffles to capture hydrocarbons and satisfy Section 11.6.1 of Council's WSUD Developer Handbook – MUSIC Modelling and Design Guideline (2020).
	Bioretention basins  *Image Source: Rhelm, 2025*	Bioretention basins are proposed as tertiary treatment measures to target finer sediment and nutrients. For portions of the precinct where on-site detention is required, bioretention basins will be co-located within detention basins to minimise land take. These measures have been located outside of the 1% AEP Hawkesbury-Nepean flood extents and outside of the 0.2% AEP Eastern Creek and Bells Creek flood extents.
	Harvesting ponds	Stormwater harvesting ponds are proposed at the downstream end of the major site catchments and will be the main source of water for landscape irrigation of public open space and sporting fields within the precinct. The proposed harvesting scheme will reduce stormwater runoff volumes

Treatment Measures	Description[1]
 *Image Source: NSW Department of Planning, Housing and Infrastructure / Bill Code*	discharging from the precinct and will also reduce the reliance on potable water servicing.

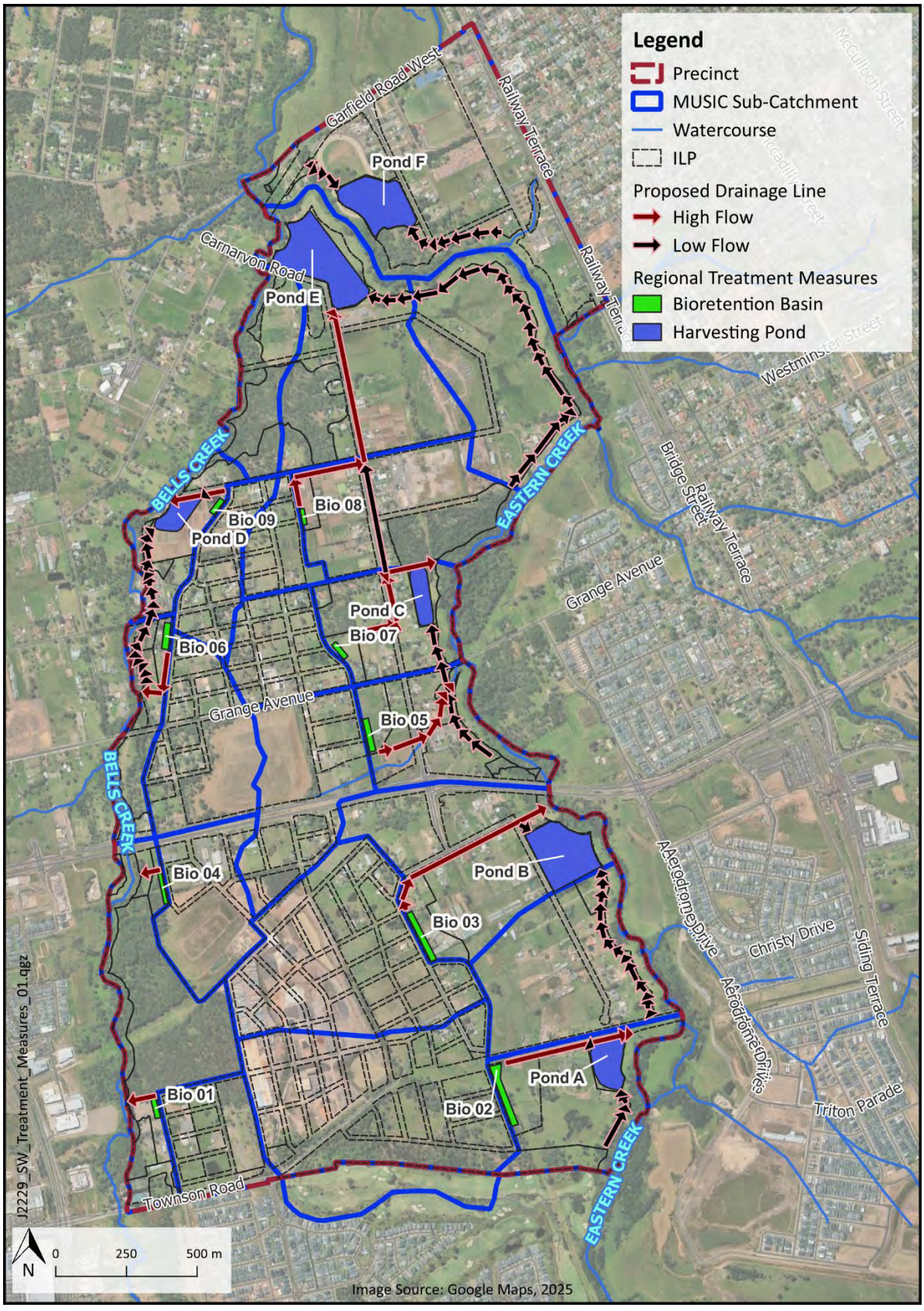


Figure 5-3 Regional Treatment Measures

5.4 Post-Development (ILP) Scenario MUSIC Modelling

5.4.1 Sub-Catchment Delineation

The sub-catchment delineation from the existing scenario modelling was modified to suit the ILP. This post-development MUSIC sub-catchment mapping is shown in **Figure 5-3**.

5.4.2 Source Nodes

Source nodes representing post-development land uses were obtained from BCC's default MUSIC nodes. The post-development land use is shown in **Figure 5-4**.

For proposed residential and commercial areas, the land use was split into roof, driveway and landscaping areas. **Table 5-5** shows the surface type split for these land uses.

Percentage impervious values were assigned in accordance with the recommended values in the WSUD Developer Handbook – MUSIC Modelling and Design Guideline (BCC, 2020). These values are considered conservative given the impervious fraction used in MUSIC modelling is typically based on effective impervious area (EIA) rather than total impervious area (TIA). The adopted percentage imperviousness for post-development land use types is shown in **Table 5-6**.

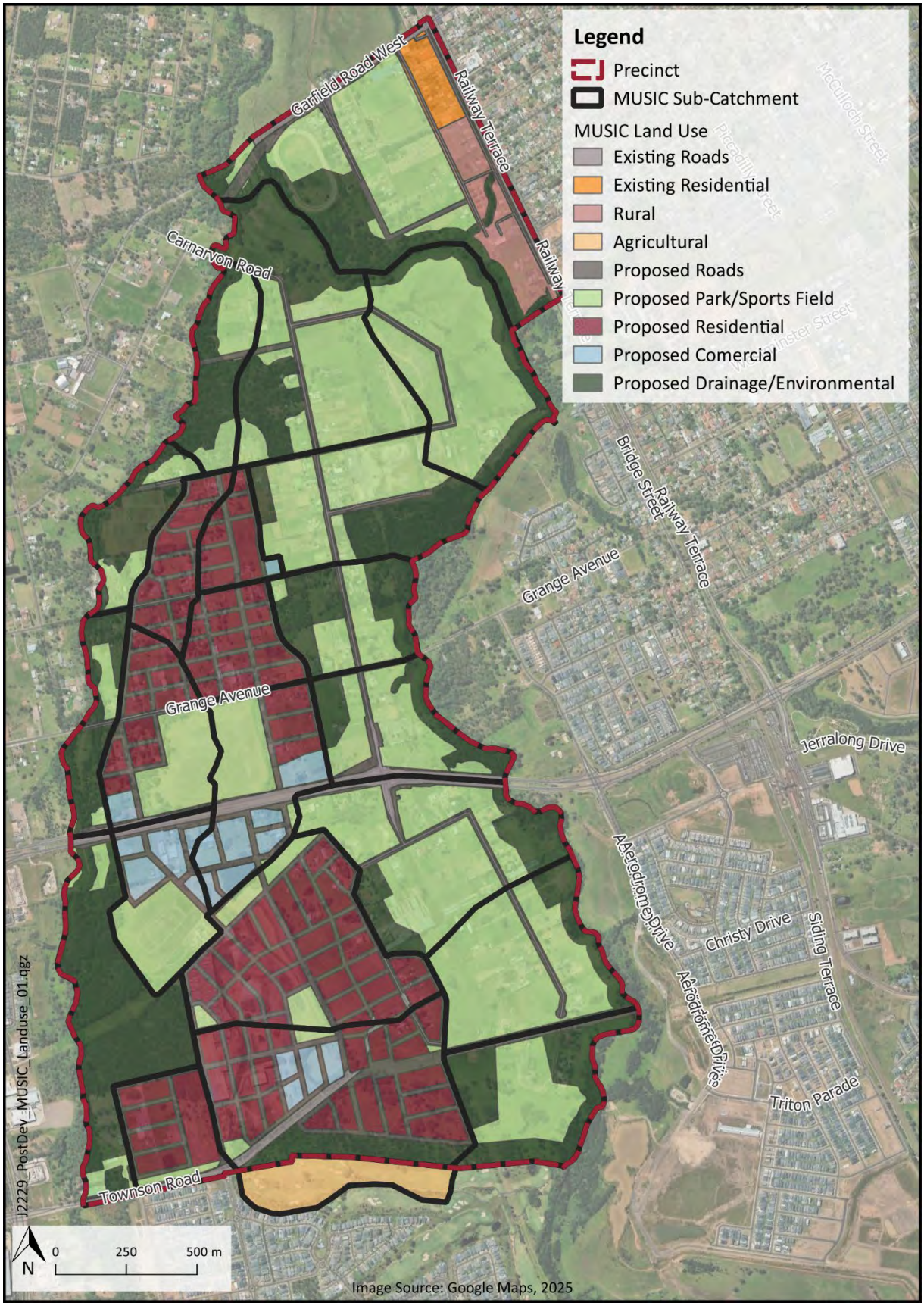


Figure 5-4 MUSIC Land Use - Post-Development Scenario

Table 5-5 Post-Development Land Use Split

Land Use	Source Node Type (% of total area)			
	BCC Roof Area	BCC Road Areas (driveways)	BCC Other Impervious Areas	BCC Pervious Areas
Residential	60	10	15	15
Commercial	45	45	5	5

Table 5-6 Post-Development Source Nodes and Imperviousness

Land Use	Source Node Type	Percentage Impervious
Proposed Residential	As per **Table 5-5**	85
Proposed Commercial	As per **Table 5-5**	95
Proposed Parks/Sports Field	Residential	10[2]
Proposed Roads	Sealed road	95
Proposed Drainage/Environmental	Forest	0

5.4.3 Treatment Nodes

Five treatment node types have been included in the MUSIC models to represent elements of the treatment train:

- Rainwater Tanks,
- Swales,
- Continuous Deflective Separation (CDS) GPTs,
- Bioretention, and
- Ponds (harvesting).

5.4.3.1 Rainwater Tanks

Default rainwater tank treatment nodes were used in the post-development MUSIC model.

Adopted residential rainwater tank assumptions are as follows:

- Tank sizing of 4kL per allotment, modelled at 90% of the total volume in MUSIC to allow for air space and sedimentation,
- Tanks assumed to receive 100% of roof runoff from each dwelling, and
- Assumed rainwater re-use rates of:
  - Internal re-use rate of 0.1kL/day/lot
  - External re-use rate of 25kL/year/lot

DCP controls will be required to enforce the minimum rainwater tank volumes and contributing roof area assumptions. Multiple slimline tanks may be required to capture runoff from the entire roof area.

For commercial areas, a rainwater tank size of 5kL per 100m^2 of roof area has been adopted. The re-use demand for these areas has been set at a rate corresponding to 80% of the non-potable water demand being met.

[2] This is lower than the 50% recommended in the WSUD Developer Handbook – MUSIC Modelling and Design Guideline (BCC, 2020). A SEPP/DCP clause will be required to enforce a maximum 10% imperviousness for public open space areas.

5.4.3.2 *Swales*

Swale treatment nodes were obtained from BCC's default MUSIC nodes. Swales have been proposed as an at-source treatment measure for public open space and sporting fields, with an assumed length of 200m per hectare of public open space/sporting field. This has been modelled as 100m/ha to allow for distributed catchment inflows along the length of the swales.

Key swale parameters are summarised in **Table 5-7.**

Table 5-7 Swale Parameters

Parameter	
Low Flow Bypass (m^3/s)	0
Bed Slope (%)	0.5
Base Width (m)	5
Top Width (m)	10
Depth (m)	0.5
Vegetation Height (m)	0.05
Exfiltration Rate (mm/hr)	0

5.4.3.3 *CDS GPTs*

CDS GPT treatment nodes were obtained from BCC's default MUSIC nodes. A single CDS node was used for each major post-development sub-catchment within the proposed residential/commercial areas. The high flow bypass rate has been set at the 4EY flowrate for each sub-catchment, calculated using a DRAINS hydrologic model (refer **Section 6.2**).

Key GPT parameters are summarised in **Table 5-8**.

Table 5-8 CDS GPT Parameters

CDS GPT		
	Input (mg/L)	**Output (mg/L)**
Low Flow Bypass (m^3/s)	0	
High Flow Bypass (m^3/s)	4EY flowrate	
Total Suspended Solids	0	0
	75	75
	1000	300
Total Phosphorous	0	0
	0.5	0.5
	10	7
Total Nitrogen	0	0
	50	50
Gross pollutants	0	0
	100	2

5.4.3.4 *Bioretention*

Default bioretention treatment nodes were used to represent the regional bioretention basins in the post-development MUSIC model, with the sizing and parameterisation based on Section 11.8 of the WSUD Developer Handbook – MUSIC Modelling and Design Guideline (BCC, 2020). High flow bypass has been set at the 4EY flow.

Key bioretention basin parameters are summarised in **Table 5-9**.

Table 5-9 Bioretention Parameters

Parameter	Bio 01	Bio 02	Bio 03	Bio 04	Bio 05	Bio 06	Bio 07	Bio 08	Bio 09
Upstream Catchment Area (Ha)	12.8	53.5	39.5	23.6	16.9	20.9	13.0	7.5	10.8
Low Flow Bypass (m^3/s)					0				
High Flow Bypass (m^3/s)	1.1	2.8	3.2	1.5	0.6	1.2	1.4	0.8	0.9
Filter Area (m^2)	1,300	5,400	4,000	2,400	1,600	2,100	1,300	800	1,200
Filter Depth (m)					0.8				
Extended Detention Depth (m)					0.3				
Saturated Hydraulic Conductivity (mm/hr)					100				
TN Content of Filter Media (mg/kg)					800				
Orthophosphate Content of Filter Media (mg/kg)					40				
Lined Base					Yes				
Vegetated with Effective Nutrient Removal Plants					Yes				

5.4.3.5 *Ponds (harvesting)*

Default pond treatment nodes were used to represent the stormwater harvesting ponds. The modelled re-use rates have been based on an assumed irrigation rate of 0.4kL/year over 90% of pervious open space/sporting field areas surrounding the ponds (downstream of the residential/commercial areas).

Key harvesting pond parameters are summarised in **Table 5-10**.

Table 5-10 Harvesting Pond Parameters

Parameter	Pond A	Pond B	Pond C	Pond D	Pond E	Pond F
Low Flow Bypass (m^3/s)			0			
High Flow Bypass (m^3/s)			100			
Surface Area (m^2)	10,000	20,000	5,000	5,000	35,000	20,000

Parameter	Pond A	Pond B	Pond C	Pond D	Pond E	Pond F
Extended Detention Depth (m)	0.5					
Permanent Pool Volume (m^3)	15,000	30,000	7,500	7,500	52,500	30,000
Exfiltration Rate (mm/hr)	0					
Evaporative Loss as % of PET	75					
Notional Detention Time (hrs)	8					
Re-use Rate (kL/year)	66,185	117,192	53,745	35,005	204,719	75,022

5.4.4 Results

5.4.4.1 NorBE Assessment

Table 5-11 shows existing and post-development pollutant loading for the purpose of the NorBE assessment.

A comparison of the existing and post-development TSS, TP and TN concentrations for runoff-generating events is provided in **Figure 5-5** to **Figure 5-7**.

Table 5-11 Existing vs Post-Development Load Comparison (NorBE Assessment)

Output	Existing Outflow Loads	Post-Development Outflow Loads	Percentage Reduction
Flow (ML/yr)	1,430	1,360	-4.9
Total Suspended solids (kg/yr)	305,000	45,300	-85.1
Total Phosphorus (kg/yr)	442	168	-62.0
Total Nitrogen (kg/yr)	2,580	1,650	-36.0
Gross Pollutants (kg/yr)	12,100	380	-96.9

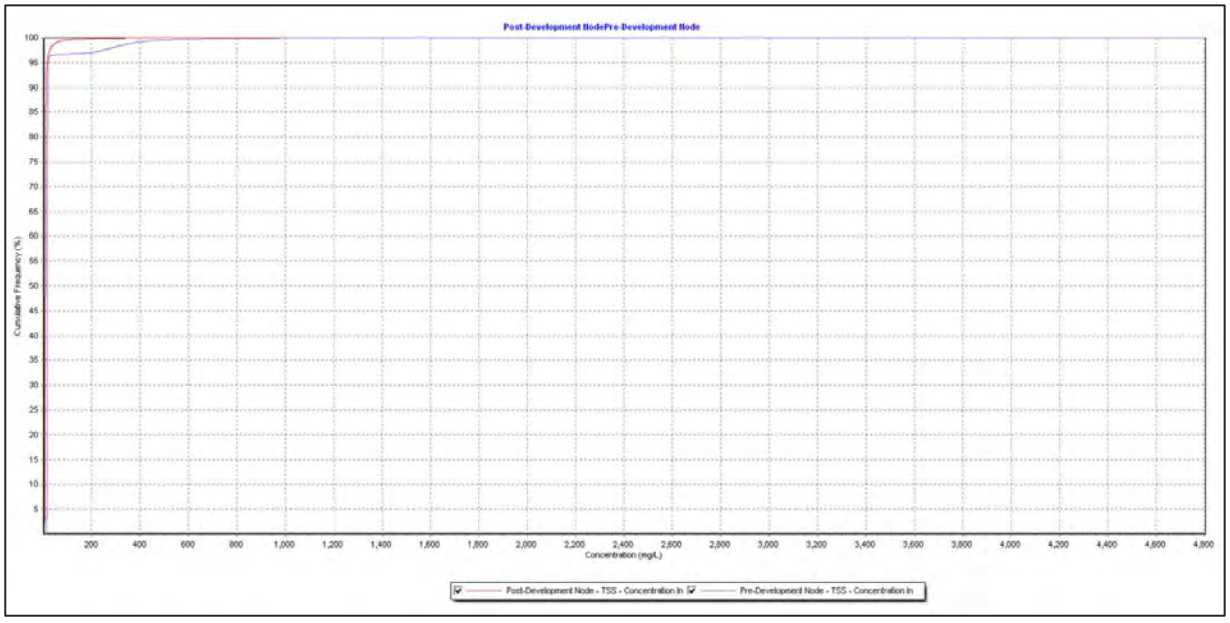


Figure 5-5 Existing vs Post-Development Concentration Comparison – TSS

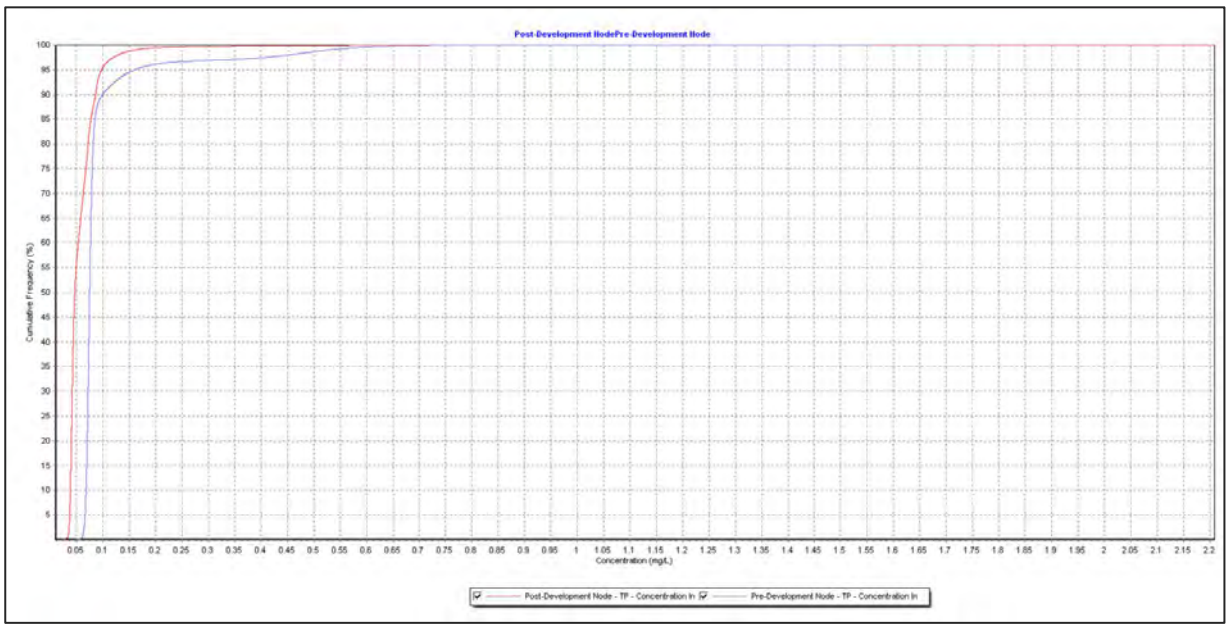


Figure 5-6 Existing vs Post-Development Concentration Comparison – TP

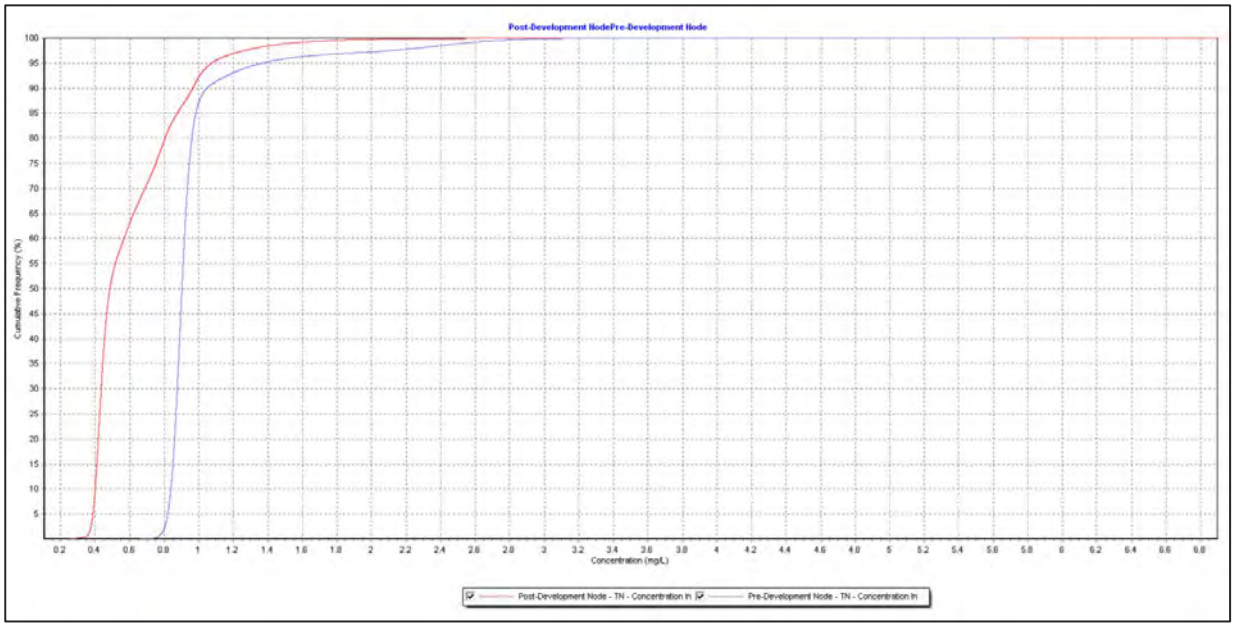


Figure 5-7 Existing vs Post-Development Concentration Comparison – TN

The results presented in **Table 5-11** and **Figure 5-5** to **Figure 5-7** show that the post-development pollutant loads and concentrations are compliant with the NorBE criteria stipulated in the *Using MUSIC in the Sydney Drinking Water Catchment* (Water NSW, 2023). The achieved water quality outcomes are thus considered to be consistent with Part 6.6 – Clause 2 (a) of the SEPP (Biodiversity and Conservation) 2021.

5.4.4.2 Pollutant Load Reductions – BCC Targets

In addition to the NorBE assessment, post-development pollutant loads were compared to un-treated catchment loads to assess the percentage reduction compared to the reduction targets in the BCC Growth Centres DCP. This comparison is shown in **Table 5-12**.

Table 5-12 Post-Development Pollutant Load Reductions (BCC)

Pollutant	Post-Development Un-Treated Loads (kg/yr)	Post-Development Outflow Loads (kg/yr)	Percentage Reduction %	BCC Target Reduction %
Total Suspended solids (TSS)	347,000	45,300	87.0	85
Total Phosphorus (TP)	667	168	74.8	65
Total Nitrogen (TN)	4,100	1,650	59.7	45
Gross Pollutants	39,800	380	99.0	90

The MUSIC results shown in **Table 5-12** indicate the proposed treatment train achieves compliance with BCC's minimum reduction targets.

A MUSIC-Link report for the post-development MUSIC modelling has been attached in **Appendix B**.

5.4.4.3 Pollutant Load Reductions – Wianamatta-South Creek Targets

To assess the performance of the stormwater treatment train against the requirements of the Wianamatta-South Creek Guidelines (DPE, 2022), the meteorological template and rainfall/runoff parameters in the post-development MUSIC model were updated based on those specified in Table 6 and Table 7 of the *MUSIC modelling toolkit for Wianamatta-South Creek* (DPE, 2022). The results of this assessment are presented in **Table 5-13**.

Table 5-13 Post-Development Pollutant Load Reductions (Wianamatta-South Creek)

Pollutant	Post-Development Un-Treated Loads (kg/yr)	Post-Development Outflow Loads (kg/yr)	Percentage Reduction %	Wianamatta-South Creek Target Reduction %
Total Suspended solids (TSS)	267,000	19,700	92.6	90
Total Phosphorus (TP)	489	75.9	84.5	80
Total Nitrogen (TN)	2,830	725	74.4	65
Gross Pollutants	36,600	364	99.0	90

The MUSIC results shown in **Table 5-13** indicate the proposed treatment train achieves compliance with the reduction targets from the Wianamatta-South Creek Guidelines (DPE, 2022).

6 Stormwater Quantity Management

6.1 Stormwater Quantity Objectives

Stormwater detention objectives for the precinct are to reduce post-development flows to less than or equal to pre-development flows design storm events ranging from the 50% AEP up to and including the 1% AEP.

Objectives for environmental flows are to mimic existing site runoff volumes and durations as much as practical and meet the flow duration targets from the Wianamatta-South Creek Guidelines (DPE, 2022).

6.2 On-Site Detention

On-site detention (OSD) basins are typically required for large scale land development projects to mitigate the increase in flows associated with the higher imperviousness of developed catchments. However, for areas located towards the downstream end of larger creek/river systems such as the precinct, on-site detention can have limited benefit (or cause adverse impacts) due to hydrograph timing differentials between local catchment and regional flows.

For the purpose of drainage land allocation within the current ILP, it has been conservatively assumed that OSD basins will be required to mitigate increases in post-development flows up to and including the 1% AEP event. Initial sizing of the basins has been undertaken using DRAINS hydrologic models of the existing and post-development sub-catchments within the precinct (refer **Figure 5-1** and **Figure 5-3**). Due to the large size of the sub-catchments the XP-RAFTS hydrologic module was used within DRAINS as per Section 3.5.1 of the *WSUD Developer Handbook – MUSIC Modelling and Design Guideline* (BCC, 2020). Australian Rainfall and Runoff 2019 (ARR2019) hydrologic inputs were adopted.

The indicative land allocation for the detention basins and ancillary features (such as access tracks and batters) is shown in **Figure 6-1**. Note that the basins have generally been located outside of the 0.2% AEP Eastern Creek and Bells Creek flood extents to avoid potential backwater influence and limit filling within the floodplain of these creek systems.

The requirement for on-site detention will be determined via regional flood modelling to be undertaken prior to the finalisation of the rezoning proposal. Depending on the outcomes of the regional flood modelling, the OSD basins may be able to be reduced in size or removed completely, reducing the area of drainage land and increasing the quantum of open space/recreational land.

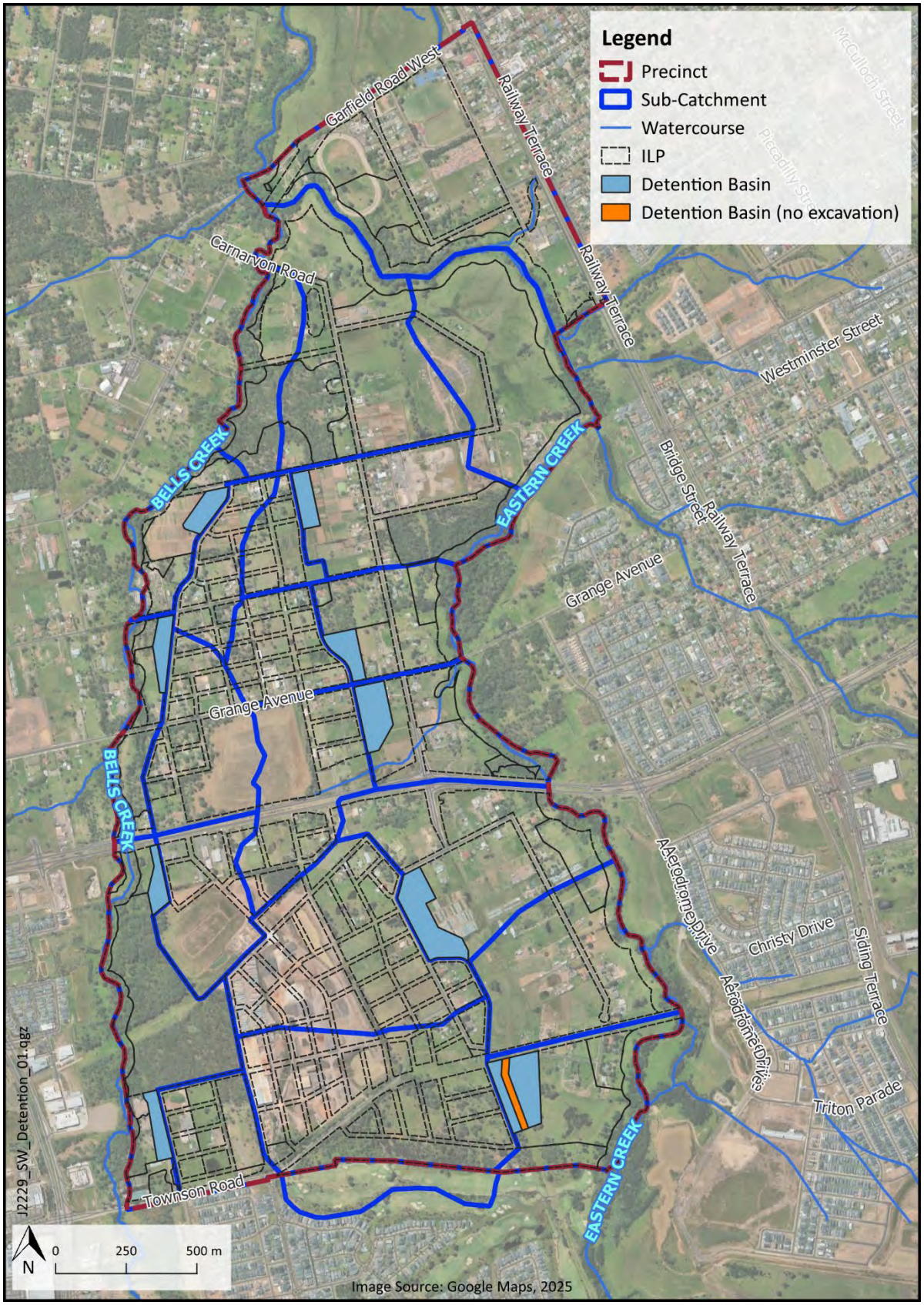


Figure 6-1 Detention Basin Locations

6.3 Stream Erosion Index

The stream erosion index (SEI) is the ratio of post-development flow to pre-development flow above the 'stream-forming flowrate' and relates to the additional erosion that can be caused by increased runoff from developed catchments. This has been calculated as follows:

- The existing 50% AEP total flow at key site discharge locations was estimated using existing scenario DRAINS/XP-RAFTS model developed for the detention basin sizing.
- The critical flow was calculated at 25% of the 50% AEP flow.
- Results of the base case and post-development MUSIC models were interrogated to determine the average annual volume of runoff for events where flows exceed the critical flow.
- The ratio of resultant post-development annual volume was compared to the existing scenario to determine the SEI.

The stream erosion indices for the aggregated Eastern Creek and Bells Creek catchments within the precinct are shown in **Table 6-1**.

Table 6-1 Stream Erosion Index

Location	SEI	Comment
Eastern Creek	0.6	SEI meets the 'ideal' 1:1 ratio in the Growth Centres DCP 2010.
Bells Creek	1.0	SEI meets the 'ideal' 1:1 ratio in the Growth Centres DCP 2010.

6.4 Water Balance Assessment

A water balance assessment has been undertaken using the post-development MUSIC model described in **Section 5.4** to determine the reliability of proposed stormwater harvesting ponds at meeting predicted demands across varying climatic conditions. For this assessment, daily rainfall data from the Richmond – UWS Hawkesbury meteorological station (Station 067021) was analysed over a 123-year period from 1900 to 2023. This meteorological data set was used in preference to the stations nominated in the WSUD Developer Handbook – MUSIC Modelling and Design Guideline (BCC, 2020) due to the close proximity to the precinct as well as the length of the data series and coverage of a wider variety of climatic conditions, including the millennium drought and 2022 floods.

Rainfall depths for wet (90th percentile), dry (10th percentile) and average (50th percentile) rainfall years were obtained from Bureau of Meteorology statistics for Station 067021 (**Table 6-2)**, with results from representative years extracted from the timeseries for the purpose of the water balance assessment.

Table 6-2 Wet, Dry and Average Year Rainfall Depths

	Wet Year	Dry Year	Average Year
Rainfall (mm)	1076	527	796
Representative Year	1989	2006	1970

Results of the MUSIC water balance assessment for the six proposed stormwater harvesting ponds are summarised in **Table 6-3**. This includes re-use demands and deficits for the representative wet, dry and average rainfall years.

Table 6-3 Water Balance Results

	Pond A			Pond B			Pond C			Pond D			Pond E			Pond F		
	Wet Year	Dry Year	Avg Year	Wet Year	Dry Year	Avg Year	Wet Year	Dry Year	Avg Year	Wet Year	Dry Year	Avg Year	Wet Year	Dry Year	Avg Year	Wet Year	Dry Year	Avg Year
Re-Use Requested (ML/yr)[3]	58.7	73.0	62.3	103.4	129.2	110.3	47.7	59.2	50.6	31.1	38.6	33.0	181.6	225.7	192.7	66.6	82.7	70.6
Re-Use Supplied (ML/yr)	58.7	68.9	62.3	103.4	126.3	110.1	47.4	50.3	47.3	31.1	37.5	33.0	177.8	117.4	145.6	66.6	51.3	66.1
Deficit (ML/yr)	0.0	4.1	0.0	0.0	2.9	0.2	0.3	8.9	3.3	0.0	1.1	0.0	3.8	108.3	47.1	0.0	31.4	4.5
% Re-use Demand Met	100	94.5	100	100	97.8	99.8	99.4	84.9	93.4	100	97.0	100	97.9	52.0	75.6	100	62.0	93.7

[3] The average external re-use rate is scaled based on daily PET – rainfall and thus varies based on the rainfall patterns of a particular year.

The results shown in **Table 6-3** suggest that the proposed stormwater harvesting ponds will provide a reliable source of water for irrigation of public open space areas. The dry year results also suggest that the proposed harvesting measures will provide the majority of re-use demands under projected climate change conditions where annual rainfall totals are expected to decrease.

6.5 Flow Duration Assessment

Flow duration curves were generated for the existing and post-development MUSIC models using the meteorological template and rainfall/runoff parameters from *MUSIC modelling toolkit for Wianamatta-South Creek* (DPE, 2022). Flow duration curves were also generated for a natural catchment of equivalent area but with zero imperviousness. **Figure 6-2** shows a comparison of the generated curves with the flow duration targets from the Wianamatta-South Creek Guidelines (DPE, 2022).

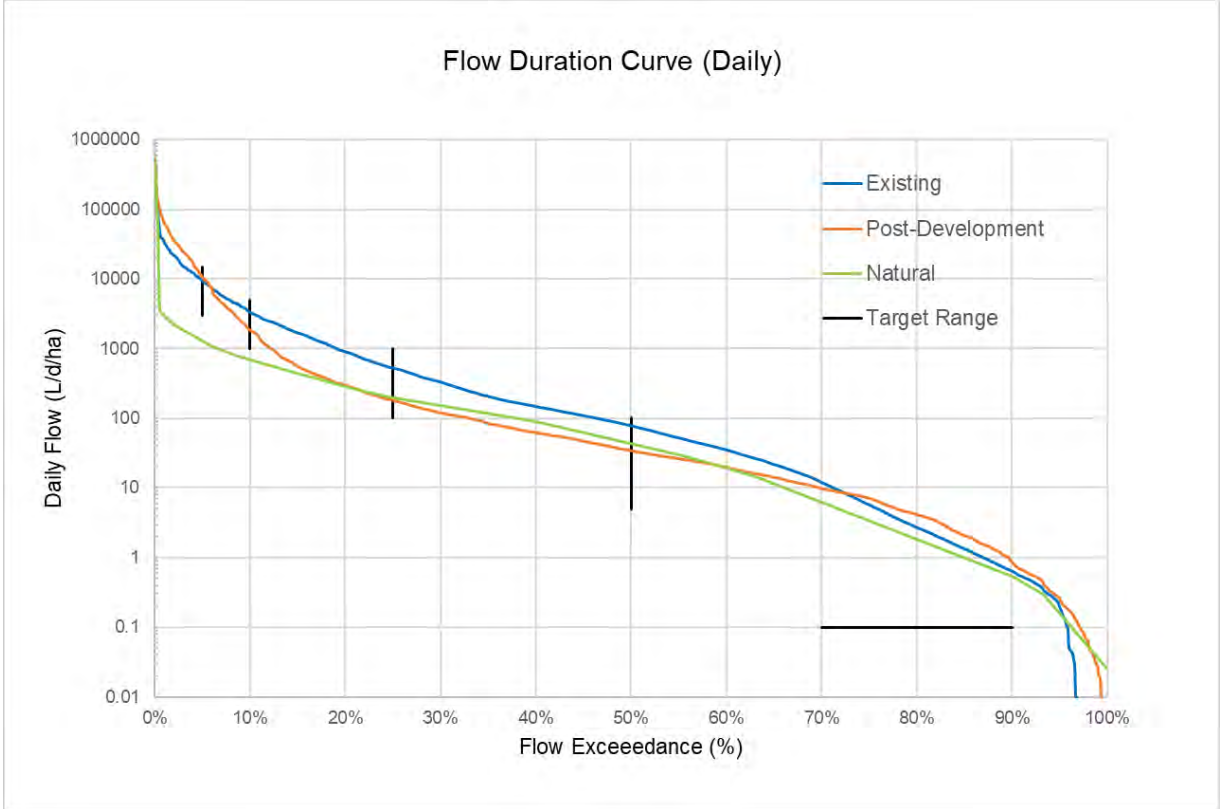


Figure 6-2 Flow Duration Curve Comparison

Figure 6-2 shows that the flow duration curve for the post-development site discharge is within the ranges required in the Wianamatta-South Creek Guidelines (DPE, 2022) for all target percentiles except for the 10-30% cease to flow. This is largely due to the significant conservation/riparian areas that bypass the harvesting ponds and therefore contribute baseflow to the surrounding drainage lines for considerable amounts of time following the cessation of rainfall. Given that the non-compliant section of the flow duration curve is similar to the existing and natural catchment scenarios, the flow duration outcomes are considered to be in accordance with the hydrological objectives for the development.

7 Construction Phase Soil and Water Management

During the construction of the precinct, there is a potential risk of increased erosion due to excavation activities creating exposed surfaces. This in turn can lead to increased sedimentation of downstream areas, including proposed stormwater management measures and potentially offsite waterways if erosion and sedimentation is not managed adequately during construction works.

Preparation of construction phase Soil and Water Management Plans will be required for each stage of development in accordance with *Managing Urban Stormwater: Soils and Construction - Volume 1* (4th ed, Landcom 2004). This would involve the nomination of measures such as:

- Diversion drains to divert 'clean' water from external catchments around disturbed areas,
- Local erosion and sedimentation controls such as silt fencing, straw bales and stabilised site entry/exit points, and
- Sediment basins to capture and settle sediment prior to discharge into receiving waterways.

It is recommended that the proposed basin excavations are used as sediment basins during construction. Installation of the bioretention filter media should be delayed until a minimum of 80% of the upstream contributing catchment is developed to avoid over-sedimentation and potential requirement for replacement.

8 Maintenance of Stormwater Management Measures

The proposed regional stormwater treatment measures would be owned and operated by BCC; whilst the maintenance of on-lot measures would be the responsibility of individual landowners. Maintenance of all stormwater management measures should be undertaken in accordance with the *Guidelines for Maintenance of Stormwater Treatment Measures* (Stormwater NSW, 2020).

At a minimum, maintenance inspections of the proposed regional treatment measures should be undertaken every 3-6 months and following significant rainfall events. Future detailed design of the stormwater management measures would be accompanied by an Operation and Maintenance Plan detailing maintenance procedures, frequencies and reporting requirements.

9 Conclusion

A water cycle management strategy has been developed for the proposed rezoning and development of the West Schofields precinct.

Hydrologic and water quality modelling undertaken as part of the assessment revealed that stormwater quality, quantity and waterway health objectives can be achieved for the precinct with the implementation of the following strategy:

- Provision of a suitably sized stormwater treatment train including lot scale and regional treatment measures to manage pollutant loading from the precinct,
- Implementation of a stormwater harvesting system comprising lot scale rainwater tanks and regional harvesting ponds to reduce site discharge volumes and reliance on potable water, and
- Provision of regional detention basins to limit post-development flows to pre-development levels for the Eastern Creek and Bells Creek catchments.

10 References

Blacktown City Council (BCC). (2020). *WSUD developer handbook - MUSIC modelling and design guide 2020*

Blacktown City Council (BCC). (2022). *Blacktown City Council Growth Centre Precincts Development Control Plan 2010*, March.

Blacktown City Council (BCC). (2023). *Blacktown Local Environmental Plan 2015*, December.

Calibre Consulting. (2018). *Flooding, Water Cycle Management and Riparian Corridor Assessment*, June.

Cardno. (2015). *Water Management, Flood Modelling and Riparian Corridor Study Report,* July.

NSW Government Department of Planning and Environment (DPE). (2022). *Technical guidance for achieving Wianamatta–South Creek stormwater management targets*

NSW Government. (2024). *State Environmental Planning Policy (Precincts—Central River City) 2021,* November.

NSW Government. (2025). *State Environmental Planning Policy (Biodiversity and Conservation) 2021,* March.

Rhelm. (2025). *West Schofields* Precinct - *Flood Impact and Risk Assessment Gap Analysis*, April.

Water NSW (2023) *Using MUSIC in Sydney Drinking Water Catchment – A Water NSW Current Recommended Best Practice*, February 2023.

Appendix A

Site Inspection Photographs

Photograph 01. Townson Road (Bells Creek Crossing) looking downstream.

Photograph 02. Townson Road (Bells Creek Crossing) looking downstream.

Photograph 03. Townson Road (Bells Creek Crossing) looking upstream.

Photograph 04. Grange Avenue (Eastern Creek Crossing) looking downstream

Photograph 05. Grange Avenue (Bells Creek Crossing) looking upstream

Photograph 06. Grange Avenue (Bells Creek Crossing) looking downstream

Photograph 07. Grange Avenue (Bells Creek Crossing) level gauge.

Photograph 08. Grange Avenue Flood Gate (Bells Creek Crossing)

Photograph 09: View of Bells Creek at Grange Avenue (Looking Downstream)

Photograph 10. Grange Avenue Flood Gate (Eastern Creek Crossing)

Appendix B

MUSIC-Link Report

MUSIC-*link* Report

Project Details		Company Details	
Project:		**Company:**	
Report Export Date:	8/09/2025	**Contact:**	
Catchment Name:	J2229_PostDev_06	**Address:**	
Catchment Area:	551.819ha	**Phone:**	
Impervious Area*:	111.2%	**Email:**	
Rainfall Station:	67035 LIVERPOOL(WHITLAM		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1967 - 31/12/1976 11:54:00 PM		
Mean Annual Rainfall:	857mm		
Evapotranspiration:	1261mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.35		
Study Area:	Blacktown		
Scenario:	Blacktown Development		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness

Node: Post-Development Node	Reduction
Flow	36.3%
TSS	87%
TP	74.8%
TN	59.6%
GP	99%

Treatment Nodes

Node Type	Number
Rain Water Tank Node	13
Swale Node	19
Bio Retention Node	9
Pond Node	6
GPT Node	9
Generic Node	2

Source Nodes

Node Type	Number
Agricultural Source Node	1
Forest Source Node	30
Urban Source Node	120

Comments

Refer to Section 5 of the Water Cycle Management Assessment (Rhelm, 2025) for commentary on deviations from BCC standard source and treatment node parameters.

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Agricultural	C01-Agriculture	Area Impervious (ha)	None	None	0.472
Agricultural	C01-Agriculture	Area Pervious (ha)	None	None	9.419
Agricultural	C01-Agriculture	Total Area (ha)	None	None	9.892
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	1.1
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	2.78
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	3.24
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	1.49
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	0.62
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	1.19
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	1.44
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	0.78
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	0.92
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Forest	C01-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C01-Drainage/Environmental	Area Pervious (ha)	None	None	0.005
Forest	C01-Drainage/Environmental	Total Area (ha)	None	None	0.005
Forest	C02a-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C02a-Drainage/Environmental	Area Pervious (ha)	None	None	0.029
Forest	C02a-Drainage/Environmental	Total Area (ha)	None	None	0.029
Forest	C02b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C02b-Drainage/Environmental	Area Pervious (ha)	None	None	2.706
Forest	C02b-Drainage/Environmental	Total Area (ha)	None	None	2.706
Forest	C02b-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C02b-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	23.49
Forest	C02b-Drainage/Environmental Bypass	Total Area (ha)	None	None	23.49
Forest	C03a-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C03a-Drainage/Environmental	Area Pervious (ha)	None	None	6.18
Forest	C03a-Drainage/Environmental	Total Area (ha)	None	None	6.18
Forest	C03b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C03b-Drainage/Environmental	Area Pervious (ha)	None	None	5.897
Forest	C03b-Drainage/Environmental	Total Area (ha)	None	None	5.897
Forest	C03b-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C03b-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	6.326
Forest	C03b-Drainage/Environmental Bypass	Total Area (ha)	None	None	6.326
Forest	C04-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C04-Drainage/Environmental	Area Pervious (ha)	None	None	1.232
Forest	C04-Drainage/Environmental	Total Area (ha)	None	None	1.232
Forest	C04-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C04-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	3.062
Forest	C04-Drainage/Environmental Bypass	Total Area (ha)	None	None	3.062
Forest	C05a-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C05a-Drainage/Environmental	Area Pervious (ha)	None	None	0.002
Forest	C05a-Drainage/Environmental	Total Area (ha)	None	None	0.002
Forest	C05b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C05b-Drainage/Environmental	Area Pervious (ha)	None	None	6.04
Forest	C05b-Drainage/Environmental	Total Area (ha)	None	None	6.04
Forest	C05b-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C05b-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	2.063
Forest	C05b-Drainage/Environmental Bypass	Total Area (ha)	None	None	2.063
Forest	C06b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C06b-Drainage/Environmental	Area Pervious (ha)	None	None	2.281
Forest	C06b-Drainage/Environmental	Total Area (ha)	None	None	2.281
Forest	C06b-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C06b-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	3.826
Forest	C06b-Drainage/Environmental Bypass	Total Area (ha)	None	None	3.826
Forest	C07b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C07b-Drainage/Environmental	Area Pervious (ha)	None	None	0.101
Forest	C07b-Drainage/Environmental	Total Area (ha)	None	None	0.101
Forest	C07c-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C07c-Drainage/Environmental	Area Pervious (ha)	None	None	1.254
Forest	C07c-Drainage/Environmental	Total Area (ha)	None	None	1.254
Forest	C07c-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C07c-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	5.928
Forest	C07c-Drainage/Environmental Bypass	Total Area (ha)	None	None	5.928
Forest	C08a-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C08a-Drainage/Environmental	Area Pervious (ha)	None	None	0.001
Forest	C08a-Drainage/Environmental	Total Area (ha)	None	None	0.001
Forest	C08b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C08b-Drainage/Environmental	Area Pervious (ha)	None	None	7.162
Forest	C08b-Drainage/Environmental	Total Area (ha)	None	None	7.162
Forest	C08b-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C08b-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	2.343

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C08b-Drainage/Environmental Bypass	Total Area (ha)	None	None	2.343
Forest	C09b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C09b-Drainage/Environmental	Area Pervious (ha)	None	None	1.236
Forest	C09b-Drainage/Environmental	Total Area (ha)	None	None	1.236
Forest	C09b-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C09b-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	8.61
Forest	C09b-Drainage/Environmental Bypass	Total Area (ha)	None	None	8.61
Forest	C10b-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C10b-Drainage/Environmental	Area Pervious (ha)	None	None	4.316
Forest	C10b-Drainage/Environmental	Total Area (ha)	None	None	4.316
Forest	C10b-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C10b-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	3.184
Forest	C10b-Drainage/Environmental Bypass	Total Area (ha)	None	None	3.184
Forest	C11-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C11-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	7.51
Forest	C11-Drainage/Environmental Bypass	Total Area (ha)	None	None	7.51
Forest	C12-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C12-Drainage/Environmental	Area Pervious (ha)	None	None	6.919
Forest	C12-Drainage/Environmental	Total Area (ha)	None	None	6.919
Forest	C12-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C12-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	9.911
Forest	C12-Drainage/Environmental Bypass	Total Area (ha)	None	None	9.911
Forest	C13-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C13-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	7.072
Forest	C13-Drainage/Environmental Bypass	Total Area (ha)	None	None	7.072
Forest	C14-Drainage/Environmental	Area Impervious (ha)	None	None	0
Forest	C14-Drainage/Environmental	Area Pervious (ha)	None	None	3.79
Forest	C14-Drainage/Environmental	Total Area (ha)	None	None	3.79
Forest	C14-Drainage/Environmental Bypass	Area Impervious (ha)	None	None	0
Forest	C14-Drainage/Environmental Bypass	Area Pervious (ha)	None	None	10.83
Forest	C14-Drainage/Environmental Bypass	Total Area (ha)	None	None	10.83
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	1.1
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	2.78
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	3.24
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	1.49
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	0.62
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	1.19
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	1.44
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	0.78
GPT	CDS 3030	Hi-flow bypass rate (cum/sec)	None	None	0.92

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Pond	Harvesting Pond	% Reuse Demand Met	None	None	94.52
Pond	Harvesting Pond	% Reuse Demand Met	None	None	94.85
Pond	Harvesting Pond	% Reuse Demand Met	None	None	90.53
Pond	Harvesting Pond	% Reuse Demand Met	None	None	81.8798
Pond	Harvesting Pond	% Reuse Demand Met	None	None	95.16
Pond	Harvesting Pond	% Reuse Demand Met	None	None	91.76
Post	Post-Development Node	% Load Reduction	None	None	36.3
Post	Post-Development Node	GP % Load Reduction	90	None	99
Post	Post-Development Node	TN % Load Reduction	45	None	59.6
Post	Post-Development Node	TP % Load Reduction	65	None	74.8
Post	Post-Development Node	TSS % Load Reduction	85	None	87
Rain	Comm/Ind Rainwater Tank	% Reuse Demand Met	80	None	80.12
Rain	Comm/Ind Rainwater Tank	% Reuse Demand Met	80	None	80.20
Rain	Comm/Ind Rainwater Tank	% Reuse Demand Met	80	None	82.13
Rain	Comm/Ind Rainwater Tank	% Reuse Demand Met	80	None	80.18
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Swale	Blacktown Only Swale 2020	Bed slope	0.005	0.01	0.005
Urban	C02a-Driveways	Area Impervious (ha)	None	None	0.809
Urban	C02a-Driveways	Area Pervious (ha)	None	None	0
Urban	C02a-Driveways	Total Area (ha)	None	None	0.809
Urban	C02a-Misc Impervious	Area Impervious (ha)	None	None	1.214
Urban	C02a-Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C02a-Misc Impervious	Total Area (ha)	None	None	1.214

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C02a-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C02a-Misc Pervious	Area Pervious (ha)	None	None	1.214
Urban	C02a-Misc Pervious	Total Area (ha)	None	None	1.214
Urban	C02a-New Road	Area Impervious (ha)	None	None	2.826
Urban	C02a-New Road	Area Pervious (ha)	None	None	0.157
Urban	C02a-New Road	Total Area (ha)	None	None	2.984
Urban	C02a-Park/Sports Field	Area Impervious (ha)	None	None	0.082
Urban	C02a-Park/Sports Field	Area Pervious (ha)	None	None	0.724
Urban	C02a-Park/Sports Field	Total Area (ha)	None	None	0.807
Urban	C02a-Roads	Area Impervious (ha)	None	None	0.749
Urban	C02a-Roads	Area Pervious (ha)	None	None	0.137
Urban	C02a-Roads	Total Area (ha)	None	None	0.887
Urban	C02a-Roof	Area Impervious (ha)	None	None	4.855
Urban	C02a-Roof	Area Pervious (ha)	None	None	0
Urban	C02a-Roof	Total Area (ha)	None	None	4.855
Urban	C02b-New Road	Area Impervious (ha)	None	None	0.329
Urban	C02b-New Road	Area Pervious (ha)	None	None	0.018
Urban	C02b-New Road	Total Area (ha)	None	None	0.348
Urban	C02b-Park/Sports Field	Area Impervious (ha)	None	None	0.220
Urban	C02b-Park/Sports Field	Area Pervious (ha)	None	None	2.027
Urban	C02b-Park/Sports Field	Total Area (ha)	None	None	2.248
Urban	C02b-Roads	Area Impervious (ha)	None	None	0.695
Urban	C02b-Roads	Area Pervious (ha)	None	None	0.127
Urban	C02b-Roads	Total Area (ha)	None	None	0.823
Urban	C03a-Comm/Ind Driveways	Area Impervious (ha)	None	None	1.346
Urban	C03a-Comm/Ind Driveways	Area Pervious (ha)	None	None	0
Urban	C03a-Comm/Ind Driveways	Total Area (ha)	None	None	1.346
Urban	C03a-Comm/Ind Misc Impervious	Area Impervious (ha)	None	None	0.15
Urban	C03a-Comm/Ind Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C03a-Comm/Ind Misc Impervious	Total Area (ha)	None	None	0.15
Urban	C03a-Comm/Ind Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C03a-Comm/Ind Misc Pervious	Area Pervious (ha)	None	None	0.15
Urban	C03a-Comm/Ind Misc Pervious	Total Area (ha)	None	None	0.15
Urban	C03a-Comm/Ind Roof	Area Impervious (ha)	None	None	1.346
Urban	C03a-Comm/Ind Roof	Area Pervious (ha)	None	None	0
Urban	C03a-Comm/Ind Roof	Total Area (ha)	None	None	1.346
Urban	C03a-Driveways	Area Impervious (ha)	None	None	1.95
Urban	C03a-Driveways	Area Pervious (ha)	None	None	0
Urban	C03a-Driveways	Total Area (ha)	None	None	1.95
Urban	C03a-Misc Impervious	Area Impervious (ha)	None	None	2.926

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C03a-Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C03a-Misc Impervious	Total Area (ha)	None	None	2.926
Urban	C03a-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C03a-Misc Pervious	Area Pervious (ha)	None	None	2.926
Urban	C03a-Misc Pervious	Total Area (ha)	None	None	2.926
Urban	C03a-New Road	Area Impervious (ha)	None	None	11.07
Urban	C03a-New Road	Area Pervious (ha)	None	None	0.616
Urban	C03a-New Road	Total Area (ha)	None	None	11.693
Urban	C03a-Park/Sports Field	Area Impervious (ha)	None	None	0.116
Urban	C03a-Park/Sports Field	Area Pervious (ha)	None	None	1.031
Urban	C03a-Park/Sports Field	Total Area (ha)	None	None	1.148
Urban	C03a-Roads	Area Impervious (ha)	None	None	1.804
Urban	C03a-Roads	Area Pervious (ha)	None	None	0.329
Urban	C03a-Roads	Total Area (ha)	None	None	2.134
Urban	C03a-Roof	Area Impervious (ha)	None	None	11.702
Urban	C03a-Roof	Area Pervious (ha)	None	None	0
Urban	C03a-Roof	Total Area (ha)	None	None	11.702
Urban	C03b-New Road	Area Impervious (ha)	None	None	1.341
Urban	C03b-New Road	Area Pervious (ha)	None	None	0.074
Urban	C03b-New Road	Total Area (ha)	None	None	1.416
Urban	C03b-Park/Sports Field	Area Impervious (ha)	None	None	0.917
Urban	C03b-Park/Sports Field	Area Pervious (ha)	None	None	8.096
Urban	C03b-Park/Sports Field	Total Area (ha)	None	None	9.014
Urban	C03b-Roads	Area Impervious (ha)	None	None	0.053
Urban	C03b-Roads	Area Pervious (ha)	None	None	0.009
Urban	C03b-Roads	Total Area (ha)	None	None	0.063
Urban	C04-New Road	Area Impervious (ha)	None	None	1.477
Urban	C04-New Road	Area Pervious (ha)	None	None	0.082
Urban	C04-New Road	Total Area (ha)	None	None	1.56
Urban	C04-Park/Sports Field	Area Impervious (ha)	None	None	2.322
Urban	C04-Park/Sports Field	Area Pervious (ha)	None	None	20.50
Urban	C04-Park/Sports Field	Total Area (ha)	None	None	22.827
Urban	C04-Roads	Area Impervious (ha)	None	None	0.382
Urban	C04-Roads	Area Pervious (ha)	None	None	0.069
Urban	C04-Roads	Total Area (ha)	None	None	0.452
Urban	C05a-Driveways	Area Impervious (ha)	None	None	2.275
Urban	C05a-Driveways	Area Pervious (ha)	None	None	0
Urban	C05a-Driveways	Total Area (ha)	None	None	2.275
Urban	C05a-Misc Impervious	Area Impervious (ha)	None	None	3.413
Urban	C05a-Misc Impervious	Area Pervious (ha)	None	None	0

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C05a-Misc Impervious	Total Area (ha)	None	None	3.413
Urban	C05a-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C05a-Misc Pervious	Area Pervious (ha)	None	None	3.413
Urban	C05a-Misc Pervious	Total Area (ha)	None	None	3.413
Urban	C05a-New Road	Area Impervious (ha)	None	None	11.06
Urban	C05a-New Road	Area Pervious (ha)	None	None	0.616
Urban	C05a-New Road	Total Area (ha)	None	None	11.679
Urban	C05a-Park/Sports Field	Area Impervious (ha)	None	None	0.444
Urban	C05a-Park/Sports Field	Area Pervious (ha)	None	None	4.095
Urban	C05a-Park/Sports Field	Total Area (ha)	None	None	4.54
Urban	C05a-Roads	Area Impervious (ha)	None	None	0.466
Urban	C05a-Roads	Area Pervious (ha)	None	None	0.085
Urban	C05a-Roads	Total Area (ha)	None	None	0.552
Urban	C05a-Roof	Area Impervious (ha)	None	None	13.65
Urban	C05a-Roof	Area Pervious (ha)	None	None	0
Urban	C05a-Roof	Total Area (ha)	None	None	13.65
Urban	C05b-New Road	Area Impervious (ha)	None	None	1.606
Urban	C05b-New Road	Area Pervious (ha)	None	None	0.089
Urban	C05b-New Road	Total Area (ha)	None	None	1.696
Urban	C05b-Park/Sports Field	Area Impervious (ha)	None	None	2.425
Urban	C05b-Park/Sports Field	Area Pervious (ha)	None	None	22.33
Urban	C05b-Park/Sports Field	Total Area (ha)	None	None	24.757
Urban	C05b-Roads	Area Impervious (ha)	None	None	2.303
Urban	C05b-Roads	Area Pervious (ha)	None	None	0.421
Urban	C05b-Roads	Total Area (ha)	None	None	2.725
Urban	C06a-Comm/Ind Driveways	Area Impervious (ha)	None	None	3.102
Urban	C06a-Comm/Ind Driveways	Area Pervious (ha)	None	None	0
Urban	C06a-Comm/Ind Driveways	Total Area (ha)	None	None	3.102
Urban	C06a-Comm/Ind Misc Impervious	Area Impervious (ha)	None	None	0.345
Urban	C06a-Comm/Ind Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C06a-Comm/Ind Misc Impervious	Total Area (ha)	None	None	0.345
Urban	C06a-Comm/Ind Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C06a-Comm/Ind Misc Pervious	Area Pervious (ha)	None	None	0.345
Urban	C06a-Comm/Ind Misc Pervious	Total Area (ha)	None	None	0.345
Urban	C06a-Comm/Ind Roof	Area Impervious (ha)	None	None	3.102
Urban	C06a-Comm/Ind Roof	Area Pervious (ha)	None	None	0
Urban	C06a-Comm/Ind Roof	Total Area (ha)	None	None	3.102
Urban	C06a-Driveways	Area Impervious (ha)	None	None	0.351
Urban	C06a-Driveways	Area Pervious (ha)	None	None	0
Urban	C06a-Driveways	Total Area (ha)	None	None	0.351

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C06a-Misc Impervious	Area Impervious (ha)	None	None	0.527
Urban	C06a-Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C06a-Misc Impervious	Total Area (ha)	None	None	0.527
Urban	C06a-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C06a-Misc Pervious	Area Pervious (ha)	None	None	0.527
Urban	C06a-Misc Pervious	Total Area (ha)	None	None	0.527
Urban	C06a-New Road	Area Impervious (ha)	None	None	4.140
Urban	C06a-New Road	Area Pervious (ha)	None	None	0.230
Urban	C06a-New Road	Total Area (ha)	None	None	4.371
Urban	C06a-Park/Sports Field	Area Impervious (ha)	None	None	0.682
Urban	C06a-Park/Sports Field	Area Pervious (ha)	None	None	6.282
Urban	C06a-Park/Sports Field	Total Area (ha)	None	None	6.965
Urban	C06a-Roads	Area Impervious (ha)	None	None	1.533
Urban	C06a-Roads	Area Pervious (ha)	None	None	0.280
Urban	C06a-Roads	Total Area (ha)	None	None	1.814
Urban	C06a-Roof	Area Impervious (ha)	None	None	2.106
Urban	C06a-Roof	Area Pervious (ha)	None	None	0
Urban	C06a-Roof	Total Area (ha)	None	None	2.106
Urban	C06b-New Road	Area Impervious (ha)	None	None	1.264
Urban	C06b-New Road	Area Pervious (ha)	None	None	0.070
Urban	C06b-New Road	Total Area (ha)	None	None	1.335
Urban	C06b-Park/Sports Field	Area Impervious (ha)	None	None	1.026
Urban	C06b-Park/Sports Field	Area Pervious (ha)	None	None	9.061
Urban	C06b-Park/Sports Field	Total Area (ha)	None	None	10.088
Urban	C06b-Roads	Area Impervious (ha)	None	None	1.811
Urban	C06b-Roads	Area Pervious (ha)	None	None	0.330
Urban	C06b-Roads	Total Area (ha)	None	None	2.142
Urban	C07a-Comm/Ind Driveways	Area Impervious (ha)	None	None	2.16
Urban	C07a-Comm/Ind Driveways	Area Pervious (ha)	None	None	0
Urban	C07a-Comm/Ind Driveways	Total Area (ha)	None	None	2.16
Urban	C07a-Comm/Ind Misc Impervious	Area Impervious (ha)	None	None	0.24
Urban	C07a-Comm/Ind Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C07a-Comm/Ind Misc Impervious	Total Area (ha)	None	None	0.24
Urban	C07a-Comm/Ind Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C07a-Comm/Ind Misc Pervious	Area Pervious (ha)	None	None	0.24
Urban	C07a-Comm/Ind Misc Pervious	Total Area (ha)	None	None	0.24
Urban	C07a-Comm/Ind Roof	Area Impervious (ha)	None	None	2.16
Urban	C07a-Comm/Ind Roof	Area Pervious (ha)	None	None	0
Urban	C07a-Comm/Ind Roof	Total Area (ha)	None	None	2.16
Urban	C07a-New Road	Area Impervious (ha)	None	None	2.141

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C07a-New Road	Area Pervious (ha)	None	None	0.119
Urban	C07a-New Road	Total Area (ha)	None	None	2.261
Urban	C07a-Park/Sports Field	Area Impervious (ha)	None	None	0.860
Urban	C07a-Park/Sports Field	Area Pervious (ha)	None	None	7.919
Urban	C07a-Park/Sports Field	Total Area (ha)	None	None	8.78
Urban	C07a-Roads	Area Impervious (ha)	None	None	0.886
Urban	C07a-Roads	Area Pervious (ha)	None	None	0.161
Urban	C07a-Roads	Total Area (ha)	None	None	1.048
Urban	C07b-Comm/Ind Driveways	Area Impervious (ha)	None	None	0.461
Urban	C07b-Comm/Ind Driveways	Area Pervious (ha)	None	None	0
Urban	C07b-Comm/Ind Driveways	Total Area (ha)	None	None	0.461
Urban	C07b-Comm/Ind Misc Impervious	Area Impervious (ha)	None	None	0.051
Urban	C07b-Comm/Ind Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C07b-Comm/Ind Misc Impervious	Total Area (ha)	None	None	0.051
Urban	C07b-Comm/Ind Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C07b-Comm/Ind Misc Pervious	Area Pervious (ha)	None	None	0.051
Urban	C07b-Comm/Ind Misc Pervious	Total Area (ha)	None	None	0.051
Urban	C07b-Comm/Ind Roof	Area Impervious (ha)	None	None	0.461
Urban	C07b-Comm/Ind Roof	Area Pervious (ha)	None	None	0
Urban	C07b-Comm/Ind Roof	Total Area (ha)	None	None	0.461
Urban	C07b-Driveways	Area Impervious (ha)	None	None	0.674
Urban	C07b-Driveways	Area Pervious (ha)	None	None	0
Urban	C07b-Driveways	Total Area (ha)	None	None	0.674
Urban	C07b-Misc Impervious	Area Impervious (ha)	None	None	1.011
Urban	C07b-Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C07b-Misc Impervious	Total Area (ha)	None	None	1.011
Urban	C07b-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C07b-Misc Pervious	Area Pervious (ha)	None	None	1.011
Urban	C07b-Misc Pervious	Total Area (ha)	None	None	1.011
Urban	C07b-New Road	Area Impervious (ha)	None	None	4.119
Urban	C07b-New Road	Area Pervious (ha)	None	None	0.229
Urban	C07b-New Road	Total Area (ha)	None	None	4.349
Urban	C07b-Park/Sports Field	Area Impervious (ha)	None	None	0.798
Urban	C07b-Park/Sports Field	Area Pervious (ha)	None	None	7.053
Urban	C07b-Park/Sports Field	Total Area (ha)	None	None	7.852
Urban	C07b-Roads	Area Impervious (ha)	None	None	0.702
Urban	C07b-Roads	Area Pervious (ha)	None	None	0.128
Urban	C07b-Roads	Total Area (ha)	None	None	0.831
Urban	C07b-Roof	Area Impervious (ha)	None	None	4.043
Urban	C07b-Roof	Area Pervious (ha)	None	None	0

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C07b-Roof	Total Area (ha)	None	None	4.043
Urban	C07c-New Road	Area Impervious (ha)	None	None	0.449
Urban	C07c-New Road	Area Pervious (ha)	None	None	0.025
Urban	C07c-New Road	Total Area (ha)	None	None	0.475
Urban	C07c-Park/Sports Field	Area Impervious (ha)	None	None	0.200
Urban	C07c-Park/Sports Field	Area Pervious (ha)	None	None	1.849
Urban	C07c-Park/Sports Field	Total Area (ha)	None	None	2.05
Urban	C07c-Roads	Area Impervious (ha)	None	None	0.270
Urban	C07c-Roads	Area Pervious (ha)	None	None	0.049
Urban	C07c-Roads	Total Area (ha)	None	None	0.32
Urban	C08a-Driveways	Area Impervious (ha)	None	None	0.864
Urban	C08a-Driveways	Area Pervious (ha)	None	None	0
Urban	C08a-Driveways	Total Area (ha)	None	None	0.864
Urban	C08a-Misc Impervious	Area Impervious (ha)	None	None	1.295
Urban	C08a-Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C08a-Misc Impervious	Total Area (ha)	None	None	1.295
Urban	C08a-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C08a-Misc Pervious	Area Pervious (ha)	None	None	1.295
Urban	C08a-Misc Pervious	Total Area (ha)	None	None	1.295
Urban	C08a-New Road	Area Impervious (ha)	None	None	3.877
Urban	C08a-New Road	Area Pervious (ha)	None	None	0.216
Urban	C08a-New Road	Total Area (ha)	None	None	4.094
Urban	C08a-Roads	Area Impervious (ha)	None	None	0.240
Urban	C08a-Roads	Area Pervious (ha)	None	None	0.043
Urban	C08a-Roads	Total Area (ha)	None	None	0.284
Urban	C08a-Roof	Area Impervious (ha)	None	None	5.182
Urban	C08a-Roof	Area Pervious (ha)	None	None	0
Urban	C08a-Roof	Total Area (ha)	None	None	5.182
Urban	C08b-New Road	Area Impervious (ha)	None	None	0.823
Urban	C08b-New Road	Area Pervious (ha)	None	None	0.045
Urban	C08b-New Road	Total Area (ha)	None	None	0.869
Urban	C08b-Park/Sports Field	Area Impervious (ha)	None	None	0.636
Urban	C08b-Park/Sports Field	Area Pervious (ha)	None	None	5.863
Urban	C08b-Park/Sports Field	Total Area (ha)	None	None	6.5
Urban	C08b-Roads	Area Impervious (ha)	None	None	0.442
Urban	C08b-Roads	Area Pervious (ha)	None	None	0.080
Urban	C08b-Roads	Total Area (ha)	None	None	0.523
Urban	C09a-Comm/Ind Driveways	Area Impervious (ha)	None	None	0.16
Urban	C09a-Comm/Ind Driveways	Area Pervious (ha)	None	None	0
Urban	C09a-Comm/Ind Driveways	Total Area (ha)	None	None	0.16

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C09a-Comm/Ind Misc Impervious	Area Impervious (ha)	None	None	0.018
Urban	C09a-Comm/Ind Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C09a-Comm/Ind Misc Impervious	Total Area (ha)	None	None	0.018
Urban	C09a-Comm/Ind Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C09a-Comm/Ind Misc Pervious	Area Pervious (ha)	None	None	0.018
Urban	C09a-Comm/Ind Misc Pervious	Total Area (ha)	None	None	0.018
Urban	C09a-Comm/Ind Roof	Area Impervious (ha)	None	None	0.16
Urban	C09a-Comm/Ind Roof	Area Pervious (ha)	None	None	0
Urban	C09a-Comm/Ind Roof	Total Area (ha)	None	None	0.16
Urban	C09a-Driveways	Area Impervious (ha)	None	None	0.478
Urban	C09a-Driveways	Area Pervious (ha)	None	None	0
Urban	C09a-Driveways	Total Area (ha)	None	None	0.478
Urban	C09a-Misc Impervious	Area Impervious (ha)	None	None	0.717
Urban	C09a-Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C09a-Misc Impervious	Total Area (ha)	None	None	0.717
Urban	C09a-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C09a-Misc Pervious	Area Pervious (ha)	None	None	0.717
Urban	C09a-Misc Pervious	Total Area (ha)	None	None	0.717
Urban	C09a-New Road	Area Impervious (ha)	None	None	2.118
Urban	C09a-New Road	Area Pervious (ha)	None	None	0.118
Urban	C09a-New Road	Total Area (ha)	None	None	2.237
Urban	C09a-Roads	Area Impervious (ha)	None	None	0.131
Urban	C09a-Roads	Area Pervious (ha)	None	None	0.023
Urban	C09a-Roads	Total Area (ha)	None	None	0.155
Urban	C09a-Roof	Area Impervious (ha)	None	None	2.87
Urban	C09a-Roof	Area Pervious (ha)	None	None	0
Urban	C09a-Roof	Total Area (ha)	None	None	2.87
Urban	C09b-New Road	Area Impervious (ha)	None	None	1.472
Urban	C09b-New Road	Area Pervious (ha)	None	None	0.082
Urban	C09b-New Road	Total Area (ha)	None	None	1.555
Urban	C09b-Park/Sports Field	Area Impervious (ha)	None	None	1.606
Urban	C09b-Park/Sports Field	Area Pervious (ha)	None	None	14.78
Urban	C09b-Park/Sports Field	Total Area (ha)	None	None	16.39
Urban	C09b-Roads	Area Impervious (ha)	None	None	0.863
Urban	C09b-Roads	Area Pervious (ha)	None	None	0.157
Urban	C09b-Roads	Total Area (ha)	None	None	1.021
Urban	C10a-Driveways	Area Impervious (ha)	None	None	0.693
Urban	C10a-Driveways	Area Pervious (ha)	None	None	0
Urban	C10a-Driveways	Total Area (ha)	None	None	0.693
Urban	C10a-Misc Impervious	Area Impervious (ha)	None	None	1.039

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C10a-Misc Impervious	Area Pervious (ha)	None	None	0
Urban	C10a-Misc Impervious	Total Area (ha)	None	None	1.039
Urban	C10a-Misc Pervious	Area Impervious (ha)	None	None	0
Urban	C10a-Misc Pervious	Area Pervious (ha)	None	None	1.039
Urban	C10a-Misc Pervious	Total Area (ha)	None	None	1.039
Urban	C10a-New Road	Area Impervious (ha)	None	None	3.465
Urban	C10a-New Road	Area Pervious (ha)	None	None	0.193
Urban	C10a-New Road	Total Area (ha)	None	None	3.659
Urban	C10a-Park/Sports Field	Area Impervious (ha)	None	None	0.000
Urban	C10a-Park/Sports Field	Area Pervious (ha)	None	None	0.003
Urban	C10a-Park/Sports Field	Total Area (ha)	None	None	0.004
Urban	C10a-Roads	Area Impervious (ha)	None	None	0.213
Urban	C10a-Roads	Area Pervious (ha)	None	None	0.039
Urban	C10a-Roads	Total Area (ha)	None	None	0.253
Urban	C10a-Roof	Area Impervious (ha)	None	None	4.156
Urban	C10a-Roof	Area Pervious (ha)	None	None	0
Urban	C10a-Roof	Total Area (ha)	None	None	4.156
Urban	C10b-New Road	Area Impervious (ha)	None	None	0.408
Urban	C10b-New Road	Area Pervious (ha)	None	None	0.022
Urban	C10b-New Road	Total Area (ha)	None	None	0.431
Urban	C10b-Park/Sports Field	Area Impervious (ha)	None	None	0.338
Urban	C10b-Park/Sports Field	Area Pervious (ha)	None	None	2.988
Urban	C10b-Park/Sports Field	Total Area (ha)	None	None	3.327
Urban	C10b-Roads	Area Impervious (ha)	None	None	0.134
Urban	C10b-Roads	Area Pervious (ha)	None	None	0.024
Urban	C10b-Roads	Total Area (ha)	None	None	0.159
Urban	C11-New Road	Area Impervious (ha)	None	None	0.802
Urban	C11-New Road	Area Pervious (ha)	None	None	0.044
Urban	C11-New Road	Total Area (ha)	None	None	0.847
Urban	C11-Park/Sports Field	Area Impervious (ha)	None	None	2.544
Urban	C11-Park/Sports Field	Area Pervious (ha)	None	None	22.46
Urban	C11-Park/Sports Field	Total Area (ha)	None	None	25.007
Urban	C11-Roads	Area Impervious (ha)	None	None	0.433
Urban	C11-Roads	Area Pervious (ha)	None	None	0.079
Urban	C11-Roads	Total Area (ha)	None	None	0.513
Urban	C12-New Road	Area Impervious (ha)	None	None	1.156
Urban	C12-New Road	Area Pervious (ha)	None	None	0.064
Urban	C12-New Road	Total Area (ha)	None	None	1.221
Urban	C12-Park/Sports Field	Area Impervious (ha)	None	None	2.216
Urban	C12-Park/Sports Field	Area Pervious (ha)	None	None	19.56

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	C12-Park/Sports Field	Total Area (ha)	None	None	21.78
Urban	C12-Roads	Area Impervious (ha)	None	None	0.927
Urban	C12-Roads	Area Pervious (ha)	None	None	0.169
Urban	C12-Roads	Total Area (ha)	None	None	1.097
Urban	C13-New Road	Area Impervious (ha)	None	None	0.548
Urban	C13-New Road	Area Pervious (ha)	None	None	0.030
Urban	C13-New Road	Total Area (ha)	None	None	0.579
Urban	C13-Park/Sports Field	Area Impervious (ha)	None	None	0.552
Urban	C13-Park/Sports Field	Area Pervious (ha)	None	None	4.874
Urban	C13-Park/Sports Field	Total Area (ha)	None	None	5.427
Urban	C13-Roads	Area Impervious (ha)	None	None	0.063
Urban	C13-Roads	Area Pervious (ha)	None	None	0.011
Urban	C13-Roads	Total Area (ha)	None	None	0.075
Urban	C14-New Road	Area Impervious (ha)	None	None	2.939
Urban	C14-New Road	Area Pervious (ha)	None	None	0.163
Urban	C14-New Road	Total Area (ha)	None	None	3.103
Urban	C14-Park/Sports Field	Area Impervious (ha)	None	None	2.356
Urban	C14-Park/Sports Field	Area Pervious (ha)	None	None	20.79
Urban	C14-Park/Sports Field	Total Area (ha)	None	None	23.155
Urban	C14-Residential	Area Impervious (ha)	None	None	1.995
Urban	C14-Residential	Area Pervious (ha)	None	None	2.016
Urban	C14-Residential	Total Area (ha)	None	None	4.012
Urban	C14-Roads	Area Impervious (ha)	None	None	3.659
Urban	C14-Roads	Area Pervious (ha)	None	None	0.668
Urban	C14-Roads	Total Area (ha)	None	None	4.328
Urban	C14-Roads Bypass	Area Impervious (ha)	None	None	1.234
Urban	C14-Roads Bypass	Area Pervious (ha)	None	None	0.225
Urban	C14-Roads Bypass	Total Area (ha)	None	None	1.46
Urban	C14-Rural	Area Impervious (ha)	None	None	0.178
Urban	C14-Rural	Area Pervious (ha)	None	None	3.289
Urban	C14-Rural	Total Area (ha)	None	None	3.468
Urban	C14-Rural Bypass	Area Impervious (ha)	None	None	0.258
Urban	C14-Rural Bypass	Area Pervious (ha)	None	None	4.767
Urban	C14-Rural Bypass	Total Area (ha)	None	None	5.026

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Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Agricultural	C01-Agriculture	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.04
Agricultural	C01-Agriculture	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Agricultural	C01-Agriculture	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.05
Agricultural	C01-Agriculture	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Agricultural	C01-Agriculture	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.3
Agricultural	C01-Agriculture	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Agricultural	C01-Agriculture	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	0.48
Agricultural	C01-Agriculture	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.26
Agricultural	C01-Agriculture	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-0.22
Agricultural	C01-Agriculture	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.3
Agricultural	C01-Agriculture	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.31
Forest	C01-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C01-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C01-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C01-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C01-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C01-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C01-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C01-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C01-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C01-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C01-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C02a-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C02a-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C02a-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C02a-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C02a-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C02a-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C02a-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C02a-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C02a-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C02a-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C02a-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C02b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C02b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C02b-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C02b-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C02b-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C02b-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C02b-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05

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Node Type	Node Name	Parameter	Min	Max	Actual

Forest	C02b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C02b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C02b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C02b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C02b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C02b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C02b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C02b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C02b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C02b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C02b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C02b-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C03a-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C03a-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C03a-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C03a-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C03a-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C03a-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C03a-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C03a-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C03a-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C03a-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C03a-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C03b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C03b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C03b-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C03b-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C03b-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C03b-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C03b-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C03b-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C03b-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C03b-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C03b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C03b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C03b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13

Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C03b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C03b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C03b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C03b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C03b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C03b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C03b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C03b-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C04-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C04-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C04-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C04-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C04-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C04-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C04-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C04-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C04-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C04-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C04-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C04-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C04-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C04-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C04-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C04-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C04-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C04-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C04-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C04-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C04-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C04-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C05a-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C05a-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13

		mg/L)			
Forest	C05a-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C05a-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C05a-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C05a-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22

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Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C05a-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C05b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C05b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C05b-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C05b-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C05b-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C05b-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C05b-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C05b-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C05b-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C05b-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C05b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C05b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C05b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C05b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C05b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C05b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C05b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C05b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C05b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C05b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C05b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C05b-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C06b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C06b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C06b-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C06b-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C06b-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C06b-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13

Forest	C06b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C06b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C06b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C06b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C06b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C06b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C06b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C06b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C06b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C06b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C06b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C06b-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C07b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C07b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C07b-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C07b-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C07b-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C07b-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C07b-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C07b-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C07b-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C07b-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C07b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C07c-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C07c-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C07c-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C07c-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C07c-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C07c-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C07c-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C07c-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C07c-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C07c-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22

Forest	Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C07c-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C07c-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C07c-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C07c-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C07c-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C07c-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C07c-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C07c-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C07c-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C08a-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C08a-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13

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Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C08a-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C08a-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C08a-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C08a-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C08a-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C08a-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C08a-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C08a-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C08a-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C08b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C08b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C08b-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C08b-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C08b-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C08b-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C08b-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C08b-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C08b-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C08b-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C08b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C08b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C08b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13

Forest	C08b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C08b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C08b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C08b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C08b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C08b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C08b-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C09b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C09b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C09b-Drainage/Environmental	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C09b-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C09b-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C09b-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C09b-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C09b-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C09b-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1

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Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C09b-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C09b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C09b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C09b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C09b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C09b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C09b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C09b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C09b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C09b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C09b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C09b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C09b-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C10b-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C10b-Drainage/Environmental	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13

Forest	C10b-Drainage/Environmental	mg/L)	0.17	0.17	0.13
Forest	C10b-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C10b-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C10b-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C10b-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C10b-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C10b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C10b-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C10b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C10b-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C10b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C10b-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C10b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C10b-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C10b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C10b-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C10b-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C11-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C11-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C11-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C11-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C11-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78

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Node Type	Node Name	Parameter	Min	Max	Actual
Forest	C11-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C11-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C11-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C11-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C11-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C11-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C12-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52

Forest	C12-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C12-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C12-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C12-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C12-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C12-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C12-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C12-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C12-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C12-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C12-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C12-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C12-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C12-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C12-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C12-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C12-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C13-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C13-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C13-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C13-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C13-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C13-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C13-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C13-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C13-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C13-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C13-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C14-Drainage/Environmental	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52

Only certain parameters are reported when they pass validation

Node

Forest	C14-Drainage/Environmental	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C14-Drainage/Environmental	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C14-Drainage/Environmental	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C14-Drainage/Environmental	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C14-Drainage/Environmental	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C14-Drainage/Environmental	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C14-Drainage/Environmental	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C14-Drainage/Environmental	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Forest	C14-Drainage/Environmental Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.52
Forest	C14-Drainage/Environmental Bypass	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.13
Forest	C14-Drainage/Environmental Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.52
Forest	C14-Drainage/Environmental Bypass	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.13
Forest	C14-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0.78
Forest	C14-Drainage/Environmental Bypass	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.13
Forest	C14-Drainage/Environmental Bypass	Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	-0.05
Forest	C14-Drainage/Environmental Bypass	Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.24
Forest	C14-Drainage/Environmental Bypass	Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-1.1
Forest	C14-Drainage/Environmental Bypass	Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.22
Forest	C14-Drainage/Environmental Bypass	Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.2
Rain	Comm/Ind Rainwater Tank	% Reuse Demand Met	80	None	79.5957
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.4461
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.5175
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.55
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.49
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.49
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.7417
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.4003
Rain	Resi Rainwater Tank	% Reuse Demand Met	80	None	74.41
Urban	C02a-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C02a-Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C02a-Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C03a-Comm/Ind Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C03a-Comm/Ind Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C03a-Comm/Ind Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C03a-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C03a-Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C03a-Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C05a-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11

Only certain parameters are reported when they pass validation

Urban	C06a-Comm/Ind Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C06a-Comm/Ind Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C06a-Comm/Ind Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C06a-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C06a-Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C06a-Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C07a-Comm/Ind Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C07a-Comm/Ind Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C07a-Comm/Ind Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C07b-Comm/Ind Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C07b-Comm/Ind Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C07b-Comm/Ind Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C07b-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C07b-Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C07b-Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C08a-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C08a-Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C08a-Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C09a-Comm/Ind Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C09a-Comm/Ind Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C09a-Comm/Ind Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C09a-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C09a-Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C09a-Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C10a-Roof	Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.11
Urban	C10a-Roof	Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.85
Urban	C10a-Roof	Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.2
Urban	C14-Rural	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.05
Urban	C14-Rural	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.22
Urban	C14-Rural	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.15
Urban	C14-Rural Bypass	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	-0.05
Urban	C14-Rural Bypass	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-1.22
Urban	C14-Rural Bypass	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.15

Only certain parameters are reported when they pass validation

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Appendix C
West Schofields Precinct Vegetation Management Strategy

West Schofields Precinct

Vegetation Management Strategy

NSW Department of Planning, Housing and Infrastructure

ecological AUSTRALIA
A TETRA TECH COMPANY

Document Tracking

Project Name:	West Schofields Precinct: West Schofields Vegetation Management Strategy
Project Number:	24SYD9893
Project Manager:	David Bonjer

Version	Prepared by	Reviewed by	Approved by	Status	Date
V2	Tony Chen, Charlotte Mills	Andrew Whitford	David Bonjer	Final	18/09/2025

This report should be cited as 'Eco Logical Australia 2025, West Schofields Precinct: West Schofields Vegetation Management Strategy, Prepared for NSW Department of Planning, Housing and Infrastructure.'

Acknowledgements

This document has been prepared by Eco Logical Australia Pty Ltd.

Abbreviations

Abbreviation	Description
AABR	Australian Association of Bush Regenerators
BCC	Blacktown City Council
CPI	Consumer Price Index
CPW	Cumberland Plain Woodland
ELA	Eco Logical Australia
ENV	Existing Native Vegetation
GST	Goods and Service Tax
LGA	Local Government Area
MZ	Management Zone
NSW DPE	New South Wales Department of Planning and Environment
PCT	Plant Community Type
VMP	Vegetation Management Plan
VMS	Vegetation Management Strategy

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1. Introduction

This Vegetation Management Strategy (VMS) has been prepared by Eco Logical Australia (ELA) on behalf of New South Wales Department of Planning, Housing and Infrastructure for the rezoning proposal for West Schofields Precinct (the precinct), which is situated in the Blacktown City Council (BCC) Local Government Area (LGA).

This strategy identifies the vegetation communities that are to be restored in the C2 Environment Conservation zones. The strategy identifies the current condition of these communities and provides high level costing of the works to restore them. Detailed works programs for these areas are to be provided in Vegetation Management Plans (VMP) that are prepared and approved at the development stage of the precinct. The VMPs are to be prepared in accordance with the Controlled activities – Guidelines for vegetation management plans on waterfront land (DCCEEW, 2024).

The aims and objectives of the VMS and detailed VMPs are provided in Table 1 below.

Table 1 Objectives for the VMS and subsequent VMPs

Objectives	Approach
Reinstate native vegetation and maintain ecological health (species composition and structure)	• Protect existing native vegetation from development pressures • Rehabilitate and revegetate using appropriate native species • Control weeds and prevent new outbreaks. • Assist in the natural regeneration of native species
Improve ecological health and integrity and in riparian areas, provide a stable watercourse	• Assist natural regenerative processes • Maintain weed control • Prevent outbreaks of priority weeds • Revegetate using appropriate native species

This VMS has been prepared and reviewed by Restoration Ecologist/s with over five years' experience in environmental management and a relevant Bachelor of Science degree.

2. Vegetation Management

2.1. Management zones

The total 107 ha VMS area has been broken into six indicative management zones (MZs) based on vegetation type, landscape position, current vegetation resilience, and management requirements. Vegetation details including Plant Community Type (PCT) and condition were informed by the biodiversity constraints report (ELA 2025) and a site visit by ELA restoration ecology staff in March 2025. Areas that were not covered by a PCT were added to MZ2 or MZ4 depending on their location in the landscape. The management zones are shown in Figure 1 (north of precinct) and Figure 2 (south of precinct).

The MZs are:

- MZ1: Inside top of bank (10.72 ha)

  This zone has been applied to the area within the top of bank (TOB) of riparian corridors.

  This zone is dominated by exotic herbs and vines including *Ipomoea purpurea* (Purple Morning Glory), and exotic cover is between 50-80%. There are patches of native groundcovers including *Lomandra longifolia* (Spiny-head Mat-rush), but overall native groundcover is less than 10%.

  Revegetation requirements have been estimated as 70-90% of the zone and would use native inundation tolerant grass and rush species.

- MZ2: Riparian corridor, poor condition (18.13 ha)

  This zone has been applied to the area outside the TOB but within the VRZ where it contains either poor condition *PCT 4025 Cumberland Red Gum Riverflat Forest* with a discontinuous canopy of <10% cover or exotic dominated areas that are not consistent with any PCT within the VRZ. Areas classified as poor condition PCT 4025 from the biodiversity constraints outside the VRZ are also included in MZ2.

  This zone is dominated by exotic herbs and vines including *I. purpurea* and *Setaria parviflora* (Slender Pigeon Grass) and exotic cover is between 70-100%. Native groundcover is less than 10%.

  Revegetation requirements have been estimated as 80-100% of the zone and would use native grass, herb, shrub and tree species relevant to PCT 4025.

- MZ3: Riparian corridor, moderate condition (20.22 ha)

  This zone has been applied to the area outside the TOB but within the VRZ where it contains moderate condition *PCT 4025 Cumberland Red Gum Riverflat Forest* with >10% native canopy cover. Areas classified as moderate condition PCT 4025 in the biodiversity constraints outside the VRZ are also included.

  Native canopy species include *Eucalyptus* spp. and non-Eucalypt species. Native ground cover is approximately 20% and exotic cover is approximately 80%.

  Revegetation requirements have been estimated as 60-80% of MZ3 using native grass, herb, shrub and tree species relevant to PCT 4025.

- MZ4: CPW, poor condition (17.32 ha)

This zone has been applied to the Environmental Conservation area where it contains poor condition *PCT 3320 Cumberland Shale Plains Woodland* (CPW) with <10% native canopy cover or exotic dominated areas that are not consistent with any PCT, and the Riparian Corridor where it contains poor condition PCT 3320.

Native canopy is dominated with *Eucalyptus tereticornis* (Forest Red Gum) and *E. moluccana* (Grey Box). The shrub layer has been subjected to grazing and slashing. Native ground cover is defined by *Themeda triandra* (Kangaroo Grass), *Entolasia marginata* (Bordered Panic), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Oplismenus aemulus* (Australian basket grass) and exotic species present include *Cirsium vulgare* (Spear Thistle), *Solanum nigrum* (blackberry nightshade), *Sida rhombifolia* (Paddy's Lucerne), *Conyza* sp. (Fleabane), and *Paspalum dilatatum* (Paspalum).

Revegetation requirements have been estimated as 80-100% of MZ4 and would use grasses, herbs, shrubs and trees relevant to PCT 3320.

- MZ5: CPW, moderate condition (34.82 ha)

  This zone has been applied to the Environmental Conservation area outside the VRZ where it contains moderate condition *PCT 3320 Cumberland Shale Plains Woodland* with >10% native canopy cover.

  Native canopy is dominated by *Eucalyptus tereticornis* and *E. moluccana*. Native ground cover is *Themeda triandra* (Kangaroo Grass), *Entolasia marginata* (Bordered Panic), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Oplismenus aemulus* (Australian Basket Grass) and exotic cover is *Cirsium vulgare* (Spear Thistle), *Solanum nigrum* (Blackberry Nightshade), *Sida rhombifolia* (Paddy's Lucerne), *Conyza* sp. (Fleabane) *Paspalum dilatatum* (Paspalum).

  Revegetation requirements have been estimated as 40-60% of MZ5, and would use grasses, herbs, shrubs and trees relevant to PCT 3320.

- MZ6: Castlereagh, good condition (5.77 ha)

  This zone has been applied to the Environmental Conservation area outside the VRZ where it contains good condition *PCT 3448 Castlereagh Ironbark Forest* in good condition, with >10% canopy cover.

  Native canopy is dominated by *Eucalyptus fibrosa (Red Ironbark)* and *Eucalyptus longifolia (Woollybutt) and Allocasuarina littoralis (Black She-oak)* in other patches. Native ground cover included *Goodenia hederacea* subsp. *hederacea* (Ivy Goodenia), *Entolasia stricta* (Wiry Panic)*, Aristida vagans* (Threeawn Speargrass), *Cheilanthes sieberi* subsp. *sieberi* and *Glycine* sp. in high abundance. Threatened shrub species, including *Grevillea juniperina* subsp *juniperina* and *Dillwynia tenuifolia* are present in this MZ. Exotic cover is <10 %.

  Revegetation requirements have been estimated as approximately 30-40% of MZ6, and would use grasses, herbs, shrubs and trees relevant to PCT 3448.

2.2. Weed control

The Biosecurity Act 2015 (BS Act) and regulations provide specific legal requirements for the state level priority weeds. Under the BS Act all plants are regulated with a general biosecurity duty to prevent, eliminate, or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated, or minimised, so far as reasonably practicable.

Specific legal requirements apply to State determined priorities under the Greater Sydney Regional Strategic Weed Management Plan 2023-2027, while regional priorities include outcomes to demonstrate compliance with the general biosecurity duty and strategical responses in the region to achieve relevant management objectives (Greater Sydney LLS 2022). Weeds listed as 'other weeds of regional concern' under the plan warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

Weed species identified during the field survey for this VMP included eight weeds with State Biosecurity restrictions, three Weeds of National Significance (WoNS) and there was one weed listed as weeds of other regional concern. The weeds present, the associated asset / value at risk and whether they are Weeds of National Significance (WoNS) or of regional concern in Greater Sydney or elsewhere are presented in Table 2.

Table 2: Priority weeds identified within the VMP area.

Scientific Name	Common Name	WoNS	NSW Priority Category	NSW Management Action
Cestrum parqui	Green Cestrum	No	Regional priority - Containment	Must be controlled
Cortaderia selloana	Pampas Grass	No	Regional priority - Containment	Must be controlled
Erythrina x sykesii	Coral Tree	No	Regional priority - Containment	Must be controlled
Ligustrum lucidum	Large-leaved Privet	No	Regional priority - Containment	Must be controlled
Ligustrum sinense	Small-leaved Privet	No	Regional priority - Containment	Must be controlled
Rubus fruticosus agg.	Blackberry	Yes	Regional priority - Containment	Must be controlled
Asparagus aethiopicus	Sprenger's Asparagus Fern	Yes	State priority - Containment and/or Asset Protection	Must be controlled
Asparagus asparagoides	Bridal Creeper	Yes	State priority - Containment and/or Asset Protection	Must be controlled
Chrysanthemoides monilifera	Boneseed	Yes	State priority - Containment and/or Asset Protection	Must be controlled
Cryptostegia grandiflora	Rubber Vine	Yes	State priority - Containment and/or Asset Protection	Must be controlled
Opuntia stricta	Prickly Pear	Yes	State priority - Containment and/or Asset Protection	Must be controlled
Anredera cordifolia	Madeira-vine	Yes	State priority - General biosecurity duty	Must be controlled
Arundo donax	Giant Reed	No	State priority - General biosecurity duty	Must be controlled
Bryophyllum delagoense	Mother-of-millions	No	State priority - General biosecurity duty	Must be controlled
Lantana camara	Lantana	Yes	State priority - General biosecurity duty	Must not be sold, must be controlled
Lycium ferocissimum	African Boxthorn	Yes	State priority - General biosecurity duty	Must be controlled
Senecio madagascariensis	Fireweed	Yes	State priority - General biosecurity duty	Must be controlled

2.2.1. Primary weed control

All weeds, including vines, herbaceous weeds, woody weeds and exotic grasses in the understorey will require treatment. It is assumed that primary weed control management would take place in the establishment period, with secondary and maintenance being undertaken in the maintenance period.

Primary and secondary weed control will include vines, herbaceous weeds, woody weeds and exotic grasses, specifically the control of priority weeds identified in Table 2 as well as significant environmental weeds such as *Ligustrum sinense* (Small-leaved privet)*, Lantana camara* (Lantana)*, Cestrum sp., Ehrharta sp.* (Veldtgrass)*, Bidens pilosa* (Cobblers Pegs)*, and Araujia sericifera* (Moth vine). Juvenile weeds can be hand-pulled, provided the whole root is removed. Large specimens, plants and those that are woody can be treated using cut and paint method. Chemical and mechanical control techniques will be required in follow up treatments. Follow up treatments of exotic seedling growth will be required.

During these weed control activities, care must be taken to avoid impacting on natural regeneration of native species.

2.2.2. Revegetation

Revegetation is likely to be required to some degree in all zones, however the proportion of revegetation is difficult to determine at a landscape scale. As such, the range of likely proportions for revegetation in each zone have been provided in Table 3. Projected planting densities within the revegetation area for each management zone along with the range of likely plants required for each zone are provided in Table 4

Revegetation works will include planting of native groundcover, grass, shrub and canopy species from suitable local provenance seed. Appropriate planning and timelines for sourcing propagation and planting material should be allowed for. All revegetation will be done using tubestock and Hiko/Viro cells.

The areas where revegetation has been identified are assumed to have little to no native resilience or potential for natural regeneration. As such, some form of biodegradable ground covering must be used such as:

- Mulch: 15 mm to 40 mm with no fines and good air-filled porosity to a depth of 100mm
- Jute: Heavyweight matting (>680 g / m²)

Revegetation areas will also require site preparation works such as additional targeted weed control, ripping or cultivation. It is assumed that any soil works, if required would be part of a civil works package and completed by those contractors prior to any management works being implemented on-site.

Finally, revegetation will require irrigation until establishment, typically a period of at least eight weeks but this is highly dependent on the seasonal climactic conditions.

Table 3: Revegetation assumptions

Zone	Total area (ha)	Revegetation area estimates (ha)		Jute / mulch proportions of revegetation area (%)	
		High	Low	Jute	Mulch
MZ1: Inside top of bank	10.72	9.65	7.50	100%	-
MZ2: Riparian corridor, poor condition	18.13	18.13	14.50	100%	-
MZ3: Riparian corridor, moderate condition	20.22	16.18	12.13	100%	-

Zone	Total area (ha)	Revegetation area estimates (ha)		Jute / mulch proportions of revegetation area (%)	
		High	Low	Jute	Mulch
MZ4: CPW, poor condition	17.32	17.32	13.86	-	100%
MZ5: CPW, moderate condition	34.82	20.89	13.93	-	100%
MZ6: Castlereagh, good condition	5.77	2.31	1.73	-	100%
Totals	**106.98**	**84.47**	**63.66**	**55%**	**45%**

Table 4: Estimated revegetation densities

Zone	Revegetation densities (per m²)				Estimated plants required (#)	
	Trees	Shrubs	Herbs	Sedge / Grass	High	Low
MZ1: Inside top of bank	-	-	-	6	578,880	450,240
MZ2: Riparian corridor, poor condition	1/50	1/25	1	3	736,078	588,862
MZ3: Riparian corridor, moderate condition	1/100	1/25	1	3	651,893	488,920
MZ4: CPW, poor condition	1/100	1/50	1	3	697,996	558,397
MZ5: CPW, moderate condition	1/100	1/50	1	3	839,858	559,906
MZ6: Castlereagh, good condition	1/100	1/50	1	3	92,782	69,586
Totals	**-**	**-**	**-**	**-**	**3,597,487**	**2,715,911**

2.3. Implementation schedule

It is assumed that the works identified in the VMS would be managed over an untimed establishment period (assumed to be one year) and a five-year maintenance period. The typical layout of how those works would be undertaken area provided in Table 5. It is noted however that there will be multiple VMPs prepared and commenced at different times as the precinct is developed.

Table 5: Implementation schedule

Task	Establishment	Year 1	Year 2	Year 3	Year 4	Year 5
Preliminary works						
Site mark out/fencing/signage						
Vegetation clearance/earthworks						
Soil preparation						
Revegetation						
Seed collection, cleaning, storage						
Site preparation						
Jute matting/Mulch						
Tubestock, supply and install						
Replacement tubestock, supply and install						
Irrigation						
Weed control						
Primary						
Secondary						
Maintenance						
Associated works						
Monitoring & Reporting						

2.4. Performance Criteria

The performance criteria for the VMS will adhere the criteria set in the VMP guidelines provided by BCC (2019) and NSW DPE (2022). A typical set of performance criteria for the final year of management has been provided in Table 6.

To track the progress of the VMS area against the performance criteria, monitoring and reporting will be conducted in accordance with the VMP guidelines provided by BCC (2019) and NSW DPE (2022).

Table 6: Typical final performance criteria

Typical final performance criteria
Revegetation is to be undertaken using seed local provenance seed for each strata with a minimum of 60% of the benchmark levels for species diversity for the appropriate PCT. No single species is to comprise more than 20% of planting in each zone or strata. Plants are to be mixed to ensure all species are distributed throughout the planting area, with species randomly grouped to best match localised ecological conditions.
90% survival of revegetation or equivalent regeneration in all strata and no areas with more than 2 m x 2 m (4m2) without surviving groundcover or 50m2 without surviving trees or shrubs
Replanting is to replace plants by the same species or where that species is unavailable with the same growth form (e.g., tree for tree) and must not decrease species diversity. Any new species must be from the community being emulated and of local provenance
Treat 100% of woody weeds and priority weeds
No greater than 5% groundcover by all weeds
No greater than 2% groundcover by priority weeds
For areas where revegetation was not required: Cover % of each strata no less than 100% of the benchmark levels for cover for the appropriate PCT
For areas where revegetation was required: Native groundcover no less than 90% of each zone
Monitoring and reporting undertaken in accordance to applicable guidelines or VMP

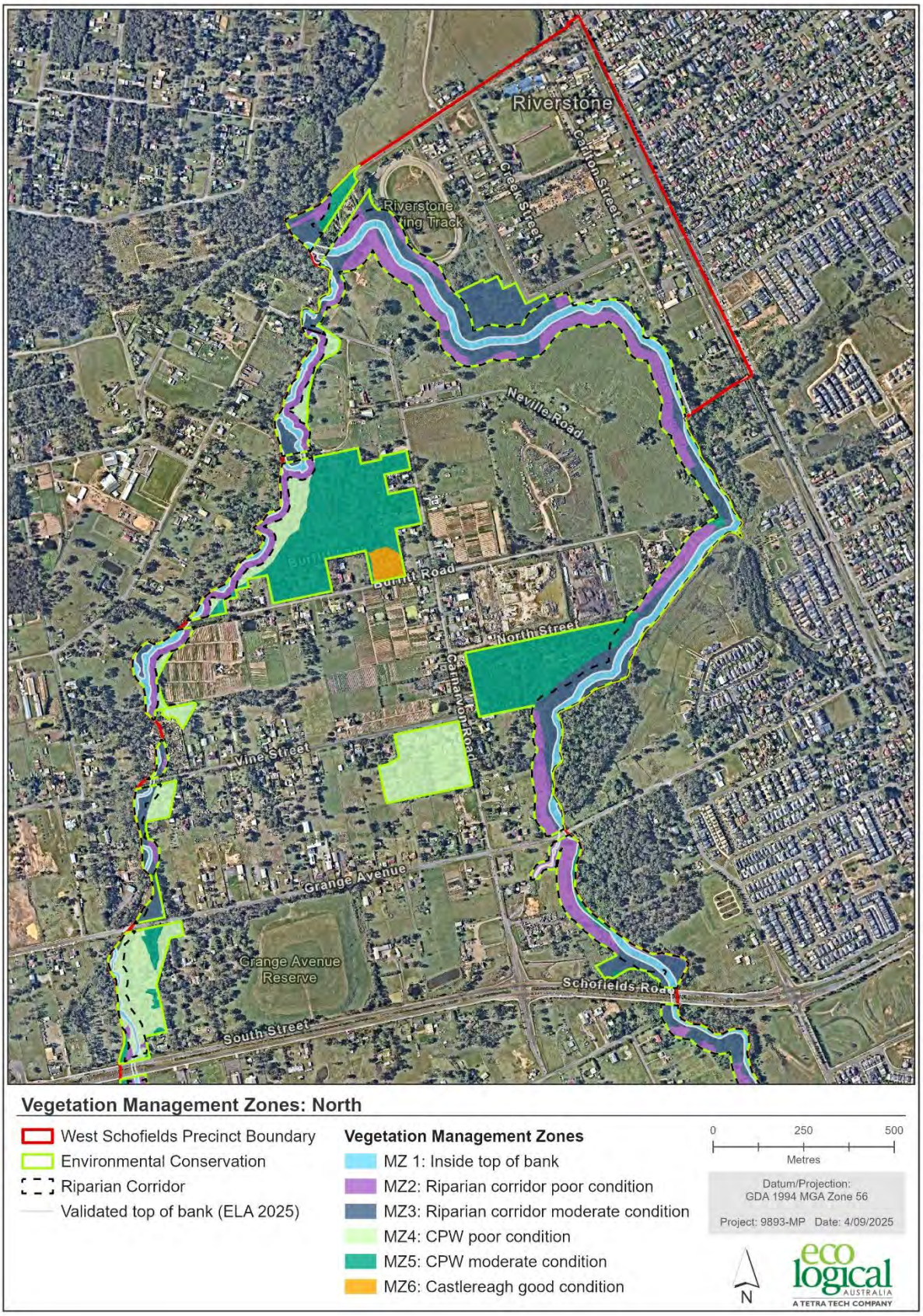

Figure 1: Vegetation management zones for the north of the study area

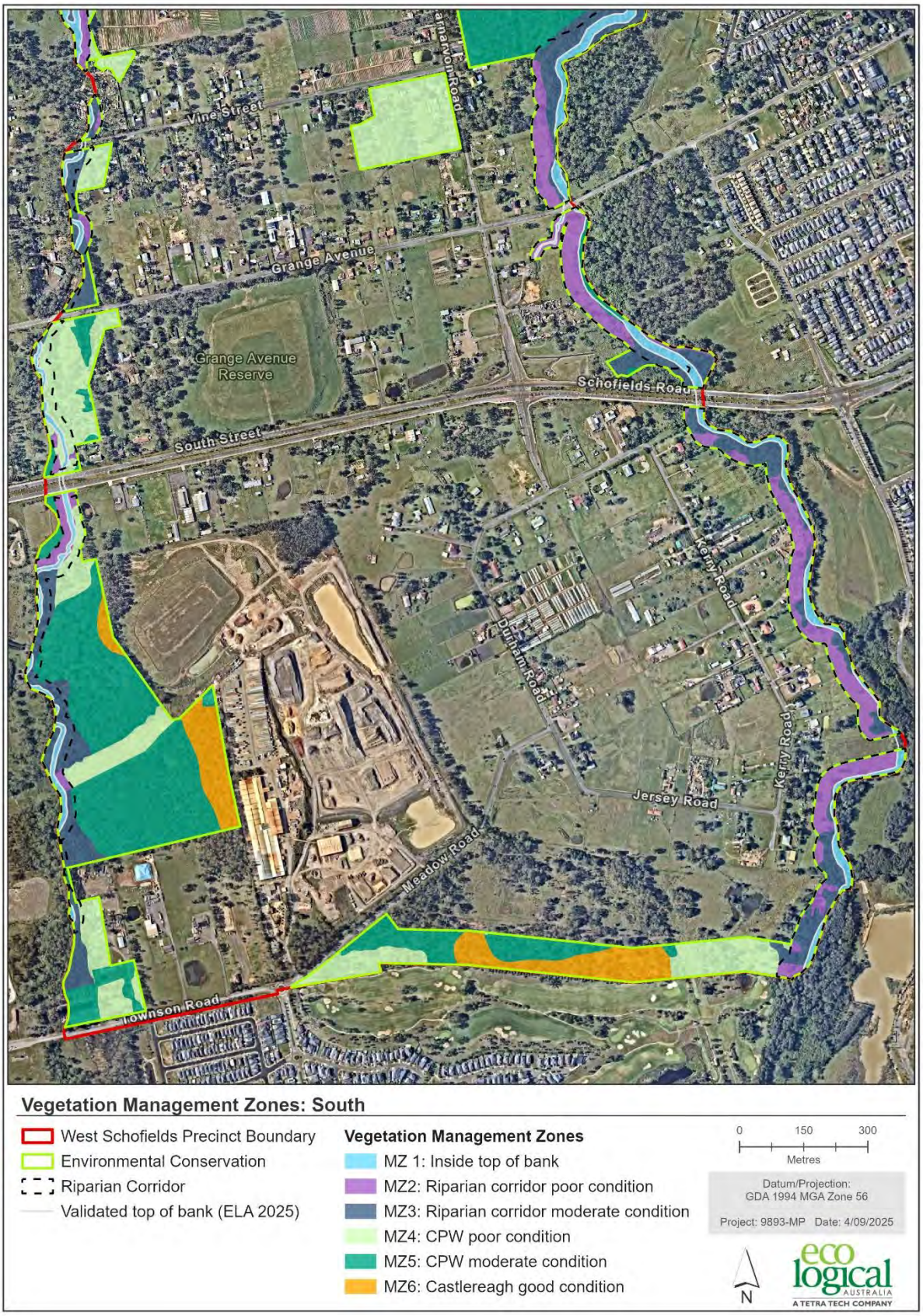

Figure 2: Vegetation management zones for the south of the study area

3. Costs

Indicative implementation costs for the VMS area to achieve are provided in **Table 7**. These costs have been modelled on a typical development implementation timeframe where the bulk of the cost is incurred in an initial establishment period during revegetation and then slowly decreasing over the maintenance period. In addition, these costs have been calculated assuming the following:

- Based on the revegetation proportions assumed in **Table 3** and **Table 4**
- According to the indicative implementation schedule in **Table 5**
- To meet the indicative performance criteria in **Table 6**
- Management works will not be undertaken holistically across the entirety of the site but rather broken down into large but manageable (e.g. 5-15 ha) stages.

A cost range has been provided to illustrate the effect of alternative management approaches and techniques. Typically, the main driver of cost is the proportion and extent of revegetation required. The lower end of this range can be achieved by increasing the resilience resulting in less revegetation. This is done by holistic, long-term management which identifies these areas early in the management process and nurtures those efficiencies. This approach also allows for the development of innovative techniques (e.g. direct seeding instead of tubestock planting).

ELA has assumed that the works will be broken up into smaller parcels and therefore has not discounted works based on the size of the overall requirements. However, the larger the package of works the more likely there are to be efficiencies of scale. For instance, the cost of plants may be able to be significantly reduced by implementing a dedicated nursery for the precinct. Alternately implementing lower-cost weed control works over a longer time period may reduce the requirement for higher-cost revegetation works. As such, if a more holistic approach is required this is recommended, although obviously this creates its own logistical challenges due to the scale of works.

Costs will need to be refined as part of preparation of VMP/s prepared for the precinct. In addition to the costs outlined in **Table 7** there would be additional costs for the management of the site in-perpetuity during the long-term maintenance phase, though this will relate to the land transfer agreements in place.

Table 7: Indicative costs for VMS implementation

MZ	MZ Area (ha)	Typical cost per m^2*	Indicative total cost*
MZ1: Inside top of bank	10.72	$ 29 – 36	$ 3,100,000 – 3,860,000
MZ2: Riparian corridor, poor condition	18.13	$ 28 – 34	$ 5,020,000 – 6,140,000
MZ3: Riparian corridor, moderate condition	20.22	$ 22 – 28	$ 4,450,000 – 5,580,000
MZ4: CPW, poor condition	17.32	$ 28 – 34	$ 4,770,000 – 5,830,000
MZ5: CPW, moderate condition	34.82	$ 18 – 23	$ 6,110,000 – 8,050,000
MZ6: Castlereagh, good condition	5.77	$ 14 – 18	$ 820,000 – 1,020,000
Totals	**106.98**	**$ 23 – 29**	**$ 24,270,000 – 30,490,000**

*over a 1-year establishment period and a 5-year maintenance period

4. Recommended planning controls

4.1. Vegetation management associated with development

It is recommended that the need for a VMP be triggered by the application of two clauses in the Precinct Plan:

X.X Development in Zone C2 Environmental Conservation

(1) This section applies to land within Zone C2 Environmental Conservation (other than any such land owned by a public authority).

(2) Despite any other provision of this Precinct Plan, the consent authority must not grant development consent for development on land to which this section applies unless it has considered a vegetation management plan that relates to all of that land.

(3) The vegetation management plan must address, to the satisfaction of the consent authority, the following matters—

(a) the environmental values of the land,

(b) methods to be used to revegetate and rehabilitate the land,

(c) weed control,

(d) the monitoring and ongoing management of the land,

(e) other measures—

(i) to control threats to the health of any remnant riparian vegetation on the land, and

(ii) to increase species diversification and riparian vegetation cover on the land, and

(iii) to improve the land's resistance to future weed colonisation.

X.X Subdivision of land adjoining Zone C2 Environmental Conservation

(1) The objectives of this section are as follows—

(a) to ensure the rehabilitation and revegetation of land that is within Zone C2 Environmental Conservation (other than any such land owned by a public authority),

(b) to ensure that land within that Zone is managed and conserved in a holistic and sensitive manner.

(2) This section applies to any lot that includes land within Zone C2 Environmental Conservation and land within another zone.

(3) Despite any other provision of this Precinct Plan, the consent authority must not grant consent for subdivision of land to which this section applies or any other development on that land unless it is satisfied that—

(a) appropriate arrangements have been made for the revegetation and rehabilitation of that land within Zone C2 Environmental Conservation, and

(b) those arrangements—

(i) provide for the ongoing monitoring and management of that land, and

(ii) will take effect before, or simultaneously with, the proposed subdivision or development concerned, and

(iii) are appropriate when considered in conjunction with any vegetation management plan prepared in accordance with section 6.5.

4.2. Vegetation management on public land

Where the C2 zone and riparian corridor adjoining public land, a Vegetation Management Plan should be prepared and implemented by the public authority responsible for the land. Vegetation management on public land will require a funding source. Consideration should be given to a contribution via local or state contribution plans.

5. References

Brodie, L. 1999, *The National Trust Bush Regenerators Handbook.* National Trust of Australia (NSW).

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NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024, *Guidelines for vegetation management plans on waterfront land*, NSW Government, Sydney.

NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024, *Guidelines for riparian corridors on waterfront land*, NSW Government, Sydney.

NSW Department of Primary Industries (DPI) 2018, *NSW Weed Control Handbook - A guide to weed control in non-crop, aquatic and bushland situations.* Online resource: https://www.dpi.nsw.gov.au/biosecurity/weeds/weed-control/management-guides/noxious-enviro-weed-control

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