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Local Water Management Report



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1. EXECUTIVE SUMMARY

Avant Hydro has been appointed by Yanchep Beach Joint Venture to prepare a Local Water Management Report [LWMR] for the area encompassing Improvement Plan No. 60 *Yanchep City Centre* (WAPC, 2024), and herein referenced as the Study Area, Figure 1.

This Local Water Management Report has been prepared to support the *Yanchep City Centre Precinct Structure Plan* [PSP] (CLE, 2026). The LWMR provides the framework for the application of total water cycle management to the proposed structure within the PSP area, consistent with the Department of Water and Environmental Regulation's principles of Water Sensitive Urban Design as described in the *Decision Process for Stormwater Management in Western Australia* (DWER, 2017b); *Stormwater Management Manual for Western Australia* (DWER, 2022), and *State Planning Policy 2.9 Water* (WAPC, 2025a) and the associated planning for water guidelines (WAPC, 2025b), and has been informed by the *Yanchep City Structure Plan Local Water Management Strategy* (Coffey Environments, 2011).

A summary of the LWMR design objectives is presented in Table 1.

Table 1: Summary of LWMR Design Principles and Criteria

Key Guiding Principles	
• Facilitate implementation of sustainable best practice urban water management. • Provide integration with planning processes and clarity for agencies involved with implementation. • To minimise public risk, including risk of injury or loss of life. • Protection of infrastructure and assets from flooding and inundation. • Encourage environmentally responsible development.	
Category	LWMR Criteria
Stormwater Management	• Maintenance of pre-development hydrological regime • Safe conveyance and management of stormwater runoff in accordance with <i>Australian Rainfall and Runoff</i> (Ball et al., 2019). • On site retention of stormwater runoff up to 1% AEP storm event. • Water quality treatment systems and water sensitive urban design structures designed in accordance with the <i>Decision Process for Stormwater Management in Western Australia</i> (DWER, 2017a) and <i>Stormwater Management Manual for Western Australia</i> (DWER, 2022a) Chapter 9 (Structural Controls). • Non-structural measures to reduce applied nutrient loads. • Ensure adequate separation from flood storage levels and habitable floor levels.
Groundwater Management	• Ensure adequate separation between finished lot levels and groundwater levels. • Managing and minimising changes in groundwater levels and groundwater quality following development. • Limit hydrological impact to native vegetation, Aboriginal culture places and wetlands proximal to the Study Area. • Manage fertiliser and pesticide application in streetscapes and POS to reduce nutrient input.
Water Conservation and Sustainability	• Consider alternative fit for purpose water sources where appropriate and cost-effective. • Aim to achieve the State Water Plan target for water use of 100 kL/person/yr. • POS areas to be planting of at least 50% native plants. • Buildings to comply with water efficiency standards detailed in the construction code. • Use of waterwise landscaping practices both at development and lot scale.
Water Quality	• Establishment of 'small' event bio-retention zones to treat a minimum of 2% of connected impervious areas of road catchments. • Adopt nutrient load reduction design objectives for stormwater runoff. • Use of amended soils and ephemeral bioretention systems to treat stormwater. • Maintain groundwater quality at pre-development levels, and if possible, improve the quality of water leaving the development area to maintain and restore ecological systems.
Monitoring	• No monitoring program is proposed due to clearance to groundwater (>26 m).

2. EXISTING SITE CHARACTERISTICS

2.1 BACKGROUND

This Local Water Management Report [LWMR] has been prepared by Avant Hydro on behalf of Yanchep Beach Joint Venture in support of a proposed Structure Plan (CLE, 2026) for Improvement Plan No. 60 *Yanchep City Centre* (WAPC, 2024).

The Study Area is located within the City of Wanneroo and comprises approximately 210 ha of Crown and private land and is generally bound by Marmion Avenue and Splendid Park to the west, Toreopango Avenue to the north, St Andrews Drive to the east and Yanchep Beach Road to the south.

The LWMR provides the framework for the application of total water cycle management to the proposed urban development, consistent with the Department of Water and Environmental Regulation (DWER) principles of Water Sensitive Urban Design (WSUD) described in the Stormwater Management Manual (DWER, 2022). This document details stormwater, groundwater and water quality management, at a level of detail suitable for the purpose of the local planning scheme.

2.2 STATUTORY FRAMEWORK

2.2.1 Regional Planning

The Study Area represents Improvement Plan No. 60 (WAPC, 2024). The area has been identified as a major activity centre for the north-western corridor of Perth in the *Yanchep-Two Rocks District Structure Plan* (Roberts Day, 2010), *Perth and Peel@3.5 million* (DPLH, 2018) and State Planning Policy 4.2 *Activity Centres* (DPLH, 2023).

The Study Area is currently zoned *Central City Area* and *Urban* in the Metropolitan Region Scheme and is bisected by a railway reserve that facilitates the Yanchep Rail Extension (WAPC, 2024), Figure 2.

2.2.2 District Planning

The Study Area is located within the *Yanchep-Two Rocks District Structure Plan* (Roberts Day, 2010) and is generally zoned *Urban Development* in the *City of Wanneroo District Planning Scheme No. 2* (City of Wanneroo, 2001), Figure 2. Some areas within the south of the Study Area have already been developed and are generally zoned *Industrial* and *Service Commercial* with small areas zoned *Public Purposes*, *Public Open Space* and *Drainage & Waterways*.

No District Water Management Report or Strategy was prepared as part of this District Structure Plan.

2.2.3 Local Planning

The Study Area is generally already covered by two local structure plans:

- *ASP No. 68 - Yanchep City Local Structure Plan* – originally endorsed 10 June 2013, current reference document is CLE (2023); and
- *ASP No. 100 – Yanchep City Centre Activity Centre Structure Plan* (CLE, 2015).

Subdivision and development have proceeded to date based on these guiding documents. Improvement Plan No. 60 was developed to create a State-led implementation pathway for ASP No. 68 & ASP No. 100 with the City of Wanneroo consulted as required under Section 119(3B) of the *Planning and Development Act 2005* (WAPC, 2024). Drainage design in ASP No. 68 to date has been informed by the *Yanchep City Structure Plan Local Water Management Strategy* (Coffey Environments, 2011) which has become outdated since the introduction of *Australian Rainfall and Runoff 2019* (Ball et al., 2019) and no longer represents current industry best practice.

This LWMR has been prepared to support the *Yanchep City Centre Precinct Structure Plan* (CLE, 2026) and guide future water management planning within the Study Area at the local scale.

2.3 KEY DESIGN PRINCIPLES AND OBJECTIVES

The LWMR employs the following documents to define its content, key principles and objectives:

- *Yanchep City Structure Plan Local Water Management Strategy* (Coffey Environments, 2011);
- *Decision Process for Stormwater Management in Western Australia* (DWER, 2017a);
- *Development Design Specification WD5 - Stormwater Drainage Design* (City of Wanneroo, 2019);
- *City of Wanneroo Local Planning Policy 4.4: Urban Water Management* (City of Wanneroo, 2020);
- *Stormwater Management Manual for Western Australia* (DWER, 2022);
- *State Planning Policy 2.9 – Water* (WAPC, 2025a);
- *State Planning Policy 2.9 – Water: Planning for Water Guidelines* (WAPC, 2025b); and
- *Local Governmental Guidelines for Subdivision Development* (IPWEA, 2026).

A summary of the key design principles and objectives is provided in Table 1 and summarised below.

2.3.1 Yanchep City Structure Plan Local Water Management Strategy (Coffey Environments, 2011)

The *Yanchep City Structure Plan Local Water Management Strategy* (Coffey Environments, 2011) was prepared for the City of Wanneroo in support of the Yanchep City Structure Plan. The primary objective of this LWMS was to maintain the site water balance and protect groundwater quality within the structure plan area.

The LWMS was prepared to the requirements of the City of Wanneroo on the advice of the then Department of Environment and Conservation and Department of Water to:

- Identify the environmental outcomes (including sustainability indicators) to be achieved through the implementation of the strategy;
- Ensure surface and groundwater were managed to the minimum requirements of Perth Coastal (Priority 3) Underground Water Pollution Control Area;
- Include provisions for the connection of all areas of development to the deep sewerage system; and
- Demonstrate that best practice WSUD principles were incorporated to maximise on-site water infiltration.

The LWMS summarises historical information/data collected within the area including vegetation surveys, groundwater monitoring and karstic investigations which have informed preparation of this LWMR. Some elements such as non-potable water supply and the stormwater management strategies are now outdated.

2.3.2 Development Design Specification WD5 - Stormwater Drainage Design (City of Wanneroo, 2019)

The City of Wanneroo (CoW) Guidelines for Subdivision Development (CoK, 2010) provides details of the City's requirements regarding stormwater drainage management. The document provides both general guidelines at the strategic conceptual design level and also more specific detailed criteria for design of drainage systems (grades, subsoil drainage).

Specific criteria in relation to stormwater/groundwater are detailed as:

- Runoff from constructed impervious surfaces generated by up to the 1-year, 1-hour average recurrence interval (ARI) events should be retained or detained as close to the source as possible.
- Drainage network is designed to 5 year ARI for residential and rural residential and 10 year ARI for commercial and industrial areas.
- Habitable floor levels are a minimum 300 mm above the major rainfall event flood level of the urban drainage system and 500 mm above the flood level of adjacent waterways and land locked flood storage areas.

- Water Sensitive Urban Design principles incorporated into the design.
- Treatment areas (small event) do not exceed 300 mm and 1:4 side slopes and are emptied within 12 hours after the rainfall event.
- Field measurements of soil conductivity should be undertaken to determine the hydraulic properties of the soil with adjustment factors applied based on soil type and/or clogging.
- Depth to water table confirmed based on monitoring of water table bores installed at the site and correlated to nearby DWER bore/s to obtain estimated maximum groundwater levels for the site.
- Flood storages to be set at least 0.3 m above the maximum groundwater level and not exceed 0.9 m up to the 10 year ARI and 1.2 m for events over the 10 year ARI to the 100 year ARI event.
- Flood storages to empty within 36 hours for the 5 year ARI event and 84 hours for the 100 year ARI event.

2.3.3 Stormwater Management Manual for Western Australia (DWER, 2022a)

The Water and Rivers Commission (Department of Water, DoW, 2006-2017; Department of Water and Environmental Regulation, DWER, 2017-present) released *A Manual for Managing Urban Stormwater Quality in Western Australia* in 1998 to define and practically describe Best Management Practices (BMP's) to reduce pollutant and nutrient inputs to stormwater drainage systems. The Manual also aimed to provide guidelines for the incorporation of water sensitive design principles into urban planning and design, which would enable the achievement of improved water quality from urban development.

The document was released to provide a guideline for best planning and management practices and was intended for use by Water and Rivers Commission, but also by other State and Local Government Authorities and sectors of the urban development industry.

In consultation with a working team comprising industry and government representatives a major review of the manual was completed in 2007. The revised manual was officially launched in August 2007.

Principle objectives for managing urban water in Western Australia are stated as:

- Water Quality: To maintain or improve the surface and groundwater quality within development areas relative to pre-development conditions.
- Water Quantity: To maintain the total water cycle balance within development areas relative to the pre-development conditions.
- Water Conservation: To maximise the reuse of stormwater.
- Ecosystem Health: To retain natural drainage systems and protect ecosystem health.
- Economic Viability: To implement stormwater systems that are economically viable in the long term.
- Public Health: To minimise the public risk, including risk of injury or loss of life to the community.
- Protection of Property: To protect the built environment from flooding and waterlogging.
- Social Values: To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater.
- Development: To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles

The manual was reviewed and updated in 2022 from the August 2007 version to ensure all information contained in the document was correct and up-to-date.

2.3.4 State Planning Policy 2.9 – Water (WAPC, 2025a) and Planning for Water Guidelines (WAPC, 2025b)

State Planning Policy 2.9 – Water (WAPC, 2025a) and its associated *Planning for Water Guidelines* (WAPC, 2025b) were prepared under Part 3 of the Planning and Development Act 2005 and released by the Western Australian Planning Commission in December 2025. This document repealed a number of former State Planning Policies and replaced *Better Urban Water Management* (WAPC, 2008) and Government sewerage policy which had till then been the planning instrument and process for urban water development in Western Australia.

The Policy outlines how water resource management should be integrated into the planning process with objectives:

- Protect and improve the environmental, social, cultural and economic values of the state’s water resources;
- Protect public health and the long-term supply of good quality and affordable drinking water;
- Manage the risk of flooding to people, property and infrastructure;
- Ensure the secure and sustainable supply, use, disposal and re-use of water resources;
- Ensure future development is resilient to the water-related impacts of climate change; and
- Minimise future costs and protect public health by ensuring appropriate wastewater infrastructure is provided.

This Policy and its Guidelines apply to the preparation and assessment of proposals in relation to water matters, including regional and sub-regional frameworks, region and local planning schemes and scheme amendments, local planning policies, planning strategies, precinct plans, activity centre plans, structure plans, subdivision applications and development applications across Western Australia.

This LWMR has been prepared to support a precinct structure plan and is the most appropriate report type for this planning stage as detailed in WAPC (2025b). The stated requirements in for a LWMR in WAPC (2025b) largely mirror those of the similarly titled Local Water Management Strategy in *Better Urban Water Management* (WAPC, 2008).

2.3.5 Local Government Subdivisional Guidelines (IPWEA, 2026)

The Institution of Public Works Engineering Australia [IPWEA] Subdivisional Guidelines (Edition 3.1 – March 2026) aim to achieve best practice for managing both water quantity and quality in a sustainable way as required in *State Planning Policy 2.9 – Water* (WAPC, 2025a).

Design criteria are to be used as a guide for development of the urban water management system for strategic planning, subdivision and development. Water management requires consideration of water quality and quantity.

Post-development annual discharge (the critical 1 Exceedance per Year [EY] event) volume and peak flow should be maintained relative to pre-development conditions in all parts of the catchment where there are identified impacts on significant ecosystems. The built environment also needs to be protected from flooding (up to the 1% Annual Exceedance Probability [AEP]) and waterlogging, minimising the public risk.

Surface and groundwater quality should be at least maintained at pre-development levels (winter concentrations) and, if possible, improved. This should be achieved through a treatment train approach including non-structural measures (e.g. community education), on-site retention of the first 15 mm of rainfall and bio-retention structures/systems sized at 2% of the constructed impervious areas. As compared to a development that does not actively manage stormwater quality; the following design objectives are required:

- At least 80% reduction of the total suspended solids;
- At least 60% reduction of total phosphorus;
- At least 45% reduction of total nitrogen; and
- At least 70% reduction of gross pollutants.

Key elements of the water-sensitive design include water conservation, flood protection, management of frequent events, groundwater drainage and general drainage design principles.

3. PROPOSED DEVELOPMENT

Yanchep City Centre, herein referenced to as the Study Area, is an urban project within the north-west corridor of the Perth Metropolitan Region located within the City of Wanneroo, approximately 50 km north-west of the Perth CBD. The Study Area is generally bound by Marmion Avenue and Splendid Park to the west, Toreopango Avenue to the north, St Andrews Drive to the east and Yanchep Beach Road to the south.

The proposed urban city centre will support retail, commercial, educational and residential uses, Figure 3, and be structured around a series of interconnected precincts. Development to date within the Study Area including existing service commercial lots in the south-east, Yanchep Train Station within the north-east and early stages of the Yanchep Botanical Garden in the centre.

Key elements of the LSP related to urban water management include:

- Retention and infiltration of frequently occurring rainfall events ('small' event) at-source within residential lots or within bio-retention structures, e.g. rain gardens, tree pits, etc. (road reserves).
- A pit and pipe system to convey minor stormwater event runoff from roads to down-gradient drainage management areas. Road carriageways will be used as an overland flow path to convey stormwater runoff from major rainfall events to the drainage management areas.
- Major event stormwater retained on-site in commercial, mixed use and residential lots.
- Retention of existing trees where possible, within public open spaces.
- Use of local native species in open spaces and streetscapes to reduce nutrient input and conserve water resources.

A breakdown of the land use within the Study Area is presented in Table 2 for the proposed structure plan land uses (CLE, 2026) as shown on Figure 3.

Table 2: Land Use Breakdown

Land Use Description	Area (ha)
Residential	45.19
Commercial	10.51
Service Commercial	8.04
Mixed Use	28.74
School	14.02
Botanic Garden	11.90
Public Open Space (POS)	15.84
Road Reserve	56.14
PTA Land	3.25
DFES Land	0.60
WAPC Land	15.71
Total	209.94

4. PRE-DEVELOPMENT ENVIRONMENT

4.1 EXISTING LAND USE

The Study Area is predominantly undeveloped except for Yanchep Station in the north-east and the associated railway tracks which bisect the Study Area north to south, and existing commercial/industrial lots within the south.

The majority of the northern half of the Study Area is vegetated with vegetation types changing depending on the depth to the underlying limestone (Coffey Environments, 2010). Areas in the southern half of the Study Area had previously been cleared and used for agricultural and plantation land use and the grazing of stock with scattered shrubland now dominating the landscape in these areas (Coffey Environments, 2010).

4.2 TOPOGRAPHY

The pre-development topography (DoW, 2008) of the Study Area is shown on Figure 4. The Study Area is defined by undulating ridges and troughs with two east-west linear ridges prominent in the north of the Study Area. Ridges and mounds within the Study Area generally rise to 35 to 45 mAHd with troughs at around 25 to 30 mAHd.

The topography on Figure 4 dates from 2008 and generally predates urban development within the Study Area including construction of the Yanchep Station and railway. The exception is the industrial lots in the south of the Study Area which were developed in 1980s/90s.

4.3 CLIMATE

The Yanchep area is characterised by a Mediterranean climate with warm dry summers and cool wet winters. The Study Area has on average 80 precipitation days per year, which occur predominately between the months of May and September. Rainfall data is provided by the nearby Bureau of Meteorology *Yanchep* (Site ID: 009045; 1935-2000) and *Wanneroo* (Site ID: 009015; 1906-20245) rain gauges, located 3 km and 25 km south-east respectively of the Study Area, locations shown on Figure 5. The rainfall record at both gauges is intermittent, with no rainfall recorded between 1930 and 1963 at Wanneroo or since 2000 at Yanchep.

The average annual rainfall at the Wanneroo gauge is 783 mm and at the Yanchep gauge is 756 mm. These averages occur across different timeframes, Figure 5, but in general annual rainfall totals at Wanneroo are 50 to 100 mm higher than at Yanchep.

The short-term average at Wanneroo (1996-2025) is 704 mm, representing a 10% decline from the long-term average annual rainfall and consistent with the decreasing rainfall trend across south-west Western Australia since the 1970s (DoW, 2015). This is evident at the Wanneroo gauge with pre-1930s annual rainfall typically exceeding 800 mm in most years whereas post-1970, there are few years with rainfall above 800 mm, Figure 5.

The seasonal rainfall distribution has also altered, with a reduction of monthly rainfall across the wetter months of May, June and July but no reduction or slight increases in the drier months (November to April), Figure 5 *top*.

Average annual pan evaporation is estimated at 1,920 mm from pan evaporation data at the Department of Primary Industries and Regional Development (DPIRD) Wanneroo weather station (2008 to 2025) and is slightly lower than the estimated pan evaporation of 2,000 mm from Luke et al. (1987).

4.4 GEOLOGY AND SOILS

Surface geology mapping by Gozzard (1982) is shown on Figure 4.

The Study Area is generally characterised by sands associated with the Quindalup Dune System and Tamala Limestone.

The Quindalup Dunes consist of steep dune slopes with generally fine to medium grained, light brown to white, calcareous sand. The sand is predominately naturally medium dense to dense. The Tamala Limestone is significantly older than the Quindalup Dunes. This sand is generally yellow and is fine to coarse grained, notably coarser than the

Quindalup Dunes. The sand is generally medium dense, has comparatively high permeability, no shrinkage and no cohesion.

Descriptions of the key geological units in the Study Area are outlined in Table 3 and shown on Figure 4.

Table 3: Key Geological Units within the Study Area

Geological unit	Description
Calcareous Sand (S2 & S3)	CALCAREOUS SAND - white, fine to medium-grained, sub-rounded quartz and shell debris, of aeolian origin. S3 occurs as relatively thick covering over LS1.
Limestone (LS1)	LIMESTONE - light yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of aeolian origin.
Limestone (LS4)	LIMESTONE - pale yellowish brown, weakly cemented, friable, medium-grained, sub-rounded, quartz and shell debris, of aeolian origin.
Sand (S7)	SAND - pale and olive yellow, medium to coarse-grained, sub-angular quartz with a trace of feldspar, moderately sorted, of residual origin.

The Study Area lies within a highly pitted karst plateau. The formation is about 45 m thick and consists of a weakly lithified limestone composed of sand-sized skeletal fragments of marine organisms and significant percentages of quartz grains (Logiden, 2007). The formation overlies a west-sloping uniformity and the karst base is at about -25 mAHD beneath the Study Area with most remnants of the karst top at elevations between 30 and 40 mAHD (Logiden, 2007). Karstic features are prominent east of the Study Area around Loch McNess as shown in Gozzard (1982). A ground penetrating radar (GPR) survey was conducted by Georadar Research over the wider area with a survey line conducted east-west in the north of the Study Area. The maximum penetration depth was about 21 m and no large open voids or cavern-like features were detected during the GPR survey (Georadar Research, 2007). Logiden (2007) notes this GPR survey did not scan the formation base zone. No major karstic features were considered present in the Study Area. The results and analysis from Logiden (2007) and Georadar Research (2007) were summarised in Coffey Geotechnics (2007) who suggested that whilst karst features may underline the area, they are considered to be at a sufficient depth to not create a significant engineering risk for the proposed development of the area.

The soils associated with the Tamla Limestone and Quindalup Dune Systems within the Yanchep area are generally highly permeable and have hydraulic conductivities in excess of 10 to 15 m/day, with zones of higher horizontal hydraulic conductivity likely at the interface of the two formations (Kretschmer & Kelsey, 2016).

A geotechnical investigation is recommended to support any Development or Subdivision Water Management Report(s) to confirm ground conditions and infiltration rates across the Study Area.

4.5 ACID SULPHATE SOILS

The Study Area is generally classified as having no known risk of Acid Sulphate Soils (A.S.S.) occurring within 3 m of natural surface soils, Figure 4, likely due to the surface geology composition and significant separation to the underlying groundwater.

4.6 GROUNDWATER

4.6.1 Regional Hydrogeology

The hydrogeological formations under the Study Area can be grouped into three aquifers, each being assigned the name of the major geological unit contributing to it. In descending order of depth from natural surface they are; Superficial Aquifer (unconfined), Leederville Aquifer (semi-confined) and Yarragadee Aquifer (confined).

Superficial Aquifer

The superficial aquifer in the vicinity of the Study Area is unconfined and directly recharged from rainfall percolation. Below the Study Area it has a saturated thickness of up to 35 m with the base of the superficial aquifer estimated at about -30 mAHD (Department of Environment, 2004). The superficial aquifer within the vicinity of the Study Area includes three formations which are, in order of increasing depth: Safety Bay Sand (Quindalup Dune System); Tamala Limestone and Ascot Formation (Davidson, 1995).

The Safety Bay Sand consists of white, unlithified, calcareous fine- to medium-grained quartz sand and shell fragments with traces of fine-grained, black heavy minerals and occurs along the coastal margin as aeolian stable and mobile dunes and uncomfortably overlies the Tamala Limestone (Davidson, 1995).

The Tamala Limestone is a creamy white to yellow, or light-grey calcareous aeolianite and contains various proportions of quartz sand, fine- to medium-grained shell fragments and minor clayey lenses (Davidson, 1995). Along the coastal areas, the Tamala Limestone varies in thickness depending on topography (Davidson, 1995).

The Ascot Formation is present beneath the Tamala Limestone at up to 10 km inland from the coast. The Ascot Formation consists of hard to friable, grey calcarenite with thinly interbedded sand, with shell fragments commonly near the base of the formation. Sands are fine- to coarse-grained and are poorly sorted and angular to rounded in shape (Davidson, 1995).

Vertical fluctuations in the groundwater table occur seasonally, consistent with Perth's winter-dominated Mediterranean rainfall pattern. Rainfall recharge to the superficial aquifer is 15 to 20% of total annual rainfall (Davidson, 1995).

Leederville Aquifer

Within the Study Area, the superficial formations overlay the Lancelin Formation and the Leederville Aquifer beneath the Study Area typically has groundwater salinity of < 500 mg/L ('fresh') (Davidson, 1995). The majority of groundwater within the aquifer is contained in discontinuous lenticular bands of sand, generally less than 10 m thick, which vary considerably in sorting, grain size and clay content (Coffey Environments, 2011).

Yarragadee Aquifer

The South Perth Shale underlies the Leederville Aquifer and acts as the confining bed between the Leederville and Yarragadee aquifers (Davidson, 1995). The Yarragadee aquifer is major water resource with groundwater salinities within the vicinity of the Study Area typically 1,000 to 2,000 mg/L.

The majority of groundwater is contained in sandstone beds, up to 30 m thick, with recharge from downward leakage from the two overlying geological units where intervening sediments are absent (Coffey Environments, 2011).

4.6.2 Groundwater Levels

The historical maximum groundwater contours presented in the *Perth Groundwater Atlas* (WRC, 1997) intersect the southern half of the Study Area and show that the groundwater flow direction is north-east to south-west across the Study Area with groundwater levels generally range from approximately 3.5 mAHD to 1.5 mAHD, Figure 6 *left*.

The pre-development depth to maximum recorded groundwater levels, Figure 6 *right*, is greater than 20 m in the southern half of the Study Area with similar depth to groundwater likely to occur in the northern half of the Study Area.

Three groundwater monitoring bores, MB1 to MB3, were installed by Coffey Environmental in August 2009 within the vicinity of the Study Area for ASP No. 68 with the locations of bores MB1 and MB2 shown on Figure 6 *left*. These bores were measured in August 2009, near the winter peak, with groundwater levels ranging from 0.77 mAHD (MB3) to 0.87 mAHD (MB2) across the Study Area, with depth to groundwater greater than 23 m below natural surface.

Groundwater levels in the region have declined significantly since the 1970s due to pumping from the superficial and Leederville aquifers and reduced groundwater recharge due to declining rainfall (Kretschmer & Kelsey, 2016). At Loch McNess, 2.5 km east (upgradient) of the Study Area, groundwater levels had declined 1.5 to 2 m (to 2012) since the 1970s and partial clearing of pine plantations east of the lake have done little to abate this continued decline (Kretschmer & Kelsey, 2016). This trend will likely continue in future based on groundwater modelling presented in DWER (2022c) for the Gnangara Mound which shows groundwater levels in the superficial aquifer in the Yanchep area declining a further 0.1 to 0.5 m regardless of changes to abstraction for public water supply and clearing of pine plantations.

4.6.3 Groundwater Quality

Limited groundwater quality information is available for the Study Area with monitoring referenced in Coffey Environments (2011) dating from 1992 and suggesting groundwater within the area was within the recommended range of drinking water guidelines. The total hardness of water, expressed as CaCO₃, was found to be about 200 mg/L and may need to be treated before use for certain purposes (Coffey Environments, 2011).

Pre-development groundwater monitoring for the Alkimos Eglinton DSP was conducted by GHD for LandCorp from July 2010 to November 2011 based on the Alkimos Eglinton Water Monitoring Plan (GHD, 2010). This included monitoring of the South Yanchep LSP area, of which bores MB10 and MB12 were located 800 m and 1,600 m south of the Study Area, Figure 6 *left*. Six rounds of groundwater sampling were completed with physico-chemical parameters analysed both in-situ and by a laboratory in each sampling event; nutrients and major ions analysed four times, July 2010 and February/March, July & November 2011; and metals analysed three times, July 2010 and July & November 2011.

A summary of the pre-development groundwater quality at MB10 and MB12 from GHD (2011) is as follows:

- pH was slightly alkaline with mean pH at 7.3 and a pH range of 7.1 to 7.4. This aligns with the regional pH in the calcareous sediments of the Ascot Formation and Tamala Limestone where pH generally ranges from 7.0 to 8.0 (Davidson, 1995).
- Groundwater was generally fresh with mean TDS of 550 mg/L and ranging from 470 to 630 mg/L. This generally align with the regional salinity contours (DoE, 2004) which range from 500 mg/L TDS inland increasing to greater than 1,500 mg/L TDS towards the coast.
- Total Nitrogen (TN) concentrations were an order of magnitude higher at MB12 (19 to 25 mg/L) than at MB10 (2.4 to 2.7 mg/L). It is unclear whether this is a transcription error or not. The results in the other bores monitored in the South Yanchep LSP area were similar to or lower than MB10. Total Phosphorus (TP) concentrations ranged from <0.01 mg/L (the PQL) to 0.04 mg/L.
- Heavy metal concentrations were generally less than both the AWDG (2011) guideline values and the analysis PQL.
- The major ions present in groundwater across the Study Area are Sodium, Calcium and Chlorine with Calcium higher than Sodium at MB10 but lower than Sodium at MB12. Sulphate ion concentrations are mostly naturally occurring and were generally less than 15 mg/L.
- Groundwater hardness is expressed in terms of an equivalent quantity of calcium carbonate and ranged from 250 mg/L to 390 mg/L with a mean hardness of 300 mg/L; consistent with 1992 monitoring referenced in Coffey Environments (2011).
- *Escherichia coli* density and Thermotolerant Coliforms density were all less than 1 CFU/100mL (the PQL).

Nutrient concentrations may be elevated within the Study Area due to nutrient inputs from the up-gradient Sun City Golf Club east of the Study Area which has been in operation since the 1970s.

Extracts from GHD (2011) are attached as Appendix A.

4.6.4 Groundwater Resources for Irrigation

The Department of Water and Environmental Regulation manages the groundwater of the State under the *Rights in Water and Irrigation Act 1914* (RIWI Act). The Study Area is located within the Yanchep Groundwater Area which forms part of the *Gnangara Groundwater Allocation Plan* (DWER, 2022b) area.

The DWER groundwater allocation limit and water allocations from the superficial aquifer are shown in Table 4 based on a Resource Allocation Report from DWER as of 04 June 2026.

Table 4: DWER Groundwater Resource Allocation and Limit, June 2026

GW Area	Sub -Area	Aquifer	General Allocation Limit Licensable component, (kL/yr)	Allocated (kL/yr)	Additionally Requested (kL/yr)	% Allocated, committed & requested
Yanchep	Yanchep ¹	Superficial Swan	786,000	1,468,818	160,000	207% ¹
	Yanchep Confined	Leederville	288,000	320,000	0	111%
		Yarragadee	0	0	0	0

Note: 1. Water is only available in the Eglinton and Yanchep subareas for irrigating planned public open space and public water supply as per the *North West corridor water supply strategy* (DoW, 2014).

The Yanchep groundwater management areas form part of the Gnangara Groundwater Allocation Plan area. A new groundwater allocation plan (DWER, 2022b) was released in June 2022 to replace the previous DoW (2009b) plan. The majority of the allocation in the Yanchep sub-area is reserved for public water supply.

A water source is needed for the irrigation of streetscapes and entry and irrigation of active/passive public open space (POS) within the Study Area.

The Study Area forms part of the *North West Corridor Water Supply Strategy* [NWCWSS] (DoW, 2014) area which covers 9000 ha of future urban development between Quinns Rocks and Yanchep. The NWCWSS was developed and implemented to provide equitable allocation of scarce shallow groundwater resources to developers and future licensees to meet the significant water demand for the irrigation of public open space within future urban areas in the north-west corridor. Water is only available in the Yanchep subarea of the *Gnangara Groundwater Allocation Plan* (DWER, 2022b) as per the NWCWSS with the design criteria detailed in Table 5 below.

Table 5: North-West Corridor Irrigation Design Criteria (DoW, 2014)

Type of POS	Description	% of site that is irrigated
Active ²	Regional/District playing fields ¹	64%

	Neighbourhood playing fields ¹	59%
Passive ²	Pocket parks	33%
	High Schools / Primary Schools	30%
	Streetscapes / Entry Statements	Establishment only

Notes: 1. Preferably co-located with schools; 2. Allowance for 2 years of establishment irrigation.

The Yanchep Beach Joint Venture holds three groundwater licences across the Study Area and areas to the north and east. These collectively total an allocation of 356,891 kL/year and specifically are:

- GWL173057 – 229,443 kL/year
- GWL179283 – 41,948 kL/year; and
- GWL207060 – 85,500 kL/year.

GWL173057 (229,443 kL/year) provides temporary water for establishment purposes under the NWCWSS. This licence is non-transferrable and will be recouped by DWER on completion of the development. GWL179283 (44,558 kL/year) is the entitlement issued to the development under the NWCWSS for the long-term ongoing irrigation of POS within the Study Area and surrounding areas. GWL207060 (85,000 kL/year) is a non-renewal, non-transferrable licence to provide water for the establishment of 12.6 ha of Botanic Park.

Groundwater Licences are attached as Appendix B.

4.6.5 Public Drinking Water Source Area

The Study Area is located within the Perth Coastal and Gwelup Underground Water Pollution Control Area (UWPCA), Figure 6 *left*, and which extends from Osborne Park in the south to Two Rocks in the north. The Study Area was originally in the Perth Coastal UWPCA which was proclaimed in 1973 under the Metropolitan Water Supply, Sewerage, and Drainage Act 1909 and amended in 1989 and 1990. A 2018 amendment combined the area with the Gwelup UWPCA. The control area lies at the western edge of the Gnangara Mound groundwater system and water from this area is abstracted by the Water Corporation from both superficial and deeper aquifers as part of the Perth Metropolitan Integrated Water Supply System (DoW, 2012).

The Perth Coastal and Gwelup UWPCA has been classified as a Priority 3 (P3) Public Drinking Water Source Area (PDWSA). A UWPCA is a specific type of PDWSA and are detailed in Water Quality Protection Note [WQPN] 36 Protecting public drinking water source areas (DoW, 2009a). P3 PDWSAs are declared over land zoned urban, commercial and light industrial where the objective is to manage the water quality contamination risks so that the drinking water source is maintained for as long as possible and coexists with higher intensity land uses (DWER, 2021). Key elements in the protection of P3 areas include the need for deep sewerage and implementing best management practices including land use restrictions. Compatible land uses for the P3 area are detailed in WQPN 25 *Land use compatibility tables for public drinking water source areas* (DWER, 2021), of which urban development inclusive of commercial, education and residential are acceptable land uses.

DWER is the lead agency in protecting catchments for water supply in Western Australia and supports the Australian Drinking Water Quality Guidelines (ADWQG) barrier approach to water quality protection, with catchment management the first barrier of protection. Subsequent barriers are water storage, treatment and disinfection.

To support the ADWQG barrier approach, catchment management measures in the form of Wellhead Protection Zones [WHPZs] around public water supply wells are supported by DWER. WHPZs within the Study Area are represented as 300 m radius buffers, shown on Figure 6 *left*, but which do not extend beyond the boundary of the PDWSA. This 300 m radius buffer is arbitrary as per DWER (2009) in the absence of modelled alternative buffer shapes.

Water Corporation has licences to abstract groundwater from the Leederville (GWL105738; 10.65 GL) and Yarragadee (GWL59345; 15.74 GL) aquifers across the Perth Coastal and Gwelup UWPCA and from the superficial aquifers in the

Eglinton (GWL162181; 0.175 GL) and Yanchep sub-areas (GWL56641; 1.1 GL). However, none of the WHPZs shown within the Study Area align with current abstraction wells as shown in DoW (2014) in the superficial aquifer or in DWER (2022c) in the Leederville and Yarragadee aquifers. Regardless, the WHPZs are located over proposed residential areas which is an acceptable land use in DWER (2021).

4.7 SURFACE WATER HYDROLOGY

The Study Area is generally located within the Swan Coastal catchment.

There are no external catchments draining into the Study Area or defined surface water drain lines within the Study Area. The majority of rainfall will rapidly infiltrate within the Study Area and surrounding areas due to the high separation to groundwater and highly permeable underlying sandy/limestone soils.

4.8 WETLANDS AND VEGETATION

Geomorphic Wetland mapping of the Swan Coastal Plain, Figure 7, shows there are no mapped wetland within the vicinity of the Study Area (DBCA, 2020), Figure 7. The nearest is Loch McNess (UFI 8010), 2.5 km east (upgradient) of the Study Area which is classified as a Conservation Wetland, Figure 7.

There are no Bush Forever sites (DoP, 2000) within the vicinity of the Study Area, Figure 7. The nearest sites are along the coastal foreshore (site 397), 1 km west of the Study Area, and within Yanchep National Park (site 288), 1.2 km east of the Study Area, and align with areas zoned Parks and Reserve in the Metropolitan Region Scheme (DPLH, 2023a).

A flora and vegetation assessment of the ASP No. 68 area was conducted by ATA Environmental in October 2005 and reported in Coffey Environments (2010). This survey predates clearing and associated development to date within the Study Area. Two vegetation complexes occurred within the area – *Quindalup Complex* and *Cottesloe Complex – North*, neither of which is considered regionally significant and was above the recommended Bush Forever 10% minimum threshold for vegetation compels conservation (Coffey Environments, 2010). No Threatened Ecological Communities were recorded in the area nor were any flora species listed as significant (Declared Rare or Priority). The majority of vegetation within the northern half of the Study Area at the time was considered to be in Good to Very Condition with areas in the southern half generally in Degraded to Completely Degraded Condition (Coffey Environments, 2010).

4.9 CONTAMINATED SITES

A search of DWER's publicly available Contaminated Site Database (accessed May 2026) indicated no contaminated sites within at least a 5 km radius of the Study Area.

Avant Hydro notes the publicly available database only identifies 3 of the 7 contaminated sites classifications: *Contaminated – restricted use*; *Contaminated – remediation required*; and *Remediated for restricted use*. The remaining classifications are *Report not substantiated*; *Possibly contaminated – investigation required*, *Not contaminated – unrestricted use*; and *Decontaminated*.

4.10 ABORIGINAL CULTURAL HERITAGE

There is one registered Aboriginal Cultural Place within the Study Area, *Yanchep Beach* (Place ID: 3394), Figure 7. The Aboriginal Cultural Heritage Enquiry System (DPLH, 2025) denotes this area as “artefacts / scatter” and will be retained within Public Open Space.

There are registered Aboriginal Cultural Places located 1 km west of the Study Area (Place IDs: 17599 & 17956) associated with Creation / Dreaming narratives and 1.6 km east of the Study Area (Place ID: 3742) covering Loch McNess and Wagardu Spring in Yanchep National Park (DPLH, 2025).

5. WATER SUSTAINABILITY

5.1 WATER SUPPLY AND WASTEWATER

Scheme and wastewater services will be extended from existing services with a new connection for the Study Area with sewer and water supply lines to be contained within a common services alignment.

Servicing of the proposed development is further detailed in the Engineering Report (Stantec, 2026).

5.2 WATER EFFICIENCY MEASURES

Lot Efficiency Measures

The State Planning Policy 2.9 regarding water resources (WAPC, 2025a) was developed to ensure that urban development is located adequately, serviced with appropriate wastewater, stormwater and groundwater management infrastructure and contributes towards the management of water quality and quantity, ecological health and the social and cultural values of water resources. This section addresses water conservation measures and fit for purpose non-potable supply.

The Water Conservation Strategy for the development is detailed below, with initiatives to be considered for adoption:

- Use of water-wise practices at the lot scale, including water efficient fixtures and fittings (WELD rated taps, showerheads, toilets, appliances, rainwater tanks) and water-wise landscaping including native plant species;
- Initiatives to encourage waterwise landscaping of residential lots including use of native plant species, hydrozoning, mulching, soil amendments, water retention products and installation of appropriate irrigation fixtures; and
- Buildings constructed to current 7-star building standards as per the current National Construction Code [NCC]. The NCC 2022 was published on 01 October 2022 and incorporates a minimum 7-star energy efficient rating for new dwellings. NCC 2022 was adopted on 01 May 2023 by the WA Government with the residential energy efficiency provisions mandatory from 01 May 2025.

These conservation measures aim to reduce scheme water consumption in the development area within the constraints of the site.

Landscape Efficiency Measures

The Landscape Strategy (EPCAD, 2026) defines an overarching urban forest strategy based on retention of existing mature trees, where feasible, supplemented with extensive street tree planting and climate-resilient vegetation species. The urban landscape is structured around a series of distinct but interconnected precincts incorporating tree plantings, native vegetation, pedestrian-friendly streetscapes and parklets, sporting fields, nature and open space.

POS will incorporate turfed areas, remnant trees and plantings of low water use-vegetation. Mulches and ground covers will be used to increase the efficiency of irrigation and conserve water. Where appropriate, native species will be used in drainage and other landscaped areas. The irrigation system will be designed to water wise principles.

Detail concept plans for each precinct including concept landscape design cross-sections are detailed in the Landscape Strategy (EPCAD, 2026) with extract of this document attached as Appendix C.

Irrigation water use will be based on the existing three groundwater licences held by the developer, Yanchep Beach Joint Venture, as part of the NWCWSS (DoW, 2014) and detailed in Section 4.6.4. This includes 229,443 kL/year of temporary water under GWL173057 for establishment purposes (excludes Botanic Gardens); 44,558 kL/year for long-term ongoing POS irrigation (GWL179283) and 85,500 kL/year of temporary water under GWL207060 for establishment irrigation in the Botanic Gardens.

6. STORMWATER MANAGEMENT

6.1 DESIGN OVERVIEW

Local stormwater management is proposed to be consistent with water sensitive design practices and to meet key objectives and criteria as detailed in Table 1 and *Decision Process for Stormwater Management in Western Australia* (DWER, 2017b); *Development Design Specification WD5 - Stormwater Drainage Design* (City of Wanneroo, 2019); and *Stormwater Management Manual for Western Australia* (DWER, 2022).

The local stormwater management system has been designed according based on small events, minor drainage and major drainage.

Small event management concentrates on the first 15 mm of rainfall (approximately the 1 EY 1 hour event) and will comprise of lot retention in soakwells (or equivalent underground storage devices) and bio-retention areas.

The minor drainage system is defined as a system of drains, pipes, culverts, kerbs, gutters etc. designed to convey runoff generated by low frequency storms, typically less than the 20% AEP for residential areas.

The major drainage system is defined as the arrangement of roads, drainage reserves and attenuation areas planned to provide safe passage of stormwater runoff from extreme rainfall events.

The drainage system is described in more detail below with the key elements of the drainage system shown on Figures 8 and 9.

6.1.1 Small Event Management

The following strategies are proposed to meet the criteria for small event management:

- Stormwater runoff from all residential, service commercial, commercial and mixed use lots and Schools will be retained and infiltrated within the lots. This can be achieved by means of systems such as soakwells and/or other underground storage devices and drainage basins. This is to be detailed in the development applications associated with each lot and approved by the City of Wanneroo.
- Stormwater runoff from impervious areas within road reserves (e.g. road carriageways, footpaths, other hardstand) will be retained and infiltration within vegetated bio-retention areas [BRAs]. These can either be at-source within tree pits and/or rain gardens within the road reserve or within the downstream flood management areas [FMAs], located at the catchment low-points. BRAs are to be underlain with amended soils and planted with suitable plant species, consistent with *Vegetation Guidelines for Biofilters in South-West Western Australia* (Monash University, 2014) or species recommended by the City of Wanneroo.

6.1.2 Minor Drainage

To meet the design criteria for the minor drainage system (for events up to the 20% AEP event (residential) or 10% AEP event (commercial/industrial)), the following strategies are proposed:

- Stormwater runoff from impervious areas within road reserves will be conveyed as piped flow to the down-gradient FMAs. The road pipe network will be sized to convey the minor event flow.
- Flood management areas [FMAs] will be located at the catchment low-point, generally either in POS or alongside the Botanical Garden area but outside of retained vegetation areas.
- Stormwater runoff from all residential, service commercial, commercial and mixed use lots will be retained and infiltrated on-site. It is noted some stormwater runoff from residential lot driveways which grade to the road carriageway may discharge into the road carriageway and thereafter the road pit-pipe drainage system.
- Stormwater runoff from impervious areas in Yanchep Train Station and the train alignment will be retained and infiltrated on-site in the surrounding sandy soils. Stormwater runoff from the Bus Station and car parks is retained

and infiltrated in existing underground storage. Based on the NEWest Alliance (2020) drainage strategy, Appendix D, these storages have been designed to manage in excess of the 10% AEP (minor) event.

6.1.3 Major Drainage

The major drainage system is designed to manage rainfall events greater than the 20% AEP event up to the 1% AEP event. Key points of the major drainage system strategy are as follows:

- Management will include infiltration of stormwater into in-situ soils (as in small and minor events) and road stormwater runoff.
- Road reserves will provide flood storage and conveyance. In major storm events, the minor drainage pit and pipe system will be full with excess stormwater bypassing the minor drainage structures and flowing overland within the road carriageway, with roads graded towards the downstream FMAs; located at the catchment lows.
- FMAs will have side slopes of 1:6 and maximum depths of 1.2 m.
- Stormwater runoff from the Bus Station and car parks in excess of the existing underground storage will overflow into the adjacent road network.
- Minimum habitable building floor levels will have a minimum 300 mm (0.3 m) clearance from the 1% AEP peak water levels in FMAs, consistent with DWER (2017a) and City of Wanneroo (2019) guidelines. For terminal/land-locked retention storages, minimum 500 mm (0.5 m) clearance is required from the 1% AEP peak water levels in FMAs.

6.2 DRAINAGE CATCHMENTS AND MODEL PARAMETERS

Proposed post-development drainage catchments for the Study Area are shown on Figure 8 and are based on the Stantec (2026) civil earthworks design, Appendix E.

Drainage catchments Y1 to Y22 grade internally to a low-point within each catchment, typically POS or the Botanic Gardens. Drainage catchments E1 to E6 grade and discharge to external roads, and E7 & E8 are to be stored within existing partially developed areas.

Drainage catchments T1 and T2 represent the Yanchep Train station catchments and contain underground storage units. Stormwater in excess of underground storage will discharge to the road drainage network in the southern carpark of catchment T1 and in T2. The northern carpark of catchment T1 grades north-east and stormwater in excess of underground storage will discharge into dune areas north-east of the Study Area and infiltrate in in-situ sandy soils.

The stormwater management system has been modelled using XP-SWMM based on the methodology in *Australian Rainfall and Runoff* [ARR] (Ball et al., 2019). Design rainfalls have been sourced from BoM (2016) and adjusted to 2030 based on climate change factors for the Study Area as detailed in the ARR Data Hub. The rainfall temporal pattern was assumed spatially uniform across the catchment with storms modelled ranging from 30 minutes to 12 hours.

FMA locations are at the catchment low-points as determined from the Stantec (2026) earthworks design and catchment slopes were also calculated from the road earthworks levels.

A breakdown of the rainfall-runoff loss model parameters is presented in Table 6 below. Regional estimates of hydraulic conductivity associated with the highly permeable sand and limestone within the Study Area indicate values that exceed 50 m/day. To adopt a conservative approach for the infiltration modelling in this report, a hydraulic conductivity rate of 5 m/d has been used for the FMA's.

From preliminary discussions with the City of Wanneroo, all developed lots (Commercial / Service Commercial / Mixed Use/ School) were modelled assuming all stormwater up to the major event (1% AEP) is retained and infiltrated within each lot, consistent with Section WD 5.26 of City of Wanneroo (2019). As some residential driveways will likely grade towards the road reserve, 10% runoff from residential lots has been modelled across the Study Area.

Underground storage in the Train Station (catchments T1 and T2) was modelled as per the NEWest Alliance (2020) drainage strategy, Appendix D, with stormwater in excess of underground storage flowing to the catchment Y7 FMA.

Table 6: Catchment Rainfall-Runoff Loss Model

Land Use	Initial Loss (mm)	Proportional Loss (%)
Residential Lots	-	90
Road Reserve	1.5	20

6.3 STORMWATER MODELLING RESULTS

Catchment areas, FMA details and stormwater modelling results for the minor (20%/10% AEP) and major (1% AEP) events for each catchment are summarised in Tables 7 and 8. Indicative FMA locations are shown on Figure 9.

The final configuration (areas, side slopes, etc.) and exact location of the flood management areas will be dependent on the final earthworks and road design levels for the development. These details will be refined at the subdivision stage and reported in the relevant Subdivision or Development Water Management Report(s).

The Small Event (15 mm) rainfall management areas for each catchment should be calculated as 2% of the connected impervious area of each road reserve catchment based on the loss model in Table 6 and road reserve areas in Table 7 and Table 8. Preliminary modelling as presented in this LWMR has assumed these areas will be co-located within the downstream FMAs for the minor/major events, however, there are opportunities to retain all or part of this stormwater runoff at-source within the catchment as described in Section 8 below and the EPCAD (2026) Landscape Strategy, Appendix C.

Table 7: Stormwater Modelling Results – Y1 to Y12

Flood Management Areas [FMAs]	Y1	Y2	Y3	Y4&5	Y6	Y7	Y8	Y9	Y10	Y11	Y12
FMA Catchment											
Residential Lots (ha)	2.65	7.25	-	3.31	0.24	-	-	3.27	0.51	2.30	-
Road Reserve (ha)	1.46	5.46	6.03	2.68	3.54	7.58	1.88	1.73	0.31	1.76	1.21
FMA Details											
FMA Invert (mAHD)	24.20	26.90	27.50	26.50	26.50	31.00	36.50	32.10	32.50	28.60	28.00
FMA Base Area (m ²)	290	1,515	1,515	415	565	2,060	225	230	55	485	150
FMA Side Slope	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6
Max Depth (m)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.80	1.00	1.20
20% AEP											
Critical Duration	2	2	2	2	1	1	2	2	1	1	2
Peak Water Depth (m)	0.62	0.50	0.49	0.64	0.63	0.49	0.69	0.68	0.47	0.48	0.70
Peak Water Elevation (mAHD)	24.82	27.40	27.99	27.14	27.13	31.49	37.19	32.78	32.97	29.08	28.70
Peak TWL area (m ²)	620	2,055	2,045	1,095	1,250	2,660	690	700	160	770	430
Peak Storage Volume (m ³)	275	890	870	465	560	1,155	300	300	50	300	195
10% AEP											
Critical Duration	2	2	2	2	2	2	2	2	1	2	2
Peak Water Depth (m)	0.74	0.64	0.63	0.76	0.76	0.63	0.80	0.80	0.55	0.59	0.81
Peak Water Elevation (mAHD)	24.94	27.54	28.13	27.26	27.26	31.63	37.30	32.90	33.05	29.19	28.81
Peak TWL area (m ²)	700	2,220	2,210	1,260	1,425	2,850	790	815	180	845	490
Peak Storage Volume (m ³)	355	1,190	1,170	605	730	1,550	380	395	60	385	245
1% AEP											
Critical Duration	3	3	3	3	3	3	2	3	2	3	3
Peak Water Depth (m)	1.17	1.20	1.19	1.15	1.18	1.18	1.18	1.20	0.80	1.00	1.20
Peak Water Elevation (mAHD)	25.37	28.10	28.69	27.65	27.68	32.18	37.68	33.30	33.30	29.60	29.20
Peak TWL area (m ²)	1,015	2,950	2,930	1,875	2,070	3,630	1,185	1,240	265	1,150	725
Peak Storage Volume (m ³)	715	2,650	2,600	1,215	1,460	3,320	750	810	115	800	485

Table 8: Stormwater Modelling Results – Y13 to Y22, E7 & E8

Flood Management Areas [FMAs]	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	E7	E8
FMA Catchment												
Residential Lots (ha)	1.52	0.72	3.46	0.24	3.00	2.67	0.43	0.93	8.61	2.05	0.48	-
Road Reserve (ha)	0.73	0.40	2.85	3.17	1.65	1.52	0.30	0.50	4.19	1.72	1.86	1.02
FMA Details												
FMA Invert (mAHD)	32.10	29.10	31.90	26.40	31.60	31.60	30.50	23.80	25.50	28.00	29.00	30.00
FMA Base Area (m ²)	95	50	570	630	285	255	45	75	1,300	345	310	105
FMA Side Slope	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6	1 in 6
Max Depth (m)	1.20	1.00	1.20	1.20	1.20	1.20	0.80	1.00	1.20	1.20	1.20	1.20
20% AEP												
Critical Duration	2	1	3	2	2	3	1	1	2	2	2	1
Peak Water Depth (m)	0.69	0.62	0.58	0.59	0.63	0.65	0.49	0.60	0.49	0.62	0.62	0.72
Peak Water Elevation (mAHD)	32.79	29.72	32.48	26.99	32.23	32.25	30.99	24.40	25.99	28.62	29.62	30.72
Peak TWL area (m ²)	310	200	1,035	1,100	660	595	160	250	1,745	670	665	370
Peak Storage Volume (m ³)	135	75	460	505	290	270	50	90	745	310	295	160
10% AEP												
Critical Duration	2	1	2	2	2	2	1	1	2	2	2	2
Peak Water Depth (m)	0.81	0.70	0.70	0.72	0.75	0.78	0.57	0.69	0.63	0.75	0.74	0.83
Peak Water Elevation (mAHD)	32.91	29.80	32.60	27.12	32.35	32.38	31.07	24.49	26.13	28.75	29.74	30.83
Peak TWL area (m ²)	360	225	1,150	1,220	745	685	185	285	1,885	755	750	425
Peak Storage Volume (m ³)	175	90	590	655	375	355	60	115	1,000	405	380	205
1% AEP												
Critical Duration	3	2	3	3	3	3	2	2	3	3	3	2
Peak Water Depth (m)	1.20	1.00	1.20	1.20	1.20	1.20	0.80	1.00	1.19	1.20	1.17	1.20
Peak Water Elevation (mAHD)	33.30	30.10	33.10	27.60	32.80	32.80	31.30	24.80	26.69	29.20	30.17	31.20
Peak TWL area (m ²)	550	340	1,680	1,720	1,130	1,690	270	420	2,220	1,075	1,100	635
Peak Storage Volume (m ³)	350	175	1,295	1,360	790	1,330	115	225	2,500	810	775	405

7. GROUNDWATER MANAGEMENT

7.1 DESIGN CRITERIA

Groundwater management for the Study Area has been prepared in line with the design criteria presented in the *Stormwater Management Manual for Western Australia* (DWER, 2022a):

- Protect infrastructure and assets from flooding and inundation by high seasonal groundwater levels, perching and/or soil moisture.
- Protect groundwater-dependent ecosystems from the impacts of urban runoff.
- Manage and minimise changes in groundwater levels and groundwater quality following development.
- Adopt nutrient load reduction design objectives for discharges to groundwater.

7.2 GROUNDWATER LEVELS

The estimated pre-development MGLs, Figure 6 *left*, shows there is likely to be greater than 20 m separation to the regional groundwater table across the Study Area, Figure 6 *right*.

Post-development, the landform will be recontoured to suit urban development and separation to groundwater is expected to be at least 15 to 20 m across most of the Study Area. Given the significant separation to groundwater, groundwater level management measures are likely not required across the Study Area but should be reviewed during subdivision stage of development after review and consideration of any geotechnical investigations and detailed earthwork strategies for the area.

7.3 GROUNDWATER QUALITY

The Study Area is within a Priority 3 (P3) groundwater protection area, Figure 6 *left*, and water quality contamination risks need to be managed so that the drinking water source is maintained for as long as possible and coexists with higher intensity land uses.

Risks to groundwater quality will be minimised by treating stormwater runoff from roads in frequently occurring rainfall events (15 mm) in bio-retention areas and a combination of soil amendments and landscape design elements (native vegetation, minimising turf areas, etc.) will be used to limit fertiliser and pesticide application in public open space areas.

8. WATER QUALITY MANAGEMENT

The effective implementation of the structural and non-structural controls as part of the residential/commercial development will enhance water quality from the Study Area as a result of land use change.

Incorporation of various best management practices (non-structural and structural source controls) provides a complete treatment train for stormwater movement through the development for water sensitive urban design. It promotes management of water volumes (by infiltration) and nutrient movement (by treatment) higher in the drainage catchment, rather than downstream end of pipe solutions.

8.1 NON-STRUCTURAL SOURCE CONTROLS

Non-structural source controls to reduce nutrient export from the Study Area will focus on reducing the need for nutrient inputs into the landscape. The following strategies are proposed:

- Native plants are to make up a minimum 50% of the planted areas and streetscape treatments. Any non-local species will be selected for drought tolerance and low fertiliser requirements;
- Community education to inform correct landscaping and fertiliser application rates; and
- Maintenance practices such as street sweeping and pit eductions to remove sediment build-up, particularly during the development and construction phase. Future Subdivision Water Management Report(s) [SWMRs] will outline the schedule and cleaning requirements for street sweeping, which will be co-ordinated with the City of Wanneroo.

8.2 STRUCTURAL SOURCE CONTROLS

The *Stormwater Management Manual for Western Australia* (DWER, 2022) outlines expected pollutant removal efficiencies for detention/retention systems, Table 9.

Table 9: BMP Water Quality Performance

Parameter	Structural Controls Nutrient Output Reduction ¹
	Detention/Retention Measures
Total Suspended Solids	65-99%
Total Phosphorus	40-80%
Total Nitrogen	50-70%
Gross Pollutants	> 90%

Note 1. Typical Performance Efficiencies via DWER (2022)

In areas such as Yanchep with sandy soils and significant depth to groundwater, most rainfall is infiltrated at-source and treated by current best management practices (ie. bio-retention areas) and can achieve pollutant removal efficiencies that exceed DWER (2022). Structural source controls can also complement the non-structural source controls and include the following:

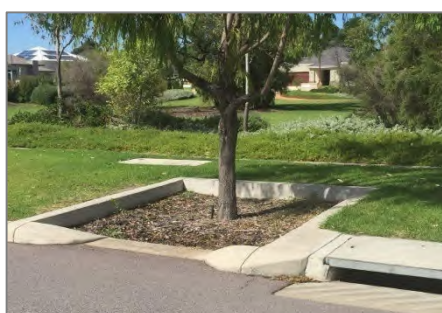
8.2.1 Flush Kerbing

Flush kerbing bordering road and POS areas allows stormwater runoff from the frequently occurring small rainfall events, i.e. first 15 mm, to flow directly into POS across grassed verge/areas, maximising infiltration at-source. It also provides an opportunity to slow water movement through the development and provides a disconnect to the pipe system.



8.2.2 Tree Pits

Tree planting on lot frontages can incorporate porous rebated storage pits at the base to maximise infiltration of stormwater runoff from road areas during the frequently occurring small rainfall events. Runoff enters the tree pit via the road and bypasses to the next pit or pipe when full. Tree pits are typically 2 m wide and contain 0.2 m depth of water.



8.2.3 Bio-Retention Areas

Bio-retention areas [BRA] have dual function of stormwater treatment and provision of public amenity.

BRA's are designed to capture and infiltrate stormwater runoff from roads during the 'small' event rainfall and are underlain with amended soil and planted with water-tolerant vegetation to provide water quality treatment. They are typically 0.3 m deep and are to provide a minimum treatment capacity of approximately 2% of the connected impervious area from road catchments as recommended in FAWB (2009).

The desired saturated hydraulic conductivity is in the range of 200 to 300 mm/hr (~5 to 7.2 m/day), to allow infiltration of stormwater while retaining sufficient moisture to support the vegetation. Clogging may occur in the first few years, however once the vegetation is established, the roots and associated biological activity will maintain the hydraulic conductivity of the soil media over time (FAWB, 2009). Minimum specifications for bio-retention areas are presented in Table 10 and are generally consistent with DWER criteria for biofilters.

Table 10: Minimum Specifications for Bio-Retention Areas

Item	Specification
Amended soil media	• Minimum 300 mm thick. • Hydraulic conductivity between 5 and 7.2 m/day. • PRI >10 • Light compaction only. • Total clay and silt fraction <3% in total (w/w). • Organic matter content <5% (w/w). • Phosphorus content <80 mg/kg.
Plant selection, planting density and distribution.	• Tolerant of periodic inundation and extended dry periods. • Preferential selection of endemic and local native species (Monash, 2014). • As per Vegetation Guidelines for Stormwater Biofilters in the South-west of Western Australia (Monash University, 2014).
Maintenance	• 24 months following initial planting.

Specific locations and types of structural controls to be implemented for the Study Area are to be detailed in any future Subdivision / Development Water Management Plans to support subdivision / development applications.



8.3 LAND USE CHANGE NUTRIENT IMPACTS

The UNDO (Urban Nutrient Decision Outcomes) decision support tool (DoW, 2016) is used to help quantify the nutrient inputs and nutrient exports for the post-development scenario. The UNDO tool analyses inputs for Total Phosphorus and Total Nitrogen only. The UNDO tool was used to model the Study Area with outputs provided in Appendix F.

The pre-development land use of the Study Area generally comprises natural dune systems with degraded native vegetation cover and isolated commercial development in the south-east and the Yanchep Train Station and associated infrastructure in the north-east. The pre-development environment has generally modelled in UNDO (2016) as *Nature* which encompasses areas of remnant native vegetation which are not irrigation or fertilised with the Botanical Gardens modelled as *Native gardens*. These land uses collectively have low nutrient inputs.

The pre-development nutrient inputs of the Study Area are 195.9 kg/ha (0.93 kg/ha/year) Nitrogen and 0.69 kg/ha (0.003 kg/ha/year) Phosphorus. The post-development nutrient inputs, based on the proposed structure plan land use as detailed in Table 2 and shown on Figure 3, are 600.6 kg/ha (2.86 kg/ha/year) Nitrogen and 15.26 kg/ha (0.072 kg/ha/year) Phosphorus.

The rise in nutrient loading post-development is due to the increase in irrigation and fertilisation associated with the proposed urban development compared the pre-development environment where the only nutrient inputs modelled were from plant nitrogen fixation and atmospheric deposition.

The implementation of the proposed structural and non-structural controls results in only a minor reduction in nutrient loading to 584.8 kg/ha (2.78 kg/ha/year) Nitrogen and 13.28 kg/ha (0.063 kg/ha/year) Phosphorus. This represents reductions of 2.7% for Nitrogen and 13% for Phosphorus compared to urban development without water sensitive urban design [WSUD]. These reductions are modest as WSUD structures are only treating stormwater runoff from road reserves which represent less than a quarter of the Study Area. The rest of the Study Area is on highly permeable soils where infiltration is occurring at-source and undergoing no further treatment through WSUD structures.

8.4 DISEASE VECTOR AND NUISANCE INSECT MANAGEMENT

Structural stormwater management systems are designed to minimise the risk of chironomid midge and mosquito breeding. Given the significant depth to groundwater and high permeability of the in-situ soils, water will generally pond only temporarily following rainfall events and then rapidly infiltrate. This will prevent water from ponding for longer than four days (96 hours) in late spring to early autumn and will prevent completion of the larval stages of the mosquito life cycle (DWER, 2022), as per requirement of the Department of Health.

9. IMPLEMENTATION

9.1 ROLES AND RESPONSIBILITIES

Table 11 details the roles and responsibilities to undertake the implementation plan.

The operation and maintenance of the stormwater management system will initially be the responsibility of the developer but will ultimately be accepted by the Local Authority. Preparation of any Subdivision / Development Water Management Plans will be the responsibility of the developer.

Table 11: Implementation Responsibilities

IMPLEMENTATION		RESPONSIBILITY	
LWMS Section	Action	Developer	City of Wanneroo
6.2	Preparation of Subdivision / Development Water Management Plan(s) to support subdivision/development	✓	
6.4	Construction of stormwater system	✓	
6.4	Stormwater system operation and maintenance Initially Following handover	✓	✓

9.2 DEVELOPMENT PROCESS

A Subdivision / Development Water Management Report [SDWMR] forms part of the planning process outlined in *State Planning Policy 2.9 – Water* (WAPC, 2025a&b). Any future SDWMR(s) will need to address:

- Local geotechnical investigations including infiltration testing;
- Design of treatment structures and flood management areas as outlined in the *Stormwater Management Manual for Western Australia* (DWER, 2022a);
- Integration of flood management areas with retained vegetation and designs for the Botanical Gardens;
- Refinement of catchment areas and the final configuration (storage side slopes, etc) and exact location of the flood management areas, dependent on final earthworks, drainage and road design levels; and
- Confirmation of irrigation areas and associated establishment / ongoing irrigation volumes for the Public Open Space and Botanical Gardens within the Study Area.

9.3 CONSTRUCTION MANAGEMENT

9.3.1 Dewatering

There is significant depth to groundwater and dewatering will not be required during development of the Study Area.

9.3.2 Acid Sulphate Soils

Figure 4 shows no known risk of A.S.S. in the Study Area.

Development of the Study Area will not incorporate subsoil drainage nor involve dewatering during construction and therefore soils beneath the groundwater table will not be disturbed.

9.3.3 Dust Suppression & Sediment Control

Best management practices (BMPs) to control dust and sediment should be incorporated by the civil contractor during construction. BMPs include minimising the area to be disturbed where possible, application of hydromulch or similar on finished lots, installation of barriers to trap wind-blown sediment, stabilised entry and exit points, etc.

Water will be required for use in construction and for dust suppression. This can either be supplied from the scheme system, water carting or groundwater abstraction. A licence to take water will be required should water be obtained from groundwater. The water required for dust suppression and/or construction purposes was not in the remit of the NWCWSS (DoW, 2014) but may be issued following DWER's standard assessment and approval processes as short-term, non-transferrable licences (DoW, 2014).

9.4 STORMWATER SYSTEM OPERATION AND MAINTENANCE

The stormwater drainage system within the proposed development will require maintenance to ensure correct operation and minimise risk to the general public and infrastructure. It is considered the following operating and maintenance practices will be required periodically:

- Inspection and removal of debris, litter and sediments surrounding pipe inlets/outlets.
- Inspection of system for erosion.
- Street sweeping to reduce particular build-up on road surface and gutters.
- Maintenance of planted areas (flood storages and POS) including plant condition and weeds as outlined in any future SDWMR(s).
- Arrange education campaigns regarding source control practise to minimise pollution runoff into the stormwater drainage system.

The operating and maintenance schedule required is presented in Table 12.

Table 12: Maintenance Schedule for Drainage Infrastructure

Item	Maintenance Interval		
	Quarterly	Bi-annually	As required
Street Drainage			
Street sweeping to reduce particulate build-up	✓		
Removal of debris to prevent blockages	✓		
Eduction of sediment and rubbish in manholes/GPTs	✓		
Planted Small Event Structures			
Inspect for erosion + sediment accumulation		✓	
Assess health of vegetation. Remove dead plants and replace where necessary.		✓	
Inspect for standing water 1 day after rainfall events			✓
Removal of sediment and leaf litter layer build up.			✓
Flood Management Areas			
Removal of debris from pipe inlets to prevent blockages	✓		
Use of slow release/low Phosphorus fertilisers in turfed areas.		✓	

9.5 MONITORING PROGRAM

Monitoring programs are developed to allow a quantitative assessment of hydrological impacts of the proposed development, in particular changes to groundwater quality.

In the Study Area, regional winter groundwater level ranges between 2 to 4 mAHD, with surface elevations ranging between 30 and 40 mAHD. This indicates a minimum separation to groundwater of 26 m.

Due to this significant depth to groundwater, groundwater levels do not impact on engineering design, and do not provide a limitation on infiltration rates beyond the native hydraulic conductivity of the soils.

Currently the existing land-use and soils will infiltrate all rainfall onsite. Urbanisation of the site will also infiltrate most rainfall at source (lots) or in swales / basins (road runoff, excess from lots), and therefore there will be little change in groundwater levels.

In terms of water quality, due to the significant depth to groundwater, groundwater quality will not be representative of the management practices of the Study Area, but provide an indication of quality and management practices across the wider regional area. Best management practices are also being implemented for treatment of the first 15 mm runoff.

Therefore, a groundwater level and quality monitoring program is not proposed for the Study Area.

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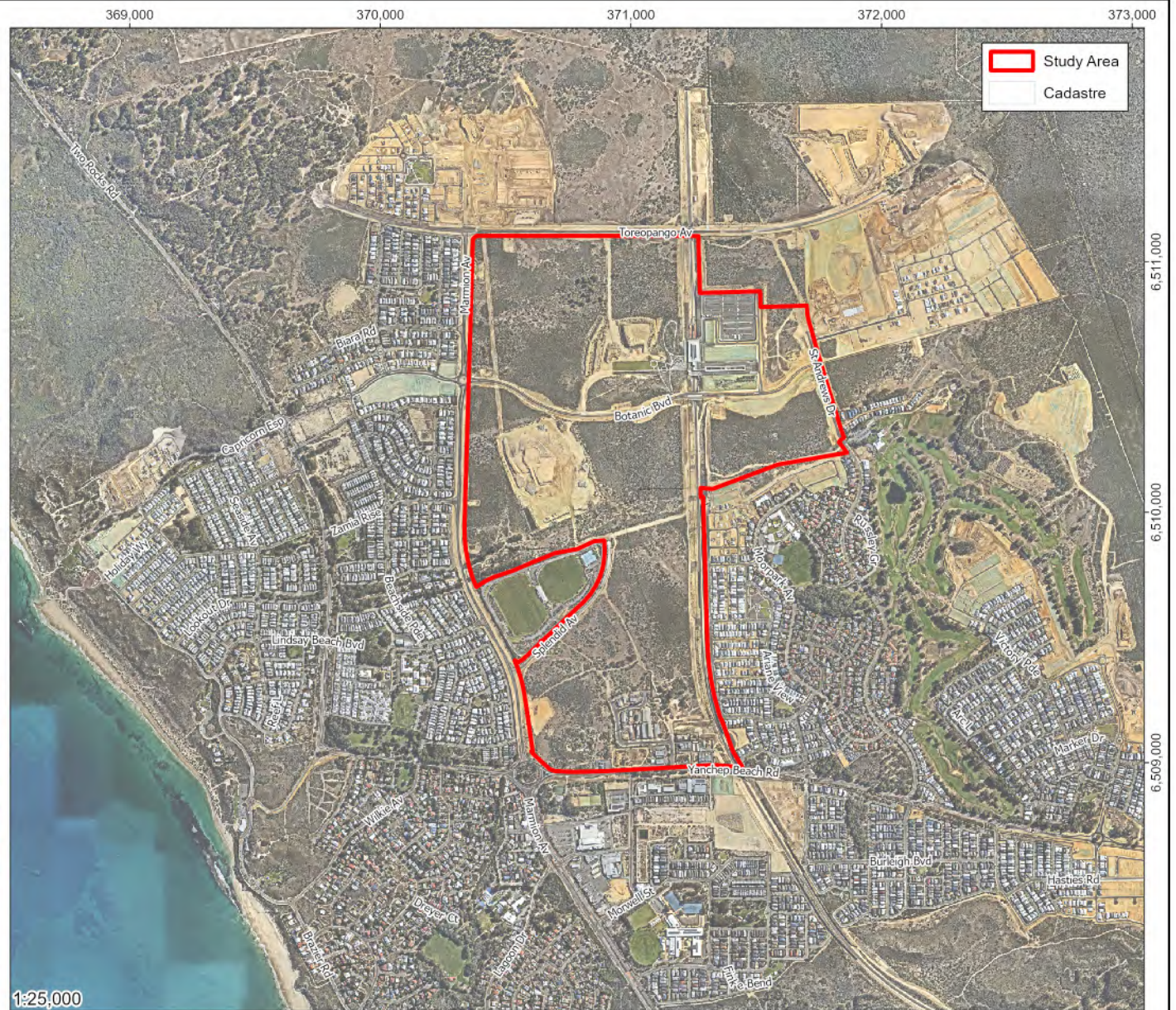
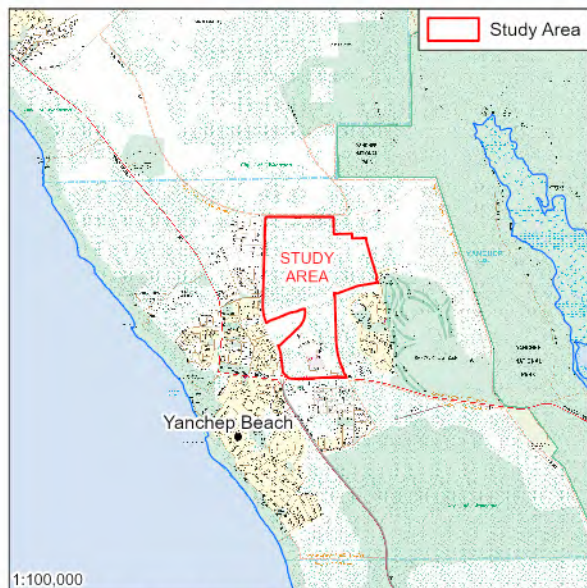
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FIGURES





Data Source: Street Express (2012); NearMaps (2026) 03 April 2026.

GDA2020 MGA Zone 50

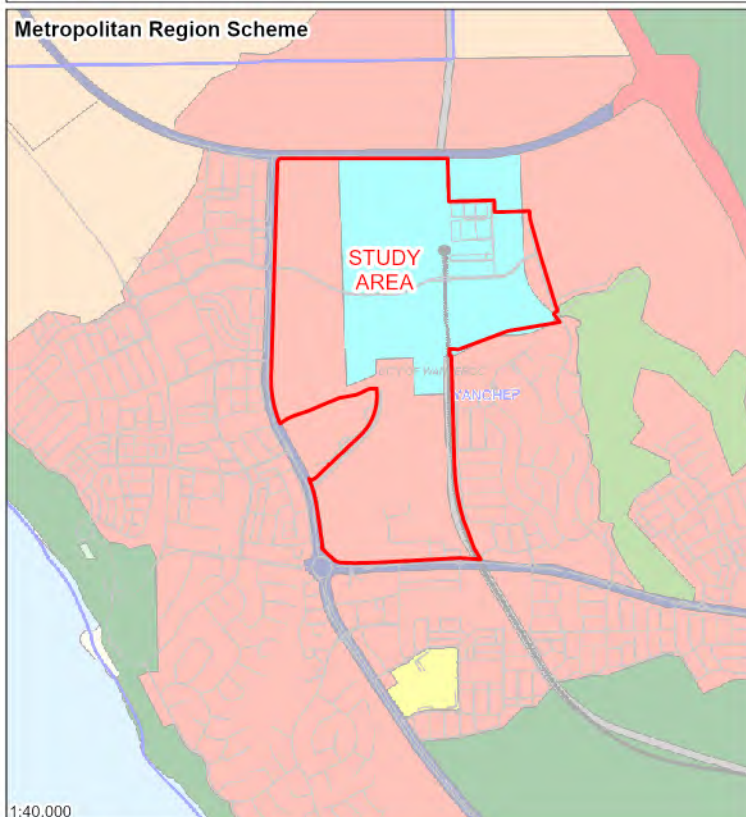


Metropolitan Region Scheme

- Urban
- Public purposes
- Central city area
- Parks and recreation
- Restricted public access
- Rural
- Rural - water protection
- Private recreation

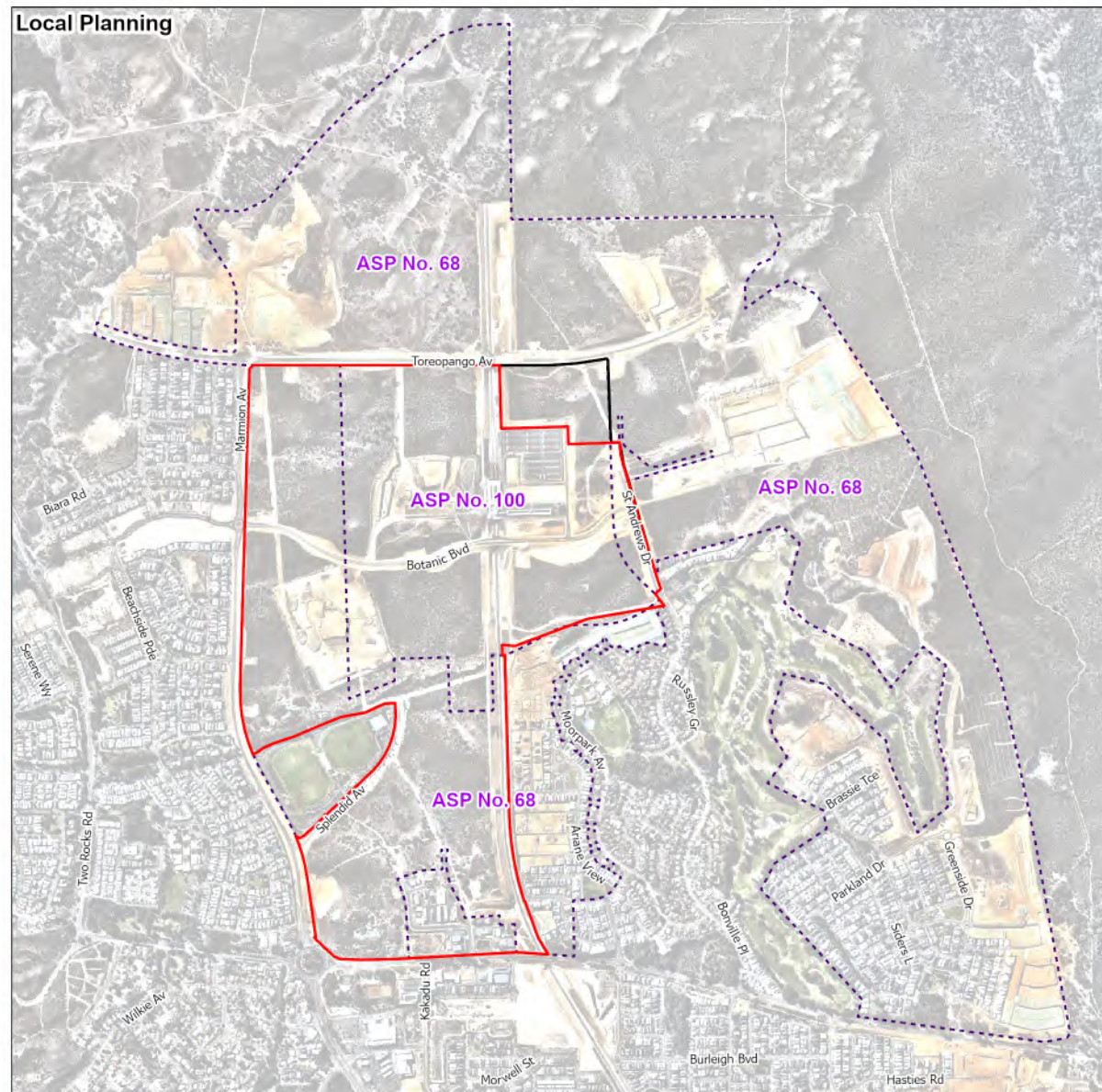
- Study Area
- Improvement Plan No. 60
- Local Structure Plans

Metropolitan Region Scheme



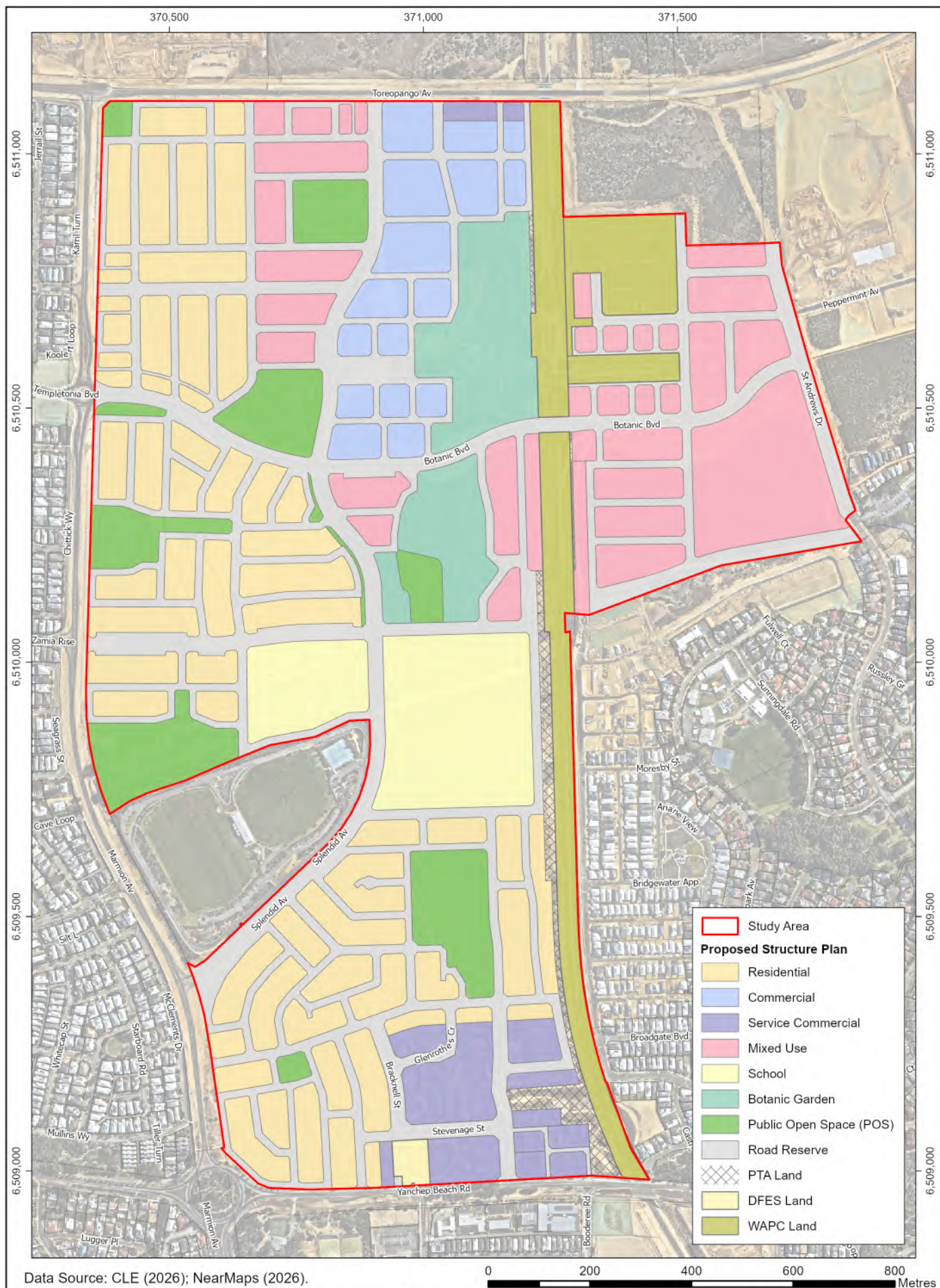
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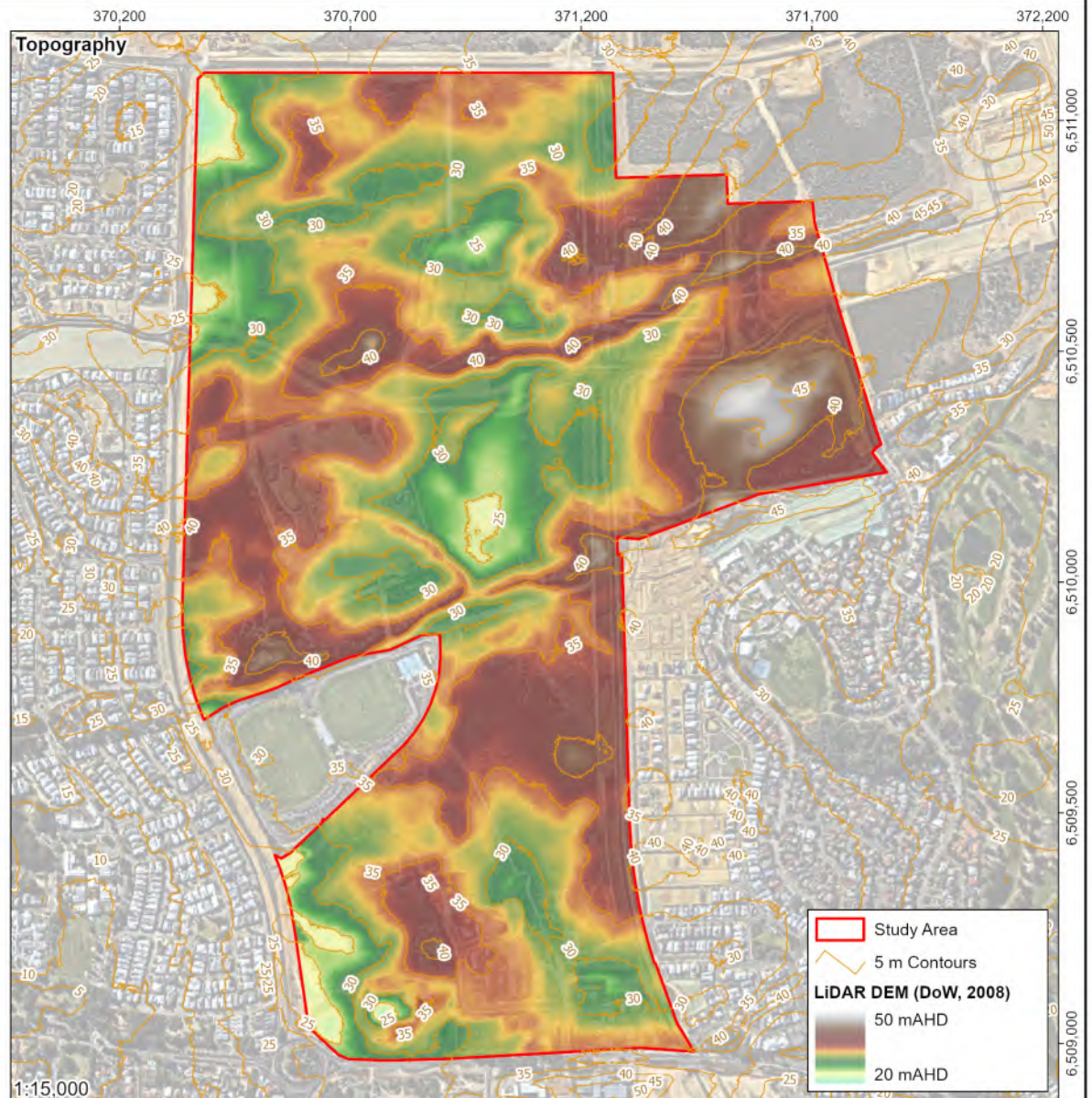
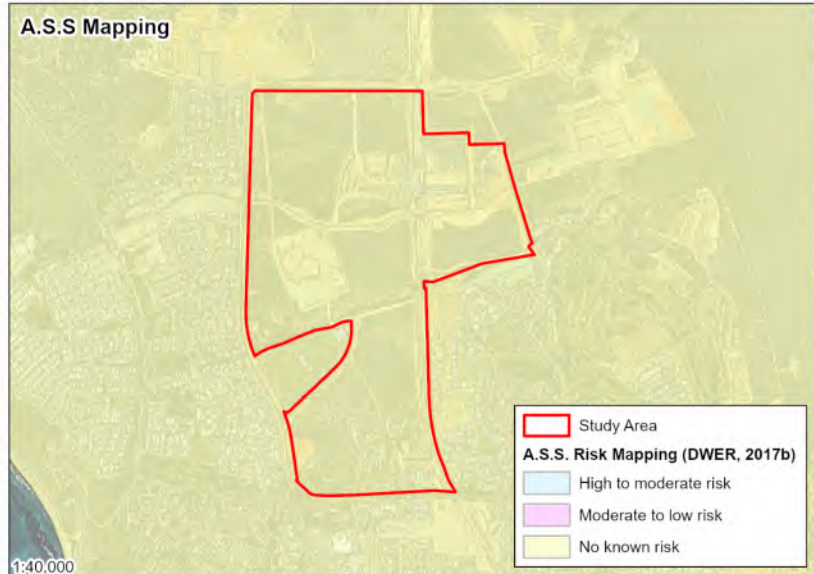
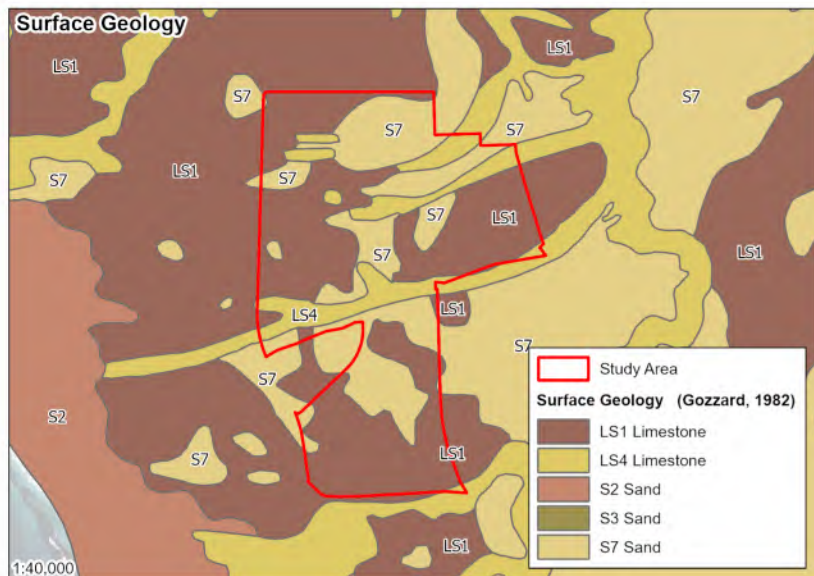
Local Planning



GDA2020 MGA Zone 50



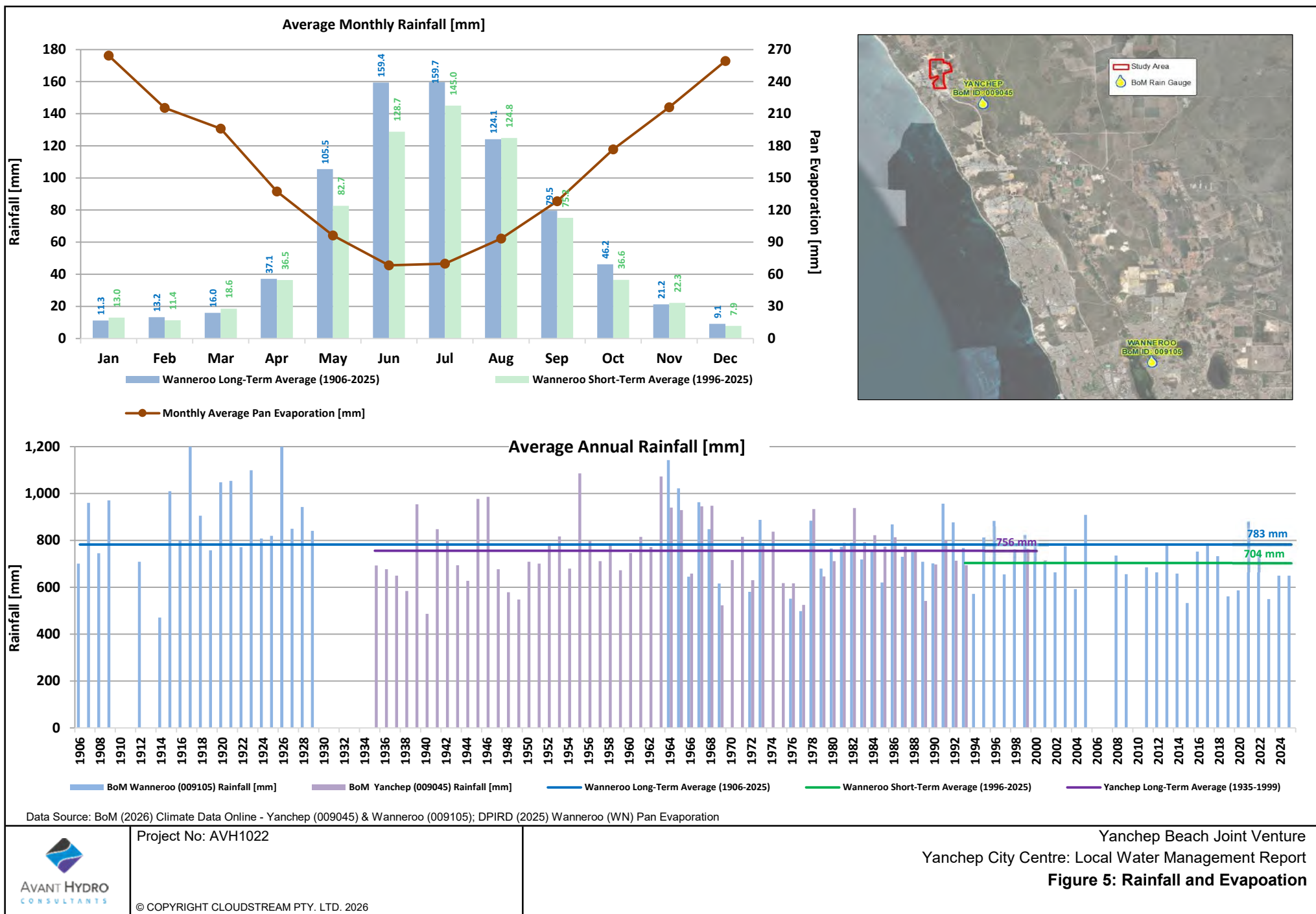


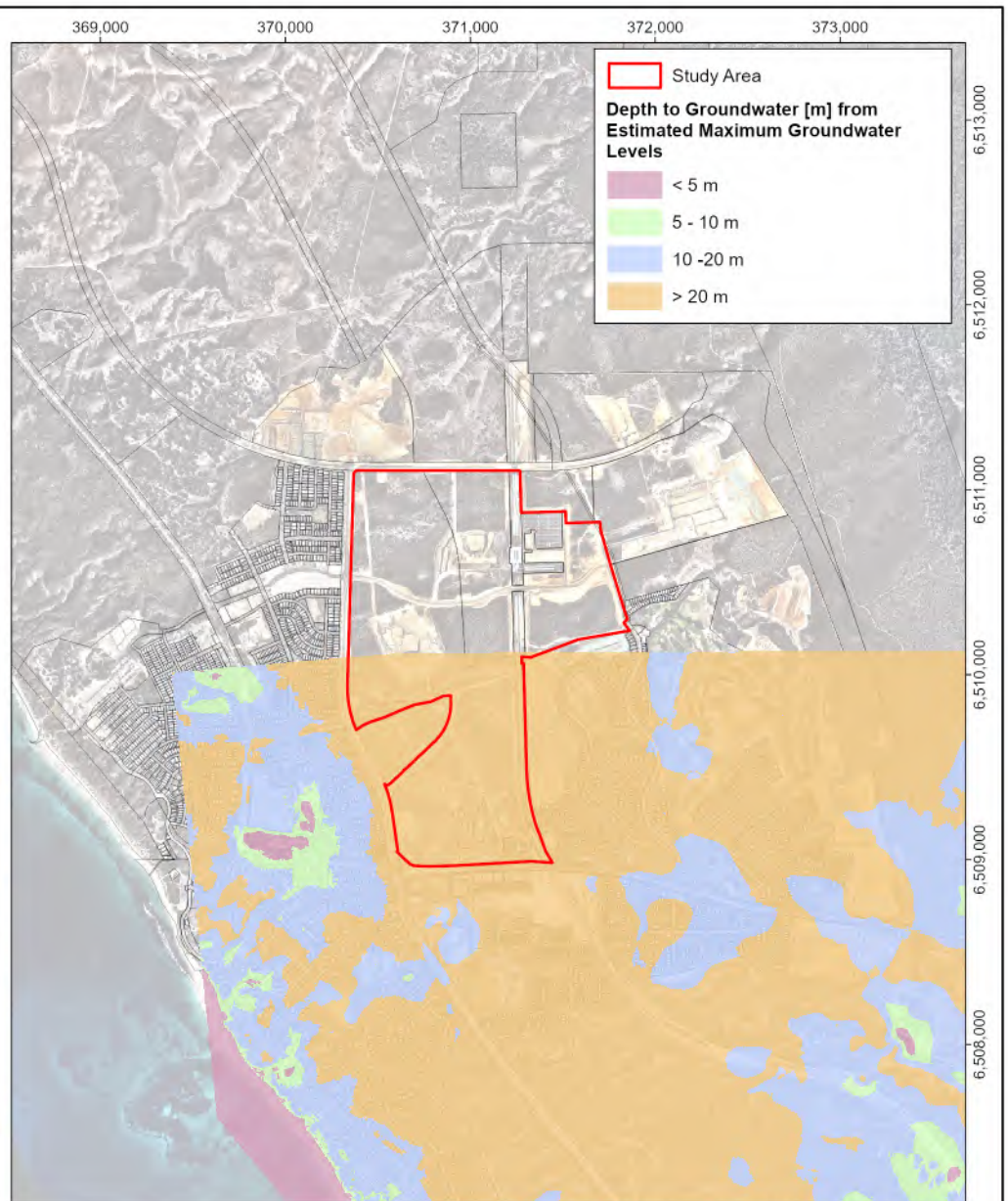
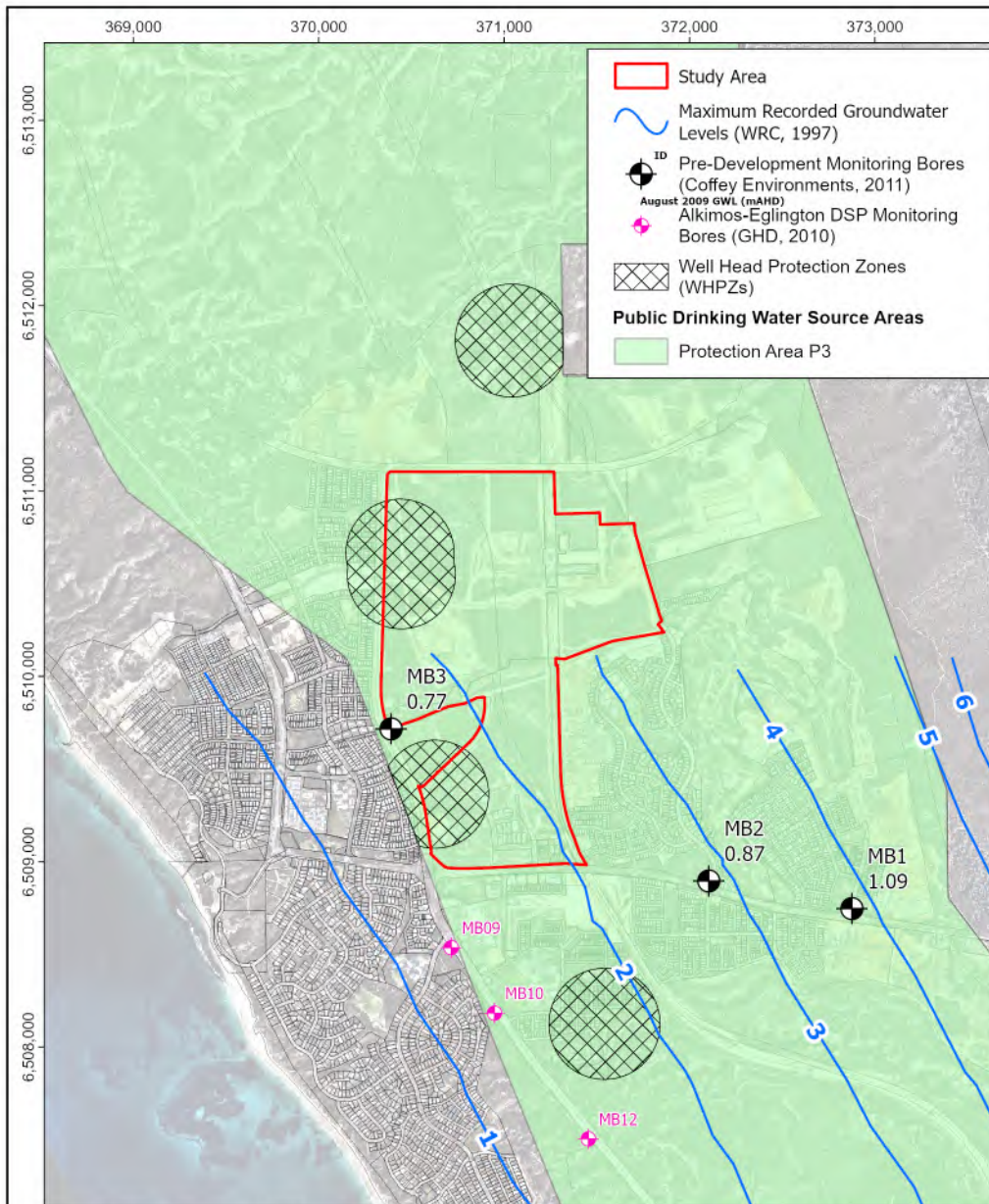


Data Source: Gozzard (1982); DoW (2008a); DWER (2017b).

GDA2020 MGA Zone 50



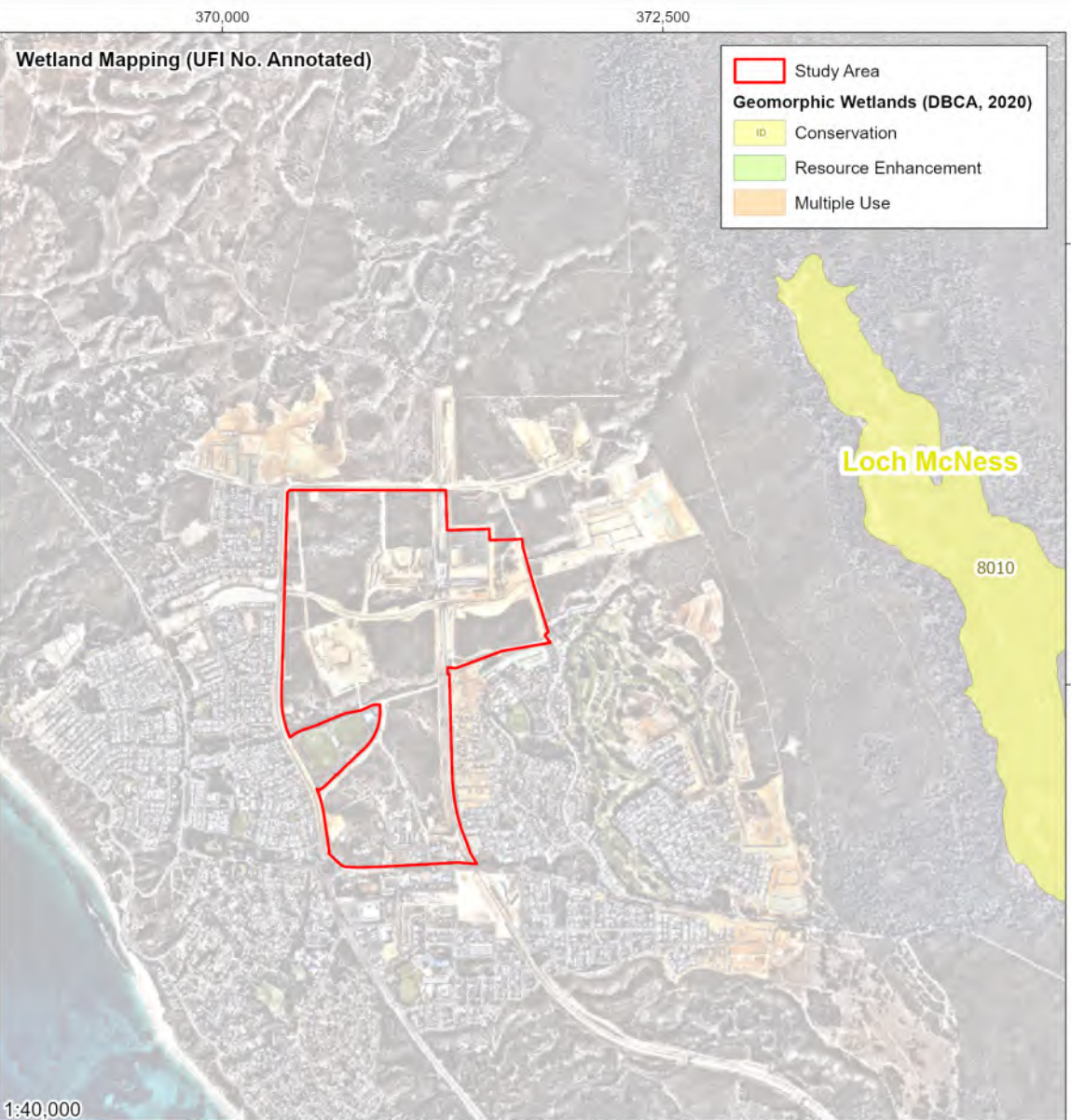
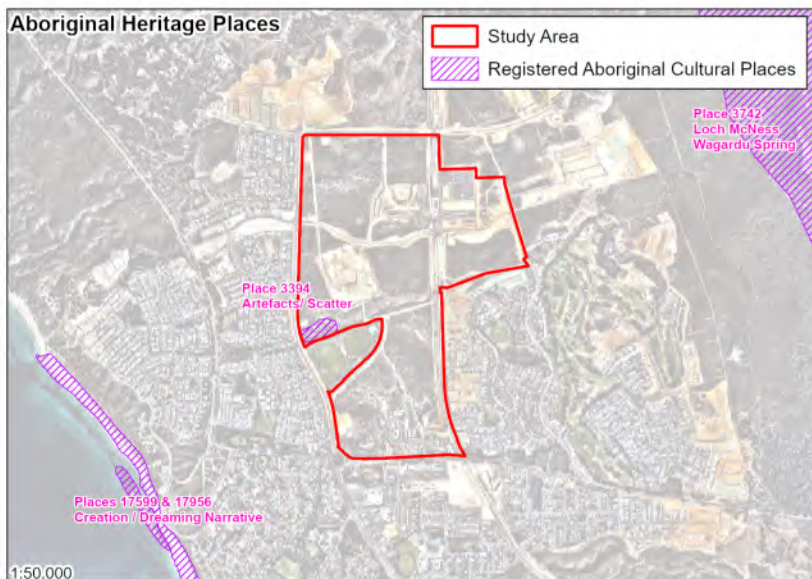




Data Source: WRC (1997); DoW (2008); Coffey Environments (2011); NearMaps (2025).

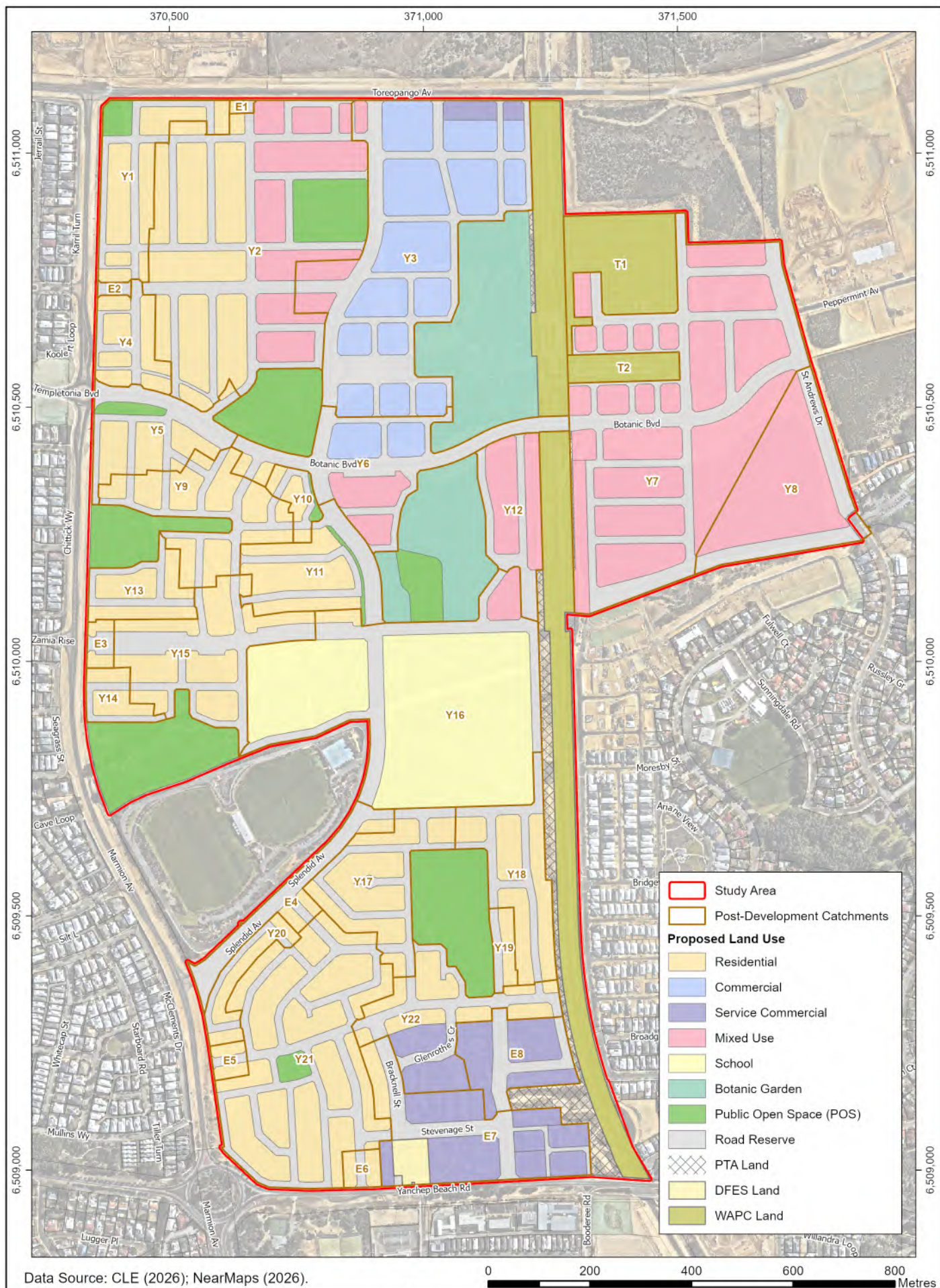
GDA2020 MGA Zone 50





Data Source: DoP (2000); DBCA (2020); DPLH (2025); NearMaps (2025).

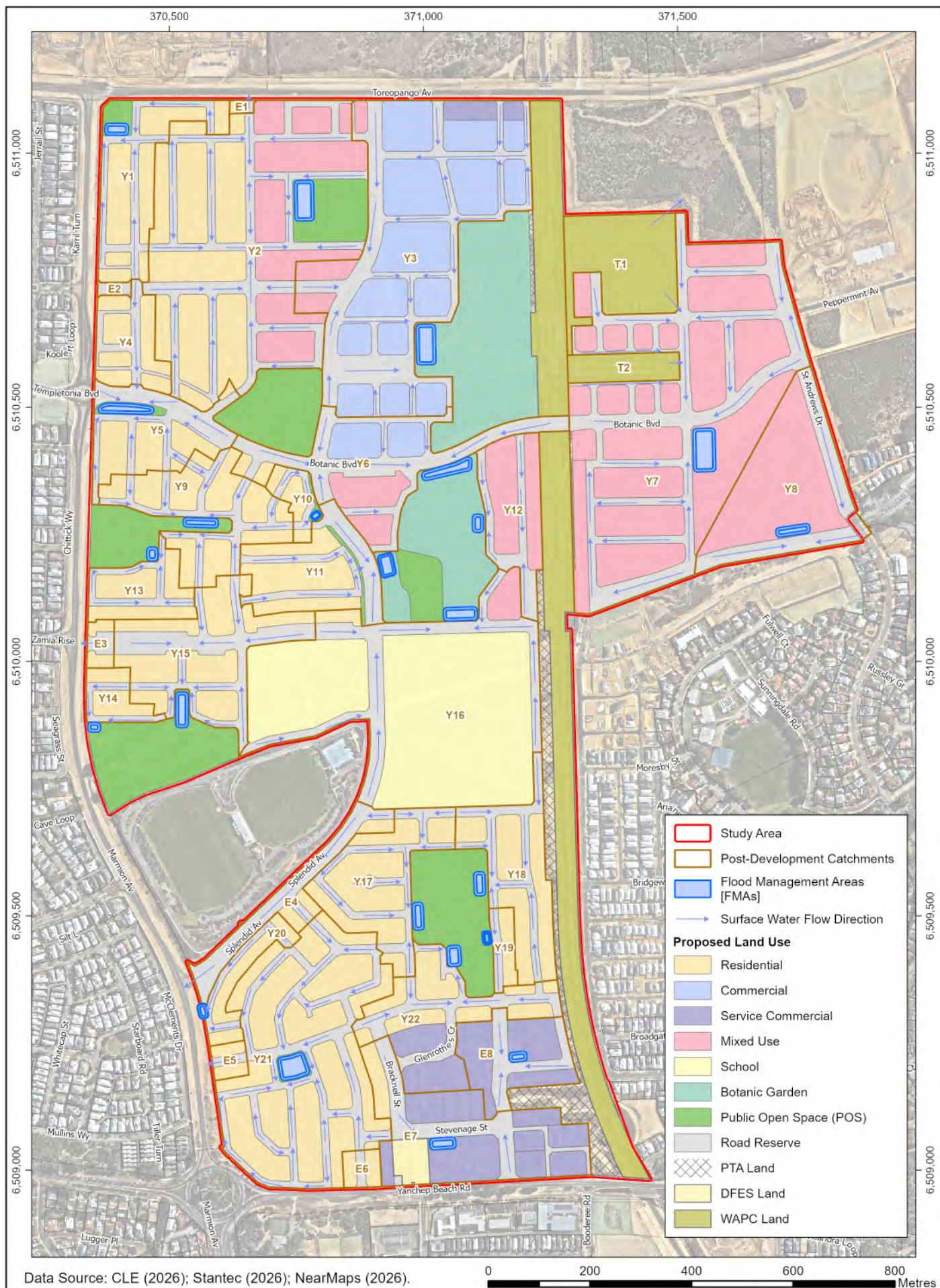
GDA2020 MGA Zone 50



Data Source: CLE (2026); NearMaps (2026).

0 200 400 600 800 Metres





Data Source: CLE (2026); Stantec (2026); NearMaps (2026).

0 200 400 600 800 Metres



APPENDICES



APPENDIX A

Pre-Development Monitoring (GHD, 2011)





LEGEND

 Bore Locations

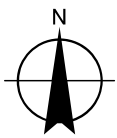
 LandCorp Land Holdings

1:40,000 (at A3)

0 200 400 800 1,200 1,600 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50



LandCorp
Alkimos WQ Monitoring

Job Number	61-25316
Revision	0
Date	14 Jan 2011

Water Quality Monitoring Sites

Figure 1

9. Area 6 – South Yanchep

9.1 Overview

The South Yanchep LSP area is located within the Yanchep Two Rocks DSP area and covers some 130 ha. This coastal project site is bounded by the Ocean Lagoon development to the North, the Indian Ocean to the West, Regional Open Space to the South and Marmion Avenue to the East (see the locality plan in **Appendix A**). The monitoring bores deemed to be representative of groundwater conditions across this LSP area are:

- ▶ PB-MB01;
- ▶ PB-MB07;
- ▶ PB-MB10;
- ▶ PB-MB12;
- ▶ PB-MB13; and
- ▶ PB-MB15.

Monitoring results for these bores are provided in the following sections which are classified as follows:

- ▶ Field measurements; and
- ▶ Laboratory analyses.

9.2 Field Measurements

Water levels were determined using an electronic dipping probe. The resultant depths measured from the top of the bore casing are summarised in **Table 30**. Summaries of the stabilised field measurements observed at the representative LSP bores are also provided in **Table 30**.

Table 30 Area 6 Field Measurements.

PB-MB01	Unit	22/7/10	12/11/10 ⁽²⁾	22/02/11	4/5/11 ⁽⁴⁾	25/7/11	4/11/11
Water Level ⁽¹⁾	mBTC	16.531	16.566	16.157	16.299	16.447	16.4
Temperature	°C	20.39	-	22.32	21.6	19.95	20.55
pH	pH	7.37	-	7.67	-	7.16	7.21
EC	mS/cm	1.04	1.00	1.208	0.992	1.05	1.009
DO	mg/L	4.9	-	3.48	-	4.88	5.10
EH	mV	98	-	-181	-	-109.000	-142.67
Turbidity	NTU	11.4	-	-	-	-	-
PB-MB07	Unit	23/7/10	12/11/10 ⁽²⁾	21/02/11	4/5/11 ⁽⁴⁾	22/7/11	2/11/11
Water Level ⁽¹⁾	mBTC	20.424	20.459	20.408	20.373	20.382	20.42
Temperature	°C	20.04	-	22.35	20.7	19.86	21.14
pH	pH	7.48	-	7.85	-	7.32	7.25
EC	mS/cm	0.665	- ⁽³⁾	0.694	0.685	0.69	0.692
DO	mg/L	5.84	-	6.95	-	6.40	6.89

EH	mV	-44	-	-8	-	105.333	46.50
Turbidity	NTU	13.3	-	-	-	-	-
PB-MB10	Unit	22/7/10	12/11/10⁽²⁾	18/02/11	4/5/11⁽⁴⁾	21/7/11	4/11/11
Water Level ⁽¹⁾	mBTOC	26.542	26.58	26.527	26.482	26.474	26.52
Temperature	°C	20.8	-	22.59	20.6	20.45	21.3
pH	pH	7.25	-	7.46	-	7.14	7.16
EC	mS/cm	0.821	- ⁽³⁾	0.893	0.827	0.86	0.863
DO	mg/L	4.78	-	5.3	-	5.32	5.47
EH	mV	110	-	38	-	135.333	73
Turbidity	NTU	7.5	-	-	-	-	-
PB-MB12	Unit	22/7/10	15/11/10	18/02/11	4/5/11⁽⁴⁾	21/7/11	4/11/11
Water Level ⁽¹⁾	mBTOC	33.707	33.74	33.687	33.641	33.642	33.68
Temperature	°C	20.58	21.25	22.46	20.6	21.09	21.44
pH	pH	7.14	6.98	7.32	-	6.97	7.08
EC	mS/cm	0.881	0.861	1.033	1.059	1.04	0.926
DO	mg/L	6.77	7.15	8.1	-	6.55	7.10
EH	mV	119	80.9	33	-	129.000	75.67
Turbidity	NTU	110	166	-	-	-	-
PB-MB13	Unit	22/7/10	11/11/10⁽²⁾	18/02/11	4/5/11⁽⁴⁾	22/7/11	1/11/11
Water Level ⁽¹⁾	mBTOC	16.567	16.603	16.564	16.522	16.525	16.53
Temperature	°C	19.99	-	21.33	20.6	19.83	28.37
pH	pH	7.52	-	7.56	-	7.20	7.06
EC	mS/cm	0.584	- ⁽³⁾	0.672	0.608	0.65	0.639
DO	mg/L	7.64	-	3.42	-	2.67	2.52
EH	mV	100	-	46	-	116.000	78.75
Turbidity	NTU	9.1	-	-	-	-	-
PB-MB15	Unit	22/7/10	12/11/10⁽²⁾	18/02/11	4/5/11⁽⁴⁾	22/7/11	2/11/11
Water Level ⁽¹⁾	mBTOC	24.989	25.091	24.814	24.866	24.892	25.07
Temperature	°C	20.22	-	21.66	20.1	20.35	20.70
pH	pH	7.49	-	7.73	-	7.36	7.34
EC	mS/cm	0.717	- ⁽³⁾	0.77	0.701	0.75	0.753
DO	mg/L	6.8	-	7.61	-	7.24	7.97
EH	mV	99	-	18	-	107.333	66
Turbidity	NTU	11.4	-	-	-	-	-

Note 1: mBTOC - Metres below top of casing.

Note 2: Field measurements were limited to water level and salinity only (see **Section 3.2**).

Note 3: Salinity not measured at this site.

Note 4: Field measurements were limited to water level; temperature and salinity (see **Section 3.2**).

Note 5: Field measurements were not obtained due to pump problems (see **Section 3.2**)

9.3 Laboratory Analyses

The details of the various laboratory analyses of samples taken from the observation bores during the monitoring rounds are provided in **Appendix E - Appendix I**. Summaries of the laboratory analyses of metals in samples taken from the representative LSP bores are provided in **Table 31**.

Table 31 Area 6 Laboratory Analyses - Metals.

PB-MB01	Unit	22/7/10	22/02/11	25/7/11	4/11/11
Aluminium	mg/L	0.007	<0.001	0.001	0.001
Arsenic	mg/L	0.002	0.007	0.002	0.002
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	85	73.0	89	81
Copper	mg/L	0.002	<0.001	<0.001	<0.001
Iron	mg/L	0.03	<0.02	<0.02	<0.02
Lead	mg/L	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	19	19.0	21	19
Manganese	mg/L	0.001	0.04	0.004	0.002
Potassium	mg/L	2.8	2.7	3	2.6
Sodium	mg/L	100	110.0	100	86
Zinc	mg/L	0.017	0.019	0.006	0.008
PB-MB07	Unit	23/7/10	21/02/11	22/7/11	2/11/11
Aluminium	mg/L	0.014	0.001	0.002	0.003
Arsenic	mg/L	0.001	<0.001	0.001	0.001
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	67	57	67	74
Copper	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.03	0.02	<0.02	<0.02
Lead	mg/L	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	10	8	10	11
Manganese	mg/L	0.009	0.004	<0.001	0.001
Potassium	mg/L	2.8	2.7	2.9	3.0
Sodium	mg/L	51	45	48	56
Zinc	mg/L	0.041	0.019	0.006	0.003
PB-MB10	Unit	22/7/10	18/02/11	21/7/11	4/11/11
Aluminium	mg/L	0.007	<0.001	<0.001	0.001
Arsenic	mg/L	0.001	<0.001	<0.001	0.001
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	91	85	92	87
Copper	mg/L	<0.001	<0.001	0.002	<0.001
Iron	mg/L	<0.02	<0.02	<0.02	<0.02
Lead	mg/L	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	11	10	11	10

Manganese	mg/L	<0.001	<0.001	<0.001	<0.001
Potassium	mg/L	3.7	3.9	4	3.6
Sodium	mg/L	64	60	64	59
Zinc	mg/L	0.016	0.015	<0.001	0.015
PB-MB12	Unit	22/7/10	18/02/11	21/7/11	4/11/11
Aluminium	mg/L	0.31	<0.001	<0.001	0.001
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	mg/L	95	99	120	110
Copper	mg/L	0.002	<0.001	0.002	<0.001
Iron	mg/L	0.32	<0.02	<0.02	<0.02
Lead	mg/L	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	15	16	21	16
Manganese	mg/L	0.005	0.002	<0.001	<0.001
Potassium	mg/L	3.1	3.6	3.7	3.2
Sodium	mg/L	60	59	61	60
Zinc	mg/L	0.019	0.01	<0.001	0.007
PB-MB13	Unit	22/7/10	18/02/11	22/7/11	1/11/11
Aluminium	mg/L	0.005	<0.001	0.001	0.006
Arsenic	mg/L	0.001	<0.001	0.001	0.001
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0003
Calcium	mg/L	63	68	71	78
Copper	mg/L	<0.001	<0.001	<0.001	0.002
Iron	mg/L	0.02	<0.02	<0.02	0.02
Lead	mg/L	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	14	16	17	19
Manganese	mg/L	<0.001	<0.001	<0.001	<0.001
Potassium	mg/L	1.5	1.2	1.6	1.8
Sodium	mg/L	34	29	28	33
Zinc	mg/L	0.008	0.01	<0.001	0.014
PB-MB15	Unit	22/7/10	18/02/11	22/7/11	2/11/11
Aluminium	mg/L	0.006	<0.001	<0.001	0.002
Arsenic	mg/L	<0.001	<0.001	0.001	<0.001
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0002
Calcium	mg/L	64	58.0	65	75
Copper	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.02	<0.02	<0.02	<0.02
Lead	mg/L	<0.001	<0.001	<0.001	<0.001
Magnesium	mg/L	14	13.0	15	17
Manganese	mg/L	<0.001	<0.001	<0.001	<0.001
Potassium	mg/L	2.6	2.6	2.7	2.8

Sodium	mg/L	57	52.0	56	67
Zinc	mg/L	0.019	0.015	0.002	0.008

Summaries of the laboratory analyses of the physical properties of the groundwater samples taken from the representative LSP bores are provided in **Table 32**.

Table 32 Area 6 Laboratory Analyses – Physical Properties.

PB-MB01	Units	22/7/10	22/02/11	25/7/11	4/11/11
pH (Lab)	pH_Units	7.4	7.4	7.4	7.3
Hardness as CaCO ₃	mg/L	290	260.0	310	280
Bicarbonate (HCO ₃)	mg/L	300	310.0	320	280
Carbonate (CO ₃)	mg/L	<1.0	<1.0	<1.0	<1
Sulphate (SO ₄)	mg/L	25	32.0	27	21
Turbidity	NTU	2	4.5	<0.1	0.2
PB-MB07	Units	23/7/10	21/02/11	22/7/11	2/11/11
pH (Lab)	pH_Units	7.4	7.6	7.5	7.6
Hardness as CaCO ₃	mg/L	210	180	210	230
Bicarbonate (HCO ₃)	mg/L	230	240	220	230
Carbonate (CO ₃)	mg/L	<1	<1.0	<1.0	<1
Sulphate (SO ₄)	mg/L	11	10	10	9
Turbidity	NTU	2.5	<0.1	<0.1	47
PB-MB10	Units	22/7/10	18/02/11	21/7/11	4/11/11
pH (Lab)	pH_Units	7.3	7.4	7.4	7.2
Hardness as CaCO ₃	mg/L	270	250	280	260
Bicarbonate (HCO ₃)	mg/L	280	250	290	260
Carbonate (CO ₃)	mg/L	<1	<1	<1.0	<1
Sulphate (SO ₄)	mg/L	11	10	11	9
Turbidity	NTU	1.2	<0.1	<0.1	<0.1
PB-MB12	Units	22/7/10	18/02/11	21/7/11	4/11/11
pH (Lab)	pH_Units	7.2	7.3	7.2	7.1
Hardness as CaCO ₃	mg/L	300	310	390	330
Bicarbonate (HCO ₃)	mg/L	320	320	360	280
Carbonate (CO ₃)	mg/L	<1.0	<1.0	<1.0	<1
Sulphate (SO ₄)	mg/L	13	12	8	7
Turbidity	NTU	52	0.3	<0.1	7.4
PB-MB13	Units	22/7/10	18/02/11	22/7/11	1/11/11
pH (Lab)	pH_Units	7.6	7.3	7.4	7.3
Hardness as CaCO ₃	mg/L	210	230	250	270
Bicarbonate (HCO ₃)	mg/L	230	180	250	240
Carbonate (CO ₃)	mg/L	<1	<1.0	<1.0	<1
Sulphate (SO ₄)	mg/L	17	15	17	15

Turbidity	NTU	1.3	<0.1	<0.1	0.9
PB-MB15	Units	22/7/10	18/02/11	22/7/11	2/11/11
pH (Lab)	pH_Units	7.5	7.6	7.5	7.6
Hardness as CaCO ₃	mg/L	220	200	220	260
Bicarbonate (HCO ₃)	mg/L	250	210	220	220
Carbonate (CO ₃)	mg/L	<1.0	<1.0	<1.0	<1
Sulphate (SO ₄)	mg/L	16	15	10	13
Turbidity	NTU	21	<0.1	<0.1	1.4

Summaries of the laboratory analyses of the salts and ions in the groundwater samples taken from the representative LSP bores are provided in **Table 33**.

Table 33 Area 6 Laboratory Analyses – Salts & ions.

PB-MB01	Units	22/7/10	22/02/11	25/7/11	4/11/11
Electrical conductivity	uS/cm	1100	1100	940	990
TDS	mg/L	588	680	552	550
Chloride	mg/L	190	210	170	160
Fluoride	mg/L	0.2	0.2	0.2	0.3
PB-MB07	Units	23/7/10	21/02/11	22/7/11	2/11/11
Electrical conductivity	uS/cm	680	660	640	610
TDS	mg/L	378	400	374	362
Chloride	mg/L	100	100	100	100
Fluoride	mg/L	0.2	0.2	0.3	0.2
PB-MB10	Units	22/7/10	18/02/11	21/7/11	4/11/11
Electrical conductivity	uS/cm	840	840	800	840
TDS	mg/L	474	500	472	478
Chloride	mg/L	130	130	120	130
Fluoride	mg/L	<0.1	<0.1	0.1	0.1
PB-MB12	Units	22/7/10	18/02/11	21/7/11	4/11/11
Electrical conductivity	uS/cm	900	860	980	900
TDS	mg/L	554	520	628	564
Chloride	mg/L	100	94	77	93
Fluoride	mg/L	<0.1	<0.1	<0.1	0.1
PB-MB13	Units	22/7/10	18/02/11	22/7/11	1/11/11
Electrical conductivity	uS/cm	600	630	600	610
TDS	mg/L	352	380	336	336
Chloride	mg/L	68	61	59	61
Fluoride	mg/L	0.3	0.3	0.4	0.3

PB-MB15	Units	22/7/10	18/02/11	22/7/11	2/11/11
Electrical conductivity	uS/cm	730	730	710	690
TDS	mg/L	412	440	396	386
Chloride	mg/L	110	110	110	120
Fluoride	mg/L	0.3	0.3	0.4	0.4

Summaries of the laboratory analyses of the nutrients and microbes in the groundwater samples taken from the representative LSP bores are provided in **Table 34**.

Table 34 Area 6 Laboratory Analyses – Nutrients & microbes.

PB-MB01	Units	22/7/10	22/02/11	25/7/11	4/11/11
Nitrate (as NO3)	mg/L	2.7	1.9	2.7	2.7
Nitrogen (Total)	µg/L	640	620	730	750
Phosphorus (Total)	mg/L	<0.01	0.02	0.02	<0.01
Total Coliforms	cfu/100 ml	-	-	<1	
E. Coli	cfu/100 ml	0	-	<1	<1
PB-MB07	Units	23/7/10	21/02/11	22/7/11	2/11/11
Nitrate (as NO3)	mg/L	1.4	1.4	1.5	1.6
Nitrogen (Total)	µg/L	530	430	400	410
Phosphorus (Total)	mg/L	0.01	0.02	0.01	0.05
Total Coliforms	cfu/100 ml	0	-	<1	
E. Coli	cfu/100 ml	0	-	<1	<1
PB-MB10	Units	22/7/10	18/02/11	21/7/11	4/11/11
Nitrate (as NO3)	mg/L	12	11	10	12
Nitrogen (Total)	µg/L	2600	2500	2400	2700
Phosphorus (Total)	mg/L	<0.01	0.02	0.03	0.04
Total Coliforms	cfu/100 ml	0	-	<1	
E. Coli	cfu/100 ml	0	-	<1	<1
PB-MB12	Units	22/7/10	18/02/11	21/7/11	4/11/11
Nitrate (as NO3)	mg/L	77	85	110	83
Nitrogen (Total)	µg/L	19,000	19,000	25,000	19,000
Phosphorus (Total)	mg/L	0.03	0.01	0.02	0.04
Total Coliforms	cfu/100 ml	-	-	<1	
E. Coli	cfu/100 ml	0	-	<1	<1
PB-MB13	Units	22/7/10	18/02/11	22/7/11	1/11/11
Nitrate (as NO3)	mg/L	20	9.2	9.4	14
Nitrogen (Total)	µg/L	4100	2200	2300	3400
Phosphorus (Total)	mg/L	<0.01	<0.01	<0.01	0.02
Total Coliforms	cfu/100 ml	-	-	<1	
E. Coli	cfu/100 ml	0	-	<1	<1

PB-MB15	Units	22/7/10	18/02/11	22/7/11	2/11/11
Nitrate (as NO ₃)	mg/L	6.1	5.2	5.6	6.2
Nitrogen (Total)	µg/L	1400	1300	1400	1400
Phosphorus (Total)	mg/L	<0.01	0.01	<0.01	0.02
Total Coliforms	cfu/100 ml	0	-	<1	
E. Coli	cfu/100 ml	0	-	<1	<1

9.4 Groundwater levels

For the six selected monitoring wells relevant to the area, depth to groundwater ranges between 16.12 mBTC (PB-MB01 in February 2011), to 33.74 mBTC (PB-MB12 in November 2011). Depth to groundwater is largely represented of the topography, with groundwater elevation reducing with proximity to the coast. For this area, groundwater elevation varies between approximately 0.3 and 1.0 mAH for manually dipped monitoring wells.

There are no groundwater level transducers installed within this area.

9.5 Summary

Since July 2010 concentrations of metals, physical parameters, salts and ions, nutrients and microbes remained relatively stable in MB01 and MB12. Changes in concentrations were recorded in MB07, MB13 and MB15, with calcium and sodium concentrations increasing slightly between this monitoring round (November 2011) and the previous one (July 2011).

APPENDIX B

Groundwater Licences





LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	New Orion Investments Pty Ltd & St Andrews Private Estate Pty Ltd		
Description of Water Resource	Yanchep Perth - Superficial Swan	Annual Water Entitlement	229,443kL
Location of Water Source	Lot 603 On Plan 58922Volume/Folio 2688/585 Lot 603 Toreopango Av Yanchep Lot 9100 On Plan 406241 - Volume/Folio 2886/80 - Lot 9100 Yanchep Beach Rd Yanchep		
Authorised Activities	Taking of water for	Location of Activity	
	Establishment of new POS for Northern Corridor	Lot 603 On Plan 58922 - Volume/Folio 2688/585 - Lot 603 Toreopango Av Yanchep Lot 603 On Plan 58922Volume/Folio 2688/585 Lot 603 Toreopango Av Yanchep Lot 9100 On Plan 406241 - Volume/Folio 2886/80 - Lot 9100 Yanchep Beach Rd Yanchep	
Duration of Licence	From 30 November 2017 to 29 November 2022		

This Licence is subject to the following terms, conditions and restrictions:

1. The licensee must install an approved meter to each water draw-point through which water is taken under this licence.
2. The volume of all water taken under this licence must be metered using an approved meter fitted to each drawpoint.
3. The annual water year for water taken under this licence is defined as 1 November to 31 October.
4. The licensee must not, in any water year, take more water than the annual water entitlement specified in this licence.
5. The licensee must take and record the reading from each meter required under this licence, at the end of each month.
6. Unless otherwise approved by the Department of Water and Environmental Regulation, all meter readings must be recorded monthly via the Department of Water and Environmental Regulation's 'Water Online Portal' or on an approved Department of Water and Environmental Regulation 'Meter Water Use Card'. The meter readings must be reported via the 'Water Online Portal' or submitted via a completed 'Meter Water Use Card' to the Department of Water and Environmental Regulation every 12 Months, commencing 07/11/2018.
7. The licensee must ensure the installed meter(s) accuracy is maintained to within plus or minus 5% of the volume metered, in field conditions.
8. The licensee must notify the Department of Water and Environmental Regulation in writing of any water meter malfunction within seven days of the malfunction being noticed.
9. The licensee must obtain authorisation from the Department of Water and Environmental Regulation before removing, replacing or interfering with any meter required under this licence.

End of terms, conditions and restrictions



LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	New Orion Investments Pty Ltd & St Andrews Private Estate Pty Ltd		
Description of Water Resource	Yanchep Perth - Superficial Swan	Annual Water Entitlement	44,558kL
Location of Water Source	Lot 8001 On Plan 407814 - Volume/Folio LR3167/621 - Lot 8001 St Andrews Dr Yanchep Lot 9001 On Plan 407072 - Volume/Folio 2917/29 - Lot 9001 Capilano Av Yanchep Lot 9100 On Plan 406241 - Volume/Folio 2886/80 - Lot 9100 Yanchep Beach Rd Yanchep		
Authorised Activities	Taking of water for	Location of Activity	
	Public Open Space purposes for Northern Corridor	Lot 603 On Plan 58922 - Volume/Folio 2688/585 - Lot 603 Toreopango Av Yanchep Lot 8001 On Plan 407814 - Volume/Folio LR3167/621 - Lot 8001 St Andrews Dr Yanchep Lot 9001 On Plan 407072 - Volume/Folio 2917/29 - Lot 9001 Capilano Av Yanchep Lot 9100 On Plan 406241 - Volume/Folio 2886/80 - Lot 9100 Yanchep Beach Rd Yanchep	
Duration of Licence	From 15 March 2018 to 14 March 2028		

This Licence is subject to the following terms, conditions and restrictions:

1. The licensee must install an approved meter to each water draw-point through which water is taken under this licence.
2. The meter(s) must be installed in accordance with the provisions of the document entitled "Guidelines for Water Meter Installation 2009" before any water is taken under this licence.
3. The annual water year for water taken under this licence is defined as 1 November to 31 October.
4. The licensee must not, in any water year, take more water than the annual water entitlement specified in this licence.
5. Unless otherwise approved by the Department of Water and Environmental Regulation, all meter readings must be recorded annually via the Department of Water and Environmental Regulation's 'Water Online Portal' or on an approved Department of Water and Environmental Regulation 'Meter Water Use Card'. The meter readings must be reported via the 'Water Online Portal' or submitted via a completed 'Meter Water Use Card' to the Department of Water and Environmental Regulation every 12 Months, commencing 07/11/2018.
6. The licensee must ensure the installed meter(s) accuracy is maintained to within plus or minus 5% of the volume metered, in field conditions.
7. The licensee must notify the Department of Water in writing of any water meter malfunction within seven days of the malfunction being noticed.
8. The licensee must obtain authorisation from the Department of Water before removing, replacing or interfering with any meter required under this licence.
9. The licensee shall not use water for non commercial purposes between 9 am and 6 pm except for the establishment of newly planted areas. For newly planted areas water may be used within these hours for a period of up to 28 consecutive days, commencing from the date of planting.
10. Between 1 June and 31 August in any year, the licence-holder must not water a lawn, garden, or grass-covered area ("turf") by reticulation, provided always that this restriction shall not apply; watering with a hand held hose; or watering, by way of reticulation: golf course tees and greens, turf wickets, bowling greens and active sporting areas; newly planted areas for a period of up to 28 days from the date of planting; for renovating turf; or for maintenance of reticulation systems

End of terms, conditions and restrictions

This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000.



LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

COPY

**LICENCE TO TAKE WATER**

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	New Orion Investments Pty Ltd & St Andrews Private Estate Pty Ltd		
Description of Water Resource	Yanchep Perth - Superficial Swan	Annual Water Entitlement	85,000kL
Location of Water Source	LOT 9 ON PLAN 415221 - Volume/Folio 2959/378 - Lot 9 TOREOPANGO AV YANCHEP		

Authorised Activities	Taking of water for	Location of Activity
	Establish of specific area public open space	LOT 9 ON PLAN 415221 - Volume/Folio 2959/378 - Lot 9 TOREOPANGO AV YANCHEP LOT 9 ON PLAN 415221 - Volume/Folio 2959/379 - Lot 9 TOREOPANGO AV YANCHEP
Duration of Licence	From 11 March 2022 to 10 March 2027	

This Licence is subject to the following terms, conditions and restrictions:

1. The annual water year for water taken under this licence is defined as 1 November to 31 October.
2. This licence is not transferable.
3. This licence is not renewable.

End of terms, conditions and restrictions

APPENDIX C

Landscape Strategy (EPCAD, 2026) Extracts



5.0 LANDSCAPE MASTERPLAN

5.1.1 CONCEPTUAL DIAGRAM

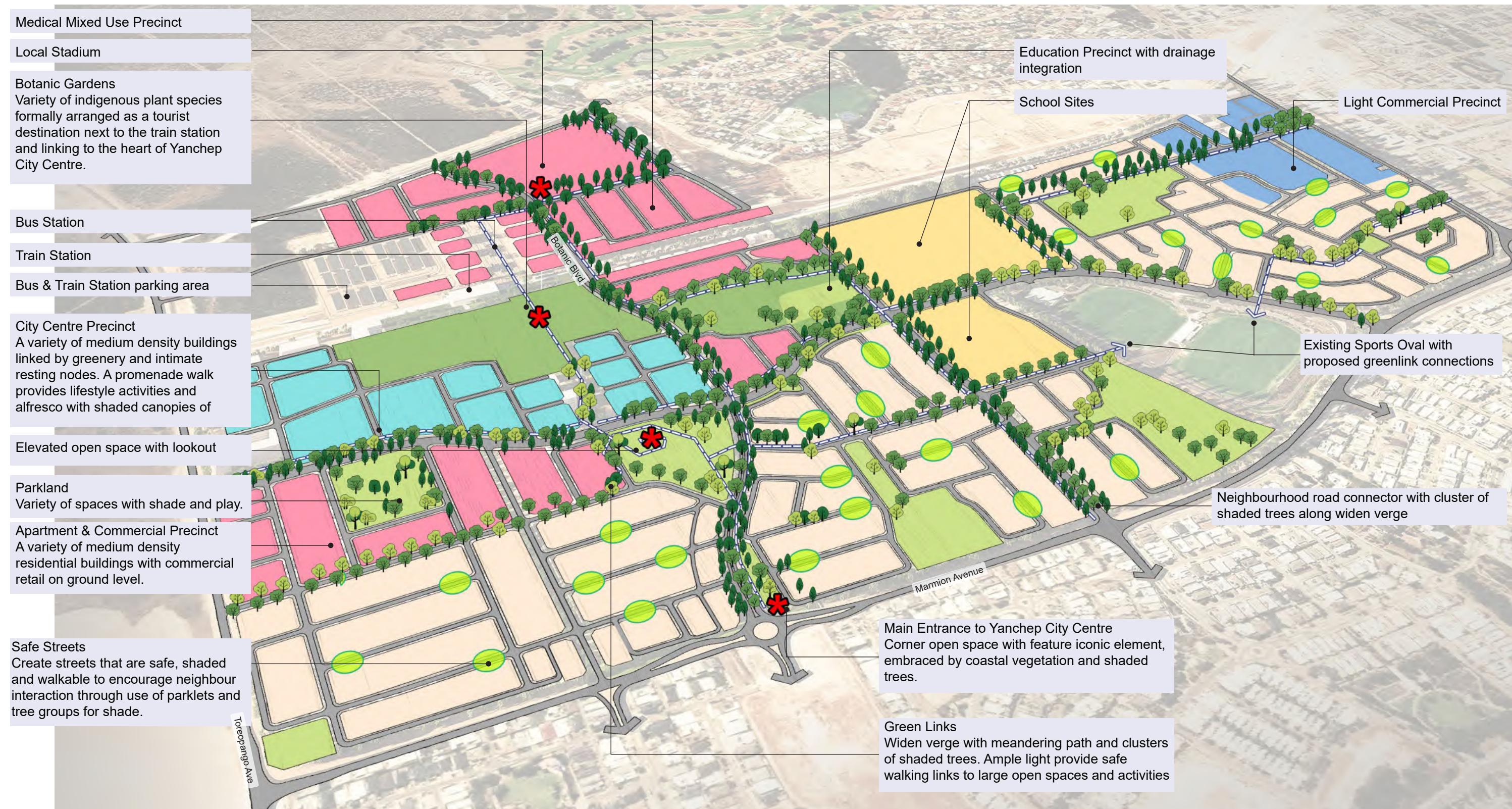


FIGURE 6

5.0 LANDSCAPE MASTERPLAN

5.1.2 LANDSCAPE MASTERPLAN



Legend

- ① Yanchep Train Station
- ② Yanchep Bus Station
- ③ Parking Area
- ④ Medical Mixed Use Precinct
- ⑤ Local Stadium
- ⑥ Botanic Gardens
- ⑦ City Centre Precinct
- ⑧ Apartment with Commercial Precinct
- ⑨ Education Precinct with integrated drainage
- ⑩ Super Lot North
- ⑪ Public Open Space
- ⑫ Lookout / High point feature
- ⑬ Super Lot Central
- ⑭ Private School
- ⑮ School
- ⑯ Light Commercial Precinct
- ⑰ Super Lot South
- ⑱ Plaza
- ⑲ Existing Oval

FIGURE 7

5.0 LANDSCAPE MASTERPLAN

5.2.1 TRANSIT PRECINCT



FIGURE 11

The Transit Precinct

The Transit Precinct forms the primary civic gateway to Yanchep, presenting the first impression for users arriving by train. It is designed as a high-quality urban landscape capable of managing large volumes of people moving through the station during peak times.

The character of the precinct has been shaped by the strong architectural presence of the bus interchange and train station. The sweeping horizontal lines of the roof forms establish a distinct urban identity, which is supported by the emerging pattern of formal street tree planting aligned to the road network. Light-coloured paving has been adopted throughout pedestrian areas, reinforcing brightness and legibility.

The adjoining car park, currently planted with young native canopy trees and shrubs, provides opportunities for further enhancement. As the landscape matures, the integration of extended shade structures and the installation of co-located solar panels would strengthen sustainability outcomes while improving user comfort.

- Primary civic gateway for train and bus users
- Strong horizontal identity from sweeping roof forms
- Light-coloured paving creates legible pedestrian areas
- Formal street tree planting aligned with road network
- Large car park with emerging native canopy trees
- Opportunity for shade structures and integrated solar panels
- Supports sustainability and user comfort at peak times



5.0 LANDSCAPE MASTERPLAN

5.2.2 BOTANIC GARDENS

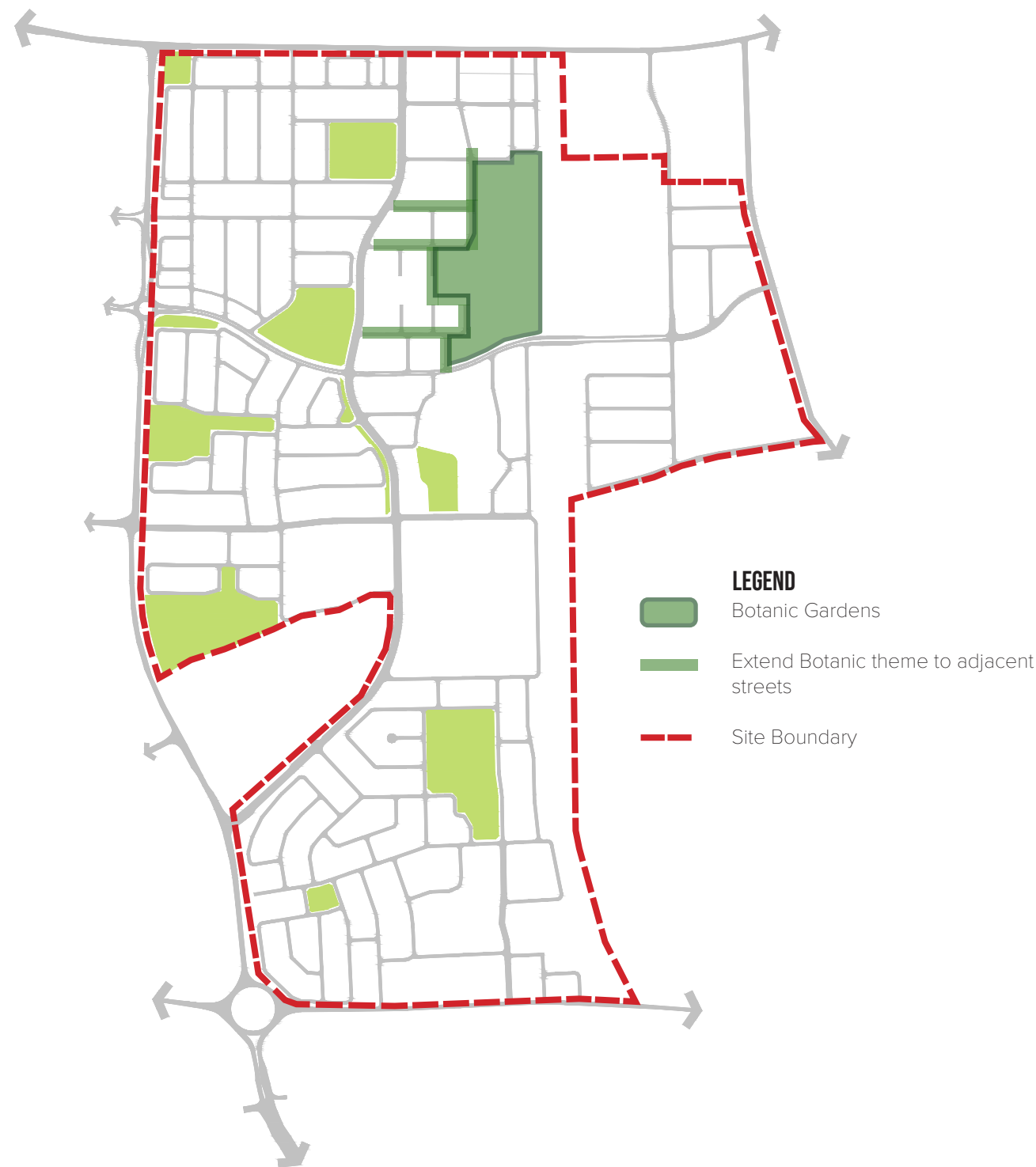


FIGURE 12

Botanic Gardens

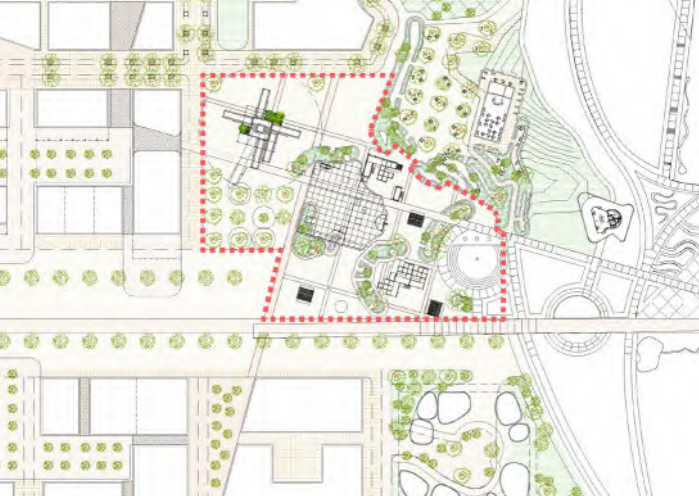
The Botanic Gardens Precinct is emerging as a distinctive green gateway to the city, forming the first experience when leaving the station. The gardens are already established and will continue to mature into a signature landscape, shaping the character and identity of the wider precinct.

The intent is to extend the botanic theme through street planting and materiality, beyond the gardens themselves into the adjoining streets, ensuring a continuity of green character within the urban form. Streets are designed to prioritise pedestrians, with shared surfaces, shaded seating, and planting that defines safe, walkable spaces. Distinctive activity areas—such as restaurants and retail zones—are integrated into the landscape, encouraging social interaction.

Native plants are central to the planting strategy, enhancing biodiversity while contributing to eventual land uses, such as restaurant gardens and shaded resting places. The arrangement of pathways and open spaces is deliberately organic, creating a sense of discovery through meandering routes, framed views, and a variety of shaded areas to sit and gather.

Overall, the precinct is designed as a flexible and adaptable landscape, capable of hosting both temporary and permanent uses. As the planting matures and extends into surrounding streets, the Botanic Gardens Precinct will grow into a living identity for the city, blending nature, community, and urban life.

- Green gateway, first impression when leaving the station, maturing into a signature landscape.
- Extension of character planting theme carried into adjacent streets.
- Pedestrian focus in streets designed as shared, walkable spaces.
- Planting strategy of native species, combining biodiversity with everyday urban life.
- Flexible spaces allow for temporary and evolving activities as the precinct grows.
- Comfort & shaded seating, trees, and planting provide rest areas
- Organic character of meandering paths and garden forms
- Integration with built form, the landscape to influence building design



5.0 LANDSCAPE MASTERPLAN

5.2.3 CITY CENTRE PRECINCT

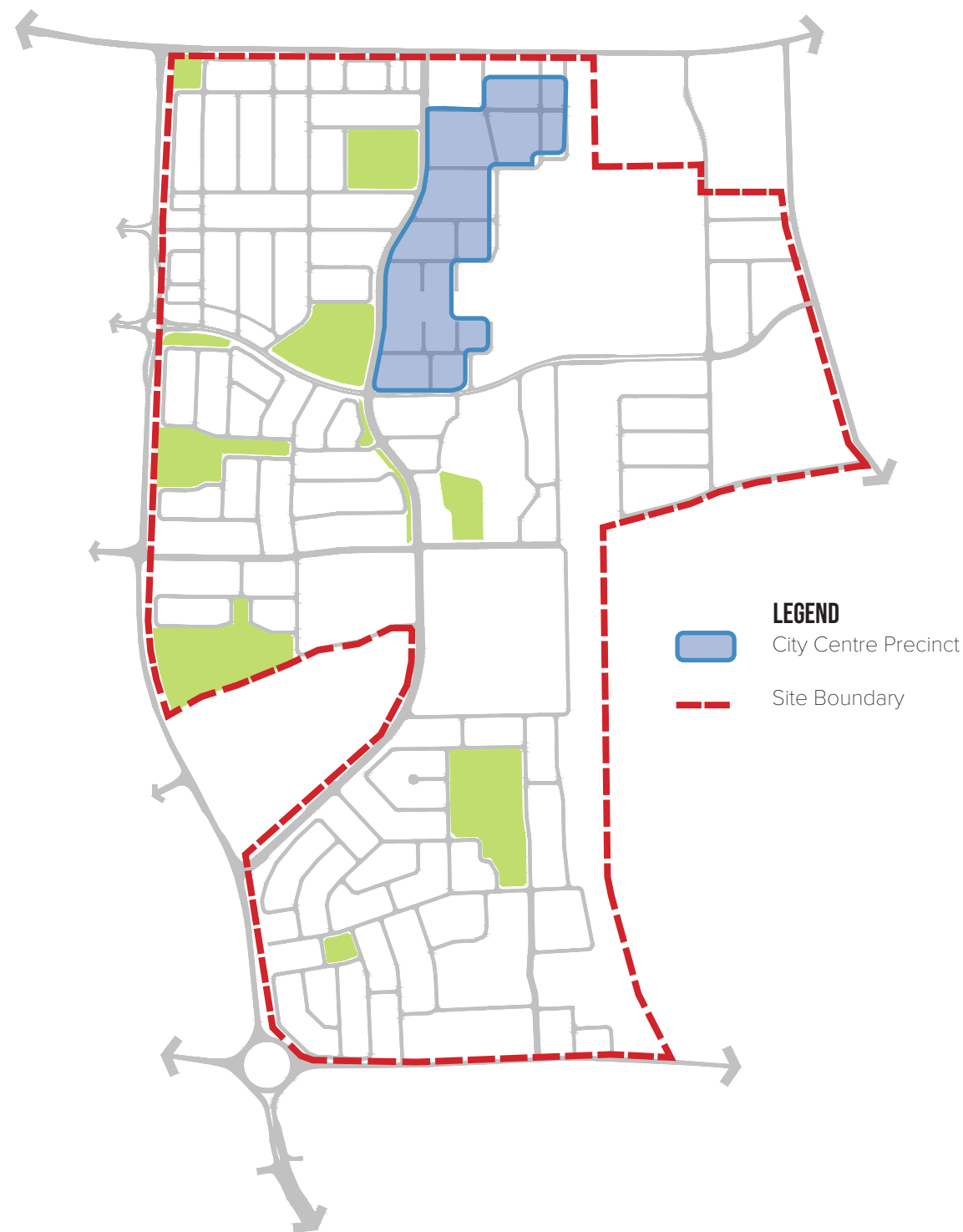


FIGURE 13

The City Centre Precinct

The City Centre Precinct is characterised by higher-density built form and a strong focus on the quality of its streetscapes. Pedestrian amenity is enhanced through incidental widening of paving to create parklets that integrate seating, shade, and social spaces. These areas serve multiple purposes—slowing traffic, supporting blocks of new canopy trees, and providing opportunities for local drainage integration with passive irrigation. Street furniture and design elements are configured to promote social interaction and ensure comfort for pedestrians and cyclists alike.

A Central Plaza forms the primary civic space within the precinct, accommodating events, art exhibitions, and weekend markets. It provides a key connection between the station, the Botanic Gardens, and the distinctive western hill that is framed as a local park. The plaza will include street furniture that is robust and provides a level of perceived pedestrian enclosure but will also retain clear lines of sight encouraging visual connection through to destinations at both west and eastern ends. Lighting to this space will afford security but also be designed to be a feature and encourage evening and night use within a safe environment.

- A broad tree canopy offering shade across plazas and streets, scaled in proportion to built form.
- Boulevard planting along perimeter roads and grouped street trees extending the Botanic Gardens' character into the urban core.
- Provision for alfresco activity at ground level of adjacent development.
- Urban water management expressed as a design feature, integrated into paving, parklets, and drainage systems.
- Material selections that emphasise the precinct's coastal character.
- Encouragement of built canopy and awnings to extend shade.
- Integrated artworks that reflect and interpret cultural history.



5.0 LANDSCAPE MASTERPLAN

5.2.4 MEDICAL MIXED USE AND SPORTS PRECINCT

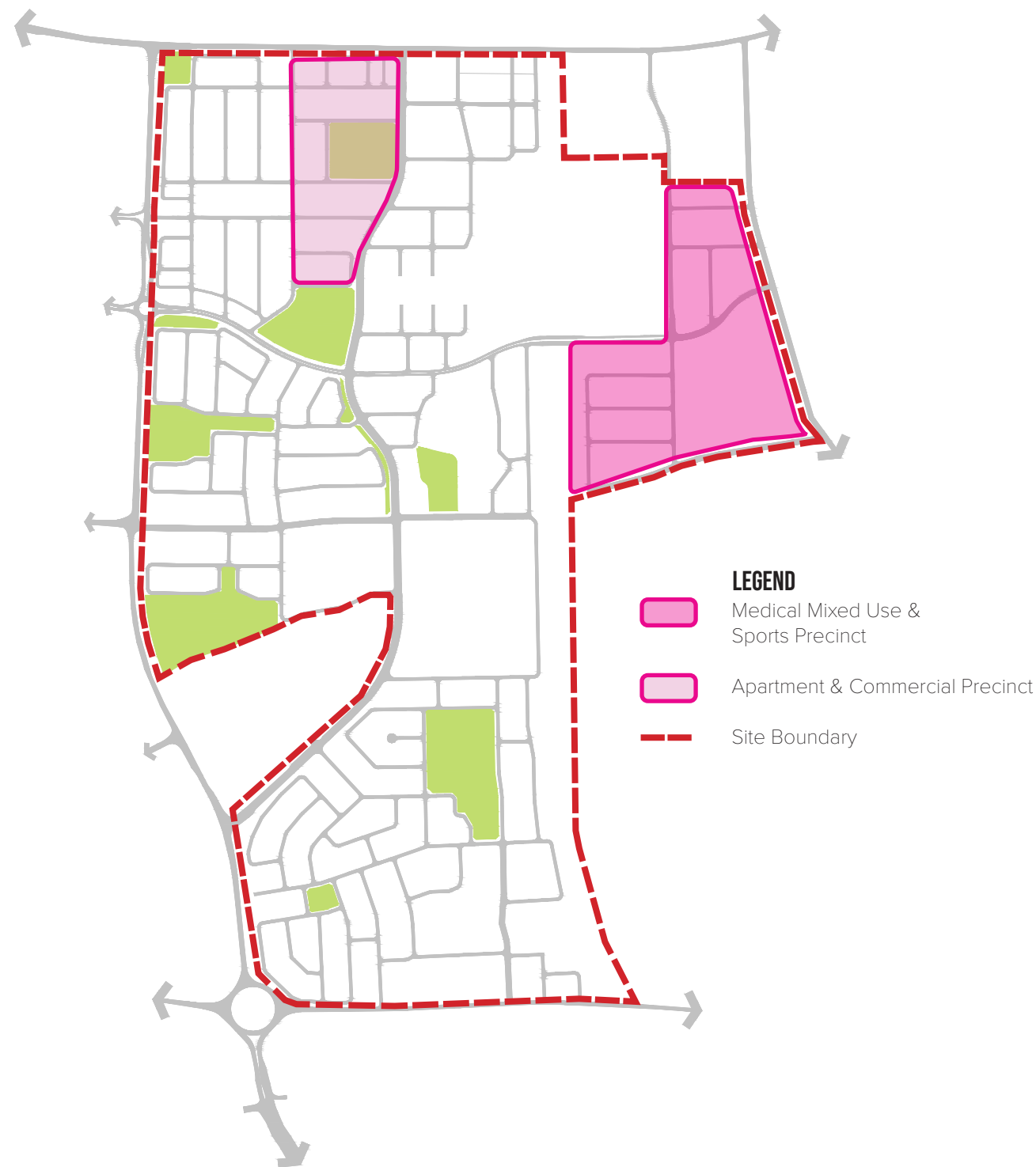


FIGURE 14

Medical Mixed Use and Sports Precinct

This precinct focuses on health and wellbeing through a mix of medical, allied professional, and sporting land uses mixed with central residential accommodation. The urban landscape reinforces this identity with shaded walking routes, spaces that encourage active lifestyles, and a civic realm that integrates functionality with cultural expression.

An opportunity to develop a central plaza associated with the local stadium providing a focused flexible space for events, markets, and community gatherings could be located at the cross roads within the stadium land. Robust street furniture, a continuous pedestrian ground plane, and broad tree canopies establish comfort and usability. Integrated artworks themed around health, wellbeing, and Aboriginal knowledge of food and medicine add cultural depth.

Connections extend activity from the station to the recreation and sports oval, supported by active ground-floor frontages. These connections waymarked with precinct themed signage and integrated artworks. Boulevard planting and grouped street trees continue the botanical theme, while urban water management is expressed within the landscape. Materials reflect Yanchep's coastal character, with tree canopies scaled to the built form. Opportunities for covered walkways with cultural artworks strengthen both identity and amenity.

- Focus on health, wellbeing, and active lifestyles
- Central plaza as flexible civic space for events/markets
- Robust street furniture and continuous pedestrian ground plane
- Broad tree canopy and shaded routes for comfort
- Integrated artworks on health, wellbeing, and Aboriginal knowledge
- Active ground-floor frontages linking station to sports oval
- Boulevard planting and grouped trees extend botanical theme
- Expressed urban water management within landscape design
- Coastal materials palette, tree canopy scaled to built form
- Opportunities for covered walkways expressing cultural references

Apartment and Commercial Precinct

This precinct is envisioned as a vibrant mixed-use neighbourhood comprising 4–6 storey apartment buildings with active commercial uses at ground level. The development is designed to create a walkable and connected urban environment, supporting a diverse community through a mix of residential living, retail, dining, and local services. Ground floor frontages will contribute to a lively public realm, encouraging pedestrian activity and social interaction, while upper-level apartments provide a medium-density housing outcome that balances urban character with residential amenity. Landscaping, streetscape improvements, and integrated public spaces will further enhance the precinct's identity and livability.



5.0 LANDSCAPE MASTERPLAN

5.2.5 EDUCATION PRECINCT

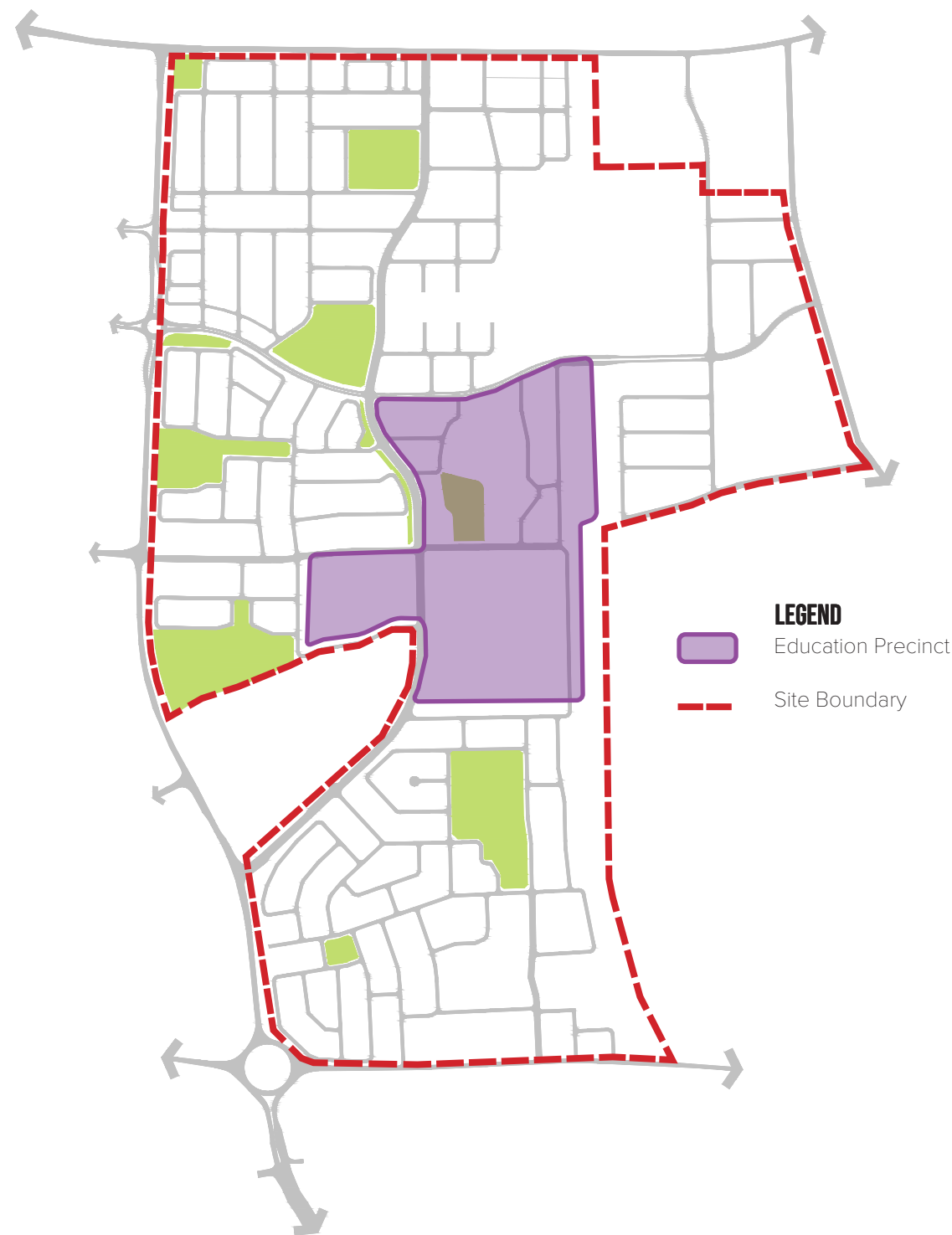


FIGURE 15

Education Precinct & Schools

At the physical centre of the city precincts lies the Educational Precinct, a neighbourhood defined by schools and associated open spaces. Education establishments sporting ovals and recreational grounds will anchor the precinct, complemented by a central parkland located within a natural low-lying terrain. This parkland forms a vital open link to the north, directly connecting to the station, while also accommodating natural drainage and preserving areas of distinctive native vegetation.

The retained natural landscape features establish the framework for a new urban park, retaining and interpreting the existing character. Pedestrian routes through this space will be enhanced with seating, boardwalks, and shade structures, together with interpretive features that communicate ecological and cultural stories. The blend of expansive greenspace for education and the central park creates a more open urban character, providing contrast with the denser neighbouring precincts.

- Design guidelines for built form and landscape to create a distinctive neighbourhood character consistent with the overall vision.
- Strong green connections around the corners and edges of sites to establish a cohesive tree canopy framework.
- Streetscapes with grouped tree plantings to strengthen the green network.
- Rest points along pedestrian routes with shaded seating.
- Clear signage and wayfinding to guide users.
- Wide, shaded walkways linking directly to the Transit Precinct.
- Flexible activation spaces capable of hosting large gatherings.
- Integrated interpretation elements—artworks, signage, and structures—providing information on plants, landscape features, and cultural heritage.



5.0 THE MASTERPLAN

5.2.6 RESIDENTIAL SUPERLOTS PRECINCT

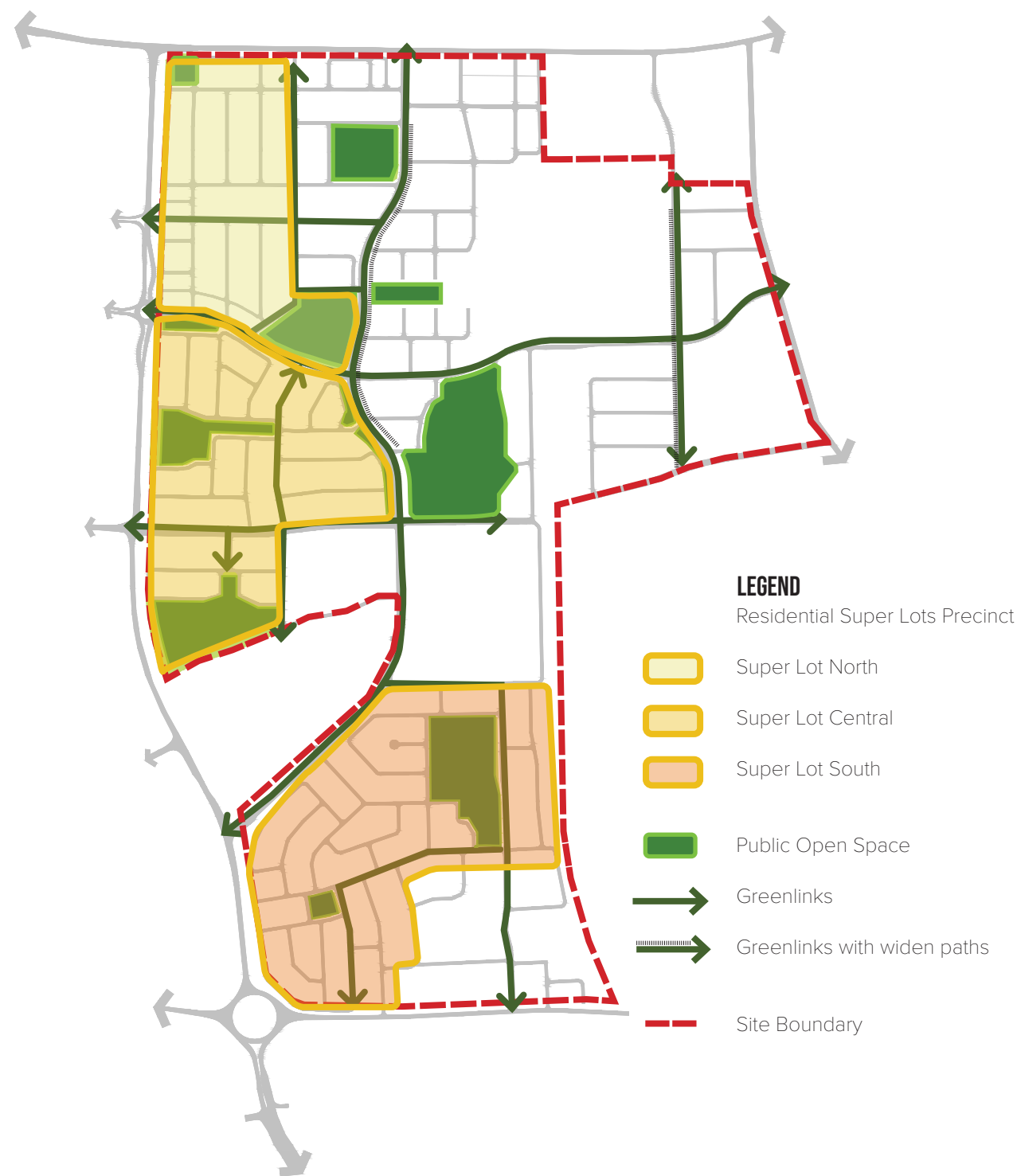


FIGURE 16

Residential Super Lots Precincts

The western flanks of the City Centre accommodate major residential neighbourhoods. These are organised into three distinct precincts, each defined by its topography, relationship to open space, and position within the primary road network.

A strong canopy framework will be established through major plantings of native trees and shrubs along primary road reserves. This green network will form the perimeter of the differing communities. The streetscape design and will further ensure that each neighbourhood achieves a shaded and comfortable living environment.

The overall intention is to create neighbourhoods with subtle variation in urban landscape character, reinforcing community identity while maintaining a consistent approach across the city. Streetscapes will be the key to this character, delivering broad tree canopies, shaded pedestrian environments, and the incorporation of parklets. The use of parklets will serve multiple functions—providing passive drainage and irrigation, slowing traffic speeds, and introducing distinctive tree species to strengthen local identity.

To achieve the urban characteristics and urban tree canopy the future subdivision and development need to deliver. While mandates and policies provide the framework for urban greening, long-term success relies on developers and residents actively supporting the urban canopy. A strategy for street tree planting should therefore combine contractual delivery mechanisms with measures that build community ownership and pride in the landscape character.

Neighbourhood branding can be achieved through distinctive species mixes that differentiate each precinct. This not only reinforces local identity but also encourages residents to view trees as an integral part of their neighbourhood, rather than as an imposition. Education and small incentives—such as support for verge gardens or water-saving rebates—further can strengthen this buy-in, ensuring residents see themselves as caretakers of the canopy.

In parallel, landscape contractual requirements should extend beyond initial planting to include 3-year establishment periods with clear survival thresholds, ensuring canopy retention is not left to chance. Transparent reporting of canopy cover targets can help maintain accountability, this may be considered as a community post feedback through a web based information portal. In this way, street trees become part of a shared neighbourhood identity and a visible measure of community

wellbeing, rather than simply a compliance exercise.

- North Precinct: Defined by linked public open spaces. Broad road reserves will allow shaded pedestrian routes that improve legibility and create a clear sense of place.
- Central Precinct: Features a series of connected parks, linked through shaded streets and pedestrian corridors that reinforce the neighbourhood's green character.
- South Precinct: Separated from the central area by an existing large recreational park. Streetscapes here will provide a distinct identity for the community, clearly differentiating it from the northern and central neighbourhoods.



5.0 LANDSCAPE MASTERPLAN

5.2.7 LIGHT COMMERCIAL PRECINCT

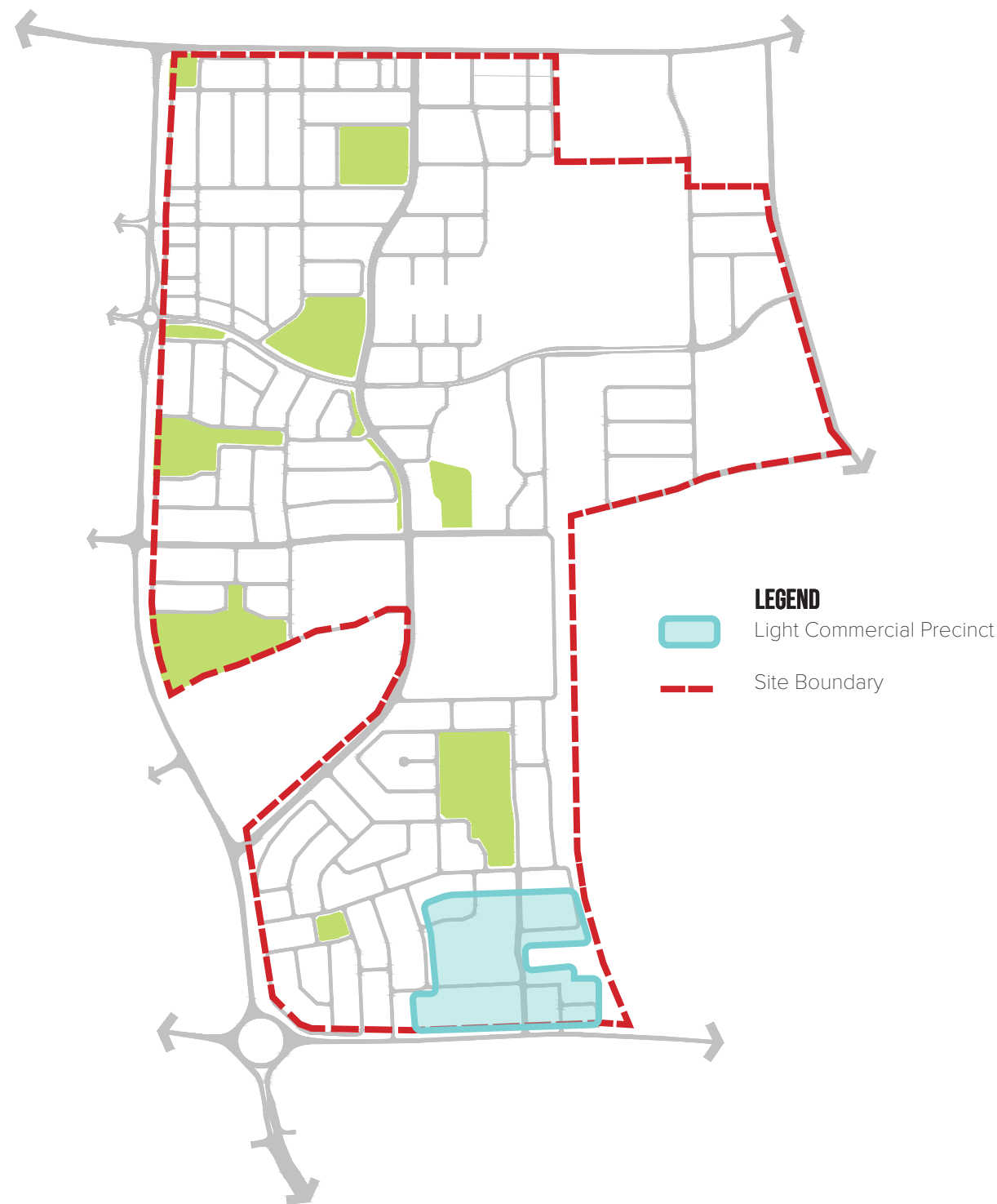


FIGURE 17

Light Commercial Precincts

The Light Commercial Precinct represents an existing area of mixed commercial uses that currently lacks a strong or consistent character. With the anticipated growth of the City Centre, this area will evolve to better meet the needs of the expanding population. To ensure it integrates with the wider city fabric, an urban landscape structure is required that upgrades the public realm and establishes clear pedestrian and cycle connections north into the adjoining residential neighbourhoods.

Within the constraints of the existing urban form, a coordinated retrofit program should focus on improving road reserves, introducing street tree planting, and enhancing walkability. Car parks and street edges should incorporate shade, structure, and incidental spaces that support social interaction. Partnerships between stakeholders and council will be critical to deliver upgrades, unify signage and branding, and guide investment into cohesive outcomes. A coordinated re-landscaping and re-branding effort will elevate the precinct, transforming it into a functional and attractive commercial neighbourhood.

- Retrofit delivered through partnerships between landowners, tenants, and council.
- Shade provision to both streetscapes and car parking areas.
- Walkability supported by a clear pedestrian and cycle framework.
- Coordinated signage and wayfinding strategy.
- Incidental spaces for repose, gathering, and amenity.
- Strong landscape and movement links to adjacent residential neighbourhoods.
- Incremental enhancements to existing built form to achieve visual cohesion.
- Establishment of a cohesive urban identity through rebranding and landscape structure.



6.0 LANDSCAPE TYPOLOGIES

6.3 GREEN LINKS



FIGURE 25

Green Links are a critical element in shaping a connected network of open spaces, ensuring parks and civic spaces are not experienced as isolated pockets but as part of a cohesive public realm. These corridors reinforce legibility across the City Centre and significantly expand opportunities for establishing an urban tree canopy.

- The design of Green Links will:
- Incorporate shaded walkways and cycleways, encouraging active movement between neighbourhoods.
- Provide occasional seating and rest points to enhance accessibility and comfort for all users.
- Integrate dog-walking amenities such as bins and waste stations.

Utilise increased road verge widths to form visible parkway connections that strengthen the landscape structure. Serve as spatial corridors for Water Sensitive Urban Design (WSUD), supporting passive irrigation of trees and vegetation. By combining movement, shade, amenity, and environmental function, Green Links will become defining features of the City Centre's landscape framework, linking daily use with long-term sustainability.



6.0 LANDSCAPE TYPOLOGIES

6.4 STREETSCAPES



FIGURE 26

Streetscapes are the most important element in achieving a meaningful urban tree canopy. Experience across metropolitan Perth shows that outcomes in new suburbs have often fallen short of expectations, largely due to incremental delivery through individual lot planting and the limitations of narrow road reserves and servicing constraints.

At the Yanchep City Centre, a coordinated strategy will ensure the delivery of an effective and continuous tree canopy through carefully planned street planting. This strategy builds on the approach outlined in the Residential Superlots Precincts, establishing a green framework that will mature with the city.

Primary planting will focus on district distributor roads and neighbourhood connector roads, where grouped vegetation in road reserves will create a strong structural framework. These plantings will be designed to comply with bushfire management requirements while providing large-scale canopy benefits.

Within city streets and residential streets, a combination of continuous street tree planting and grouped plantings within parklets will be adopted. Parklets will serve as punctuation points along straight carriageways, maturing into significant vegetation clusters that provide shade, slow traffic, and enhance neighbourhood character.

This integrated approach to streetscape design will ensure that tree canopy outcomes are consistent, resilient, and central to the identity of the City Centre.

- Establish a strong urban tree canopy as the defining element of the public realm.
- Prioritise coordinated planting at the subdivision stage to group planting opportunities rather than relying on individual lot planting.
- Use grouped vegetation in road reserves to create a clear structural framework.
- Ensure street planting complies with bushfire management requirements.
- Apply large-scale canopy planting along district distributor and neighbourhood connector roads.
- Incorporate continuous street tree planting along residential and city streets.
- Introduce grouped planting within parklets to create shade, slow traffic, and add visual punctuation.
- Design streetscapes as multifunctional spaces that integrate drainage, amenity, and identity.
- Deliver consistent outcomes across all precincts, avoiding fragmented or piecemeal planting.



6.0 LANDSCAPE TYPOLOGIES

6.4.1 DISTRICT DISTRIBUTOR 'B' ROAD - BOTANIC BOULEVARD

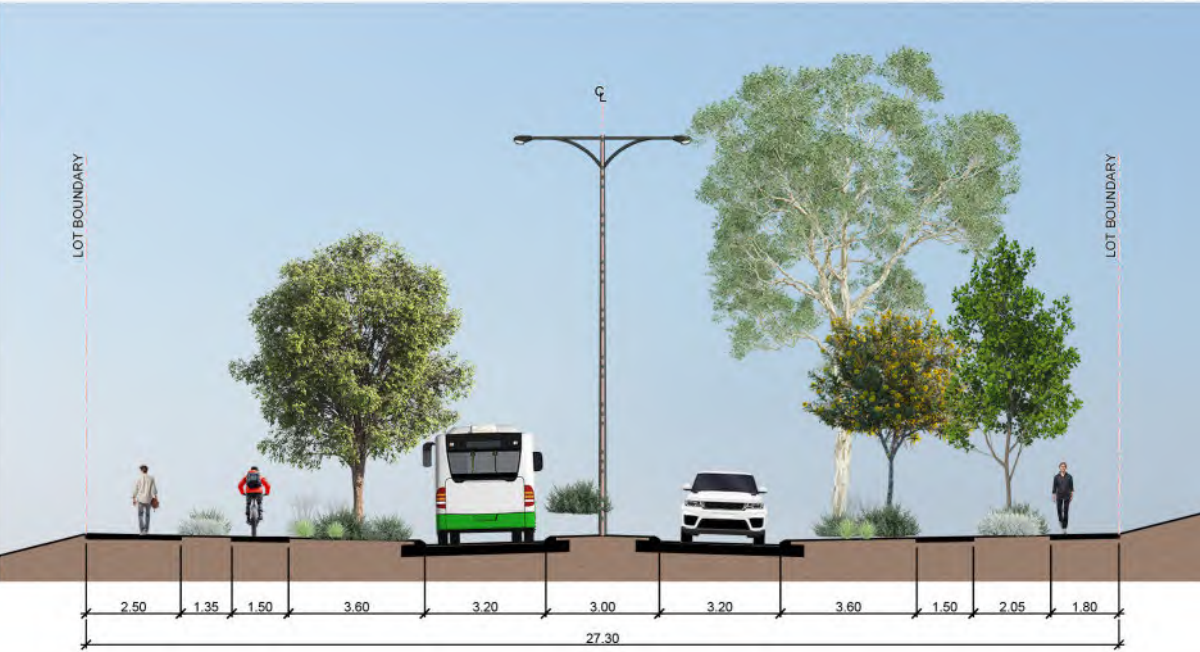


FIGURE 27
Botanic Boulevard connecting to Capricorn Esplanade

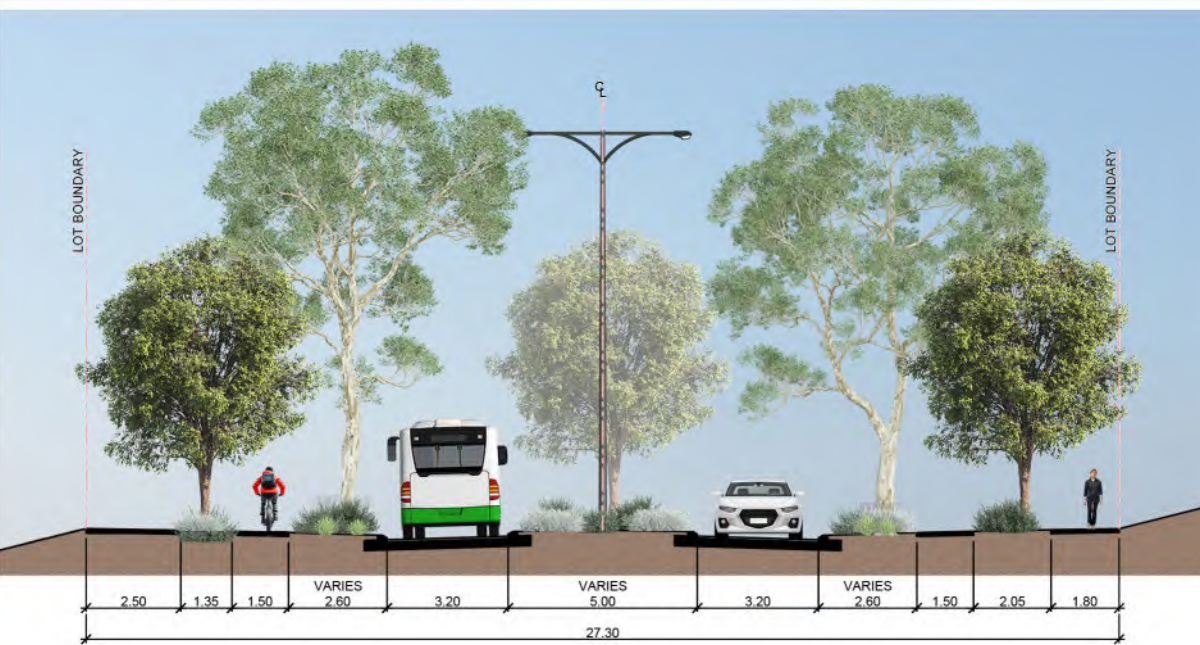
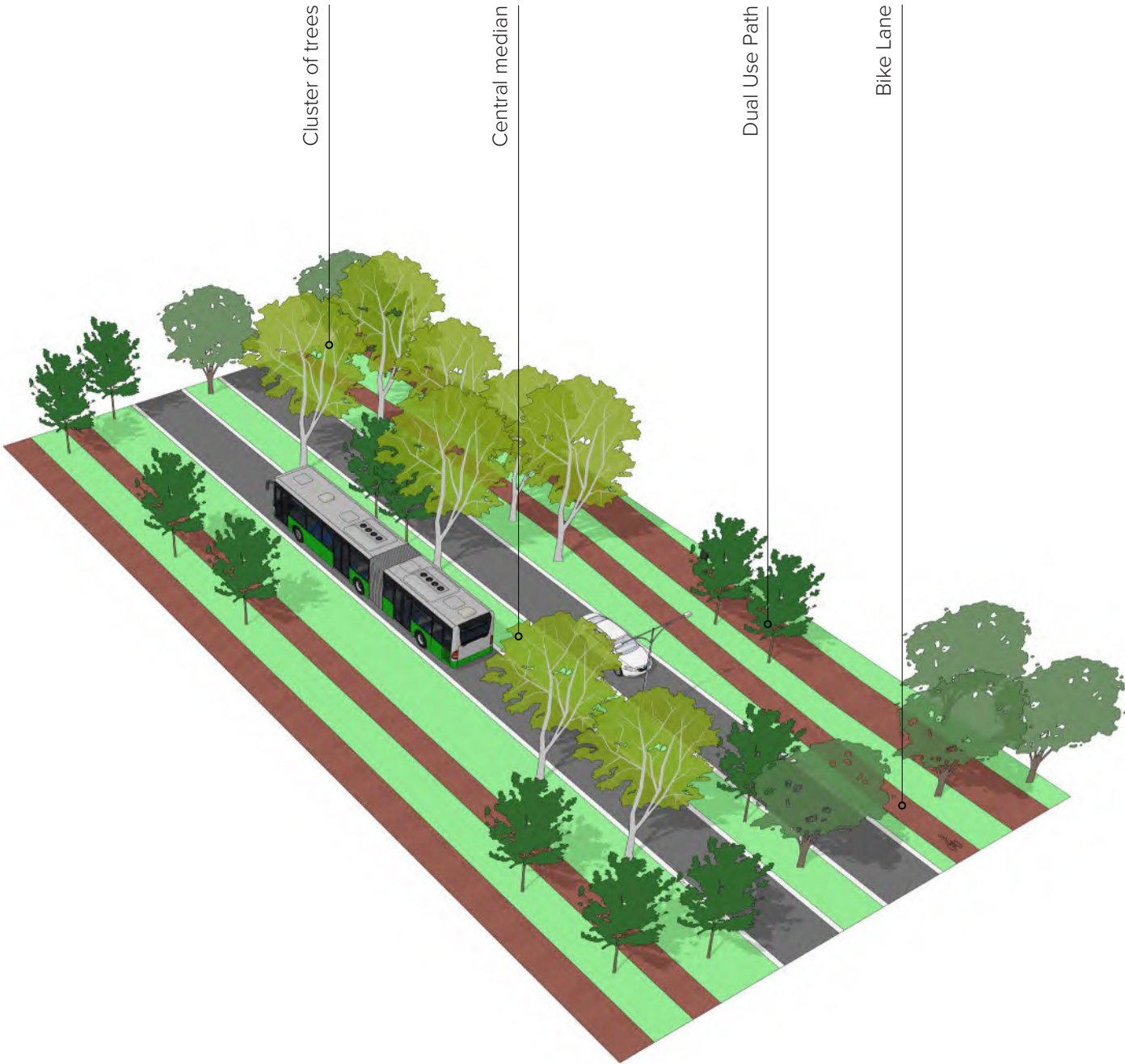


FIGURE 28
Botanic Boulevard near Bus Station

NOTE : Landscape sections are only indicative. Final design of road cross sections will be determined during design development phase and engineer drawings and traffic management reports will take precedent.

District Distributor 'B' Road - Botanic Boulevard

- Existing road with varying central median width with cluster of native trees
- Wide road to allow for bus and cars
- Meandering dual use path for bikes and
- Grouping of trees to provide shade along the dual use path
- Street lighting to central median



6.0 LANDSCAPE TYPOLOGIES

6.4.2 DISTRICT DISTRIBUTOR 'B' ROAD - SPLENDID AVENUE

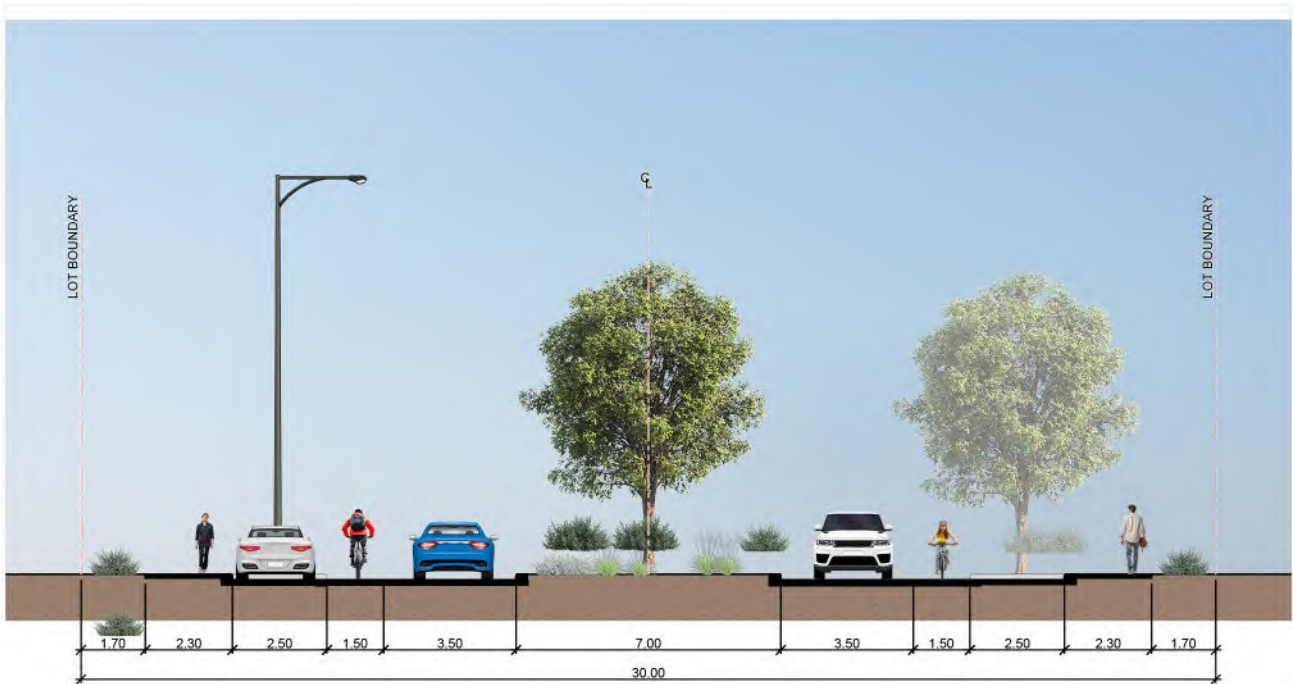


FIGURE 29
Splendid Avenue near Sports Oval

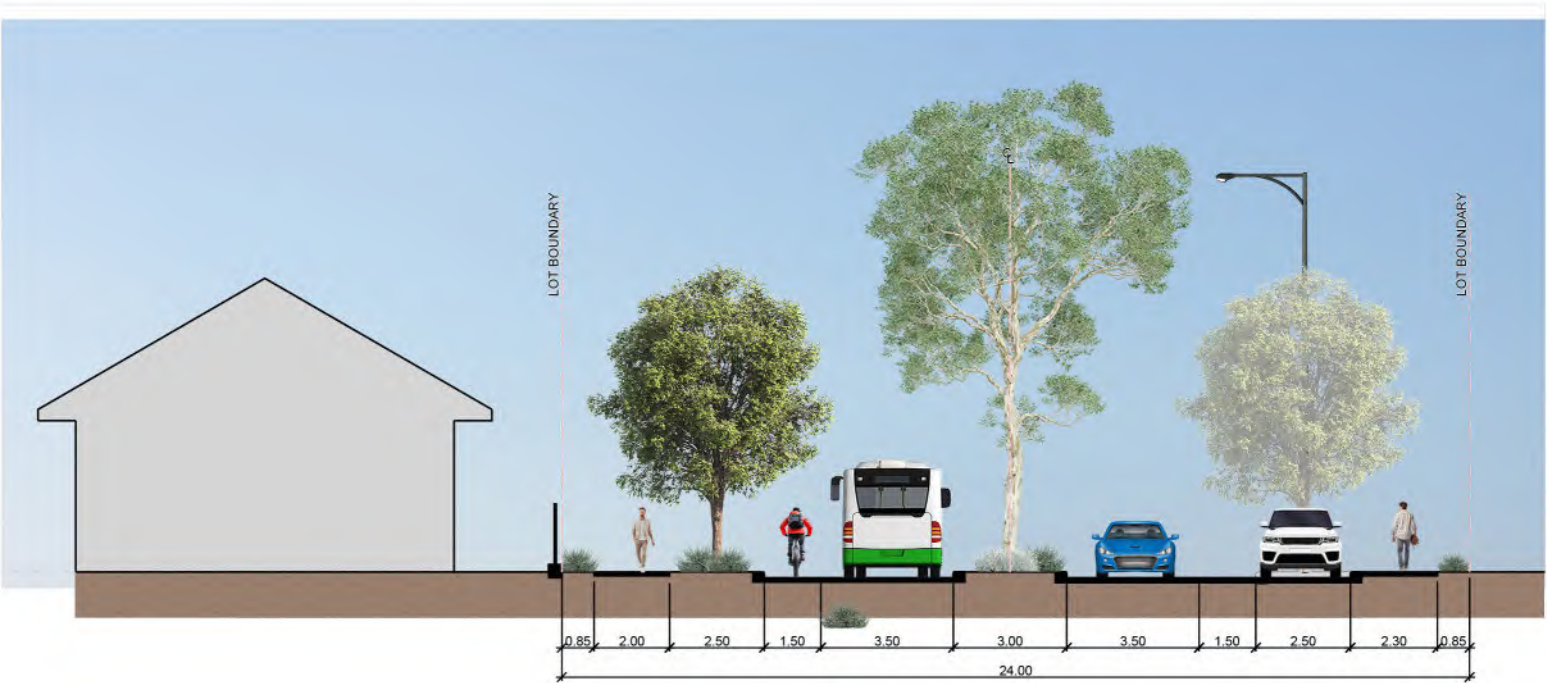


FIGURE 30
Zamia Rise connector

NOTE : Landscape sections are only indicative. Final design of road cross sections will be determined during design development phase and engineer drawings and traffic management reports will take precedent.

- District Distributor 'B' Road - Splendid Avenue & Zamia Rise Connect
- Existing road parallel to existing oval.
 - Parallel parking
 - Bike lane
 - Wide road to allow for bus and cars
 - Footpath to both sides of the verge
 - Grouping of trees to provide shade along the dual use path
 - Street lighting to road
 - Potential drainage to central median



6.0 LANDSCAPE TYPOLOGIES

6.4.3 NEIGHBOURHOOD CONNECTOR

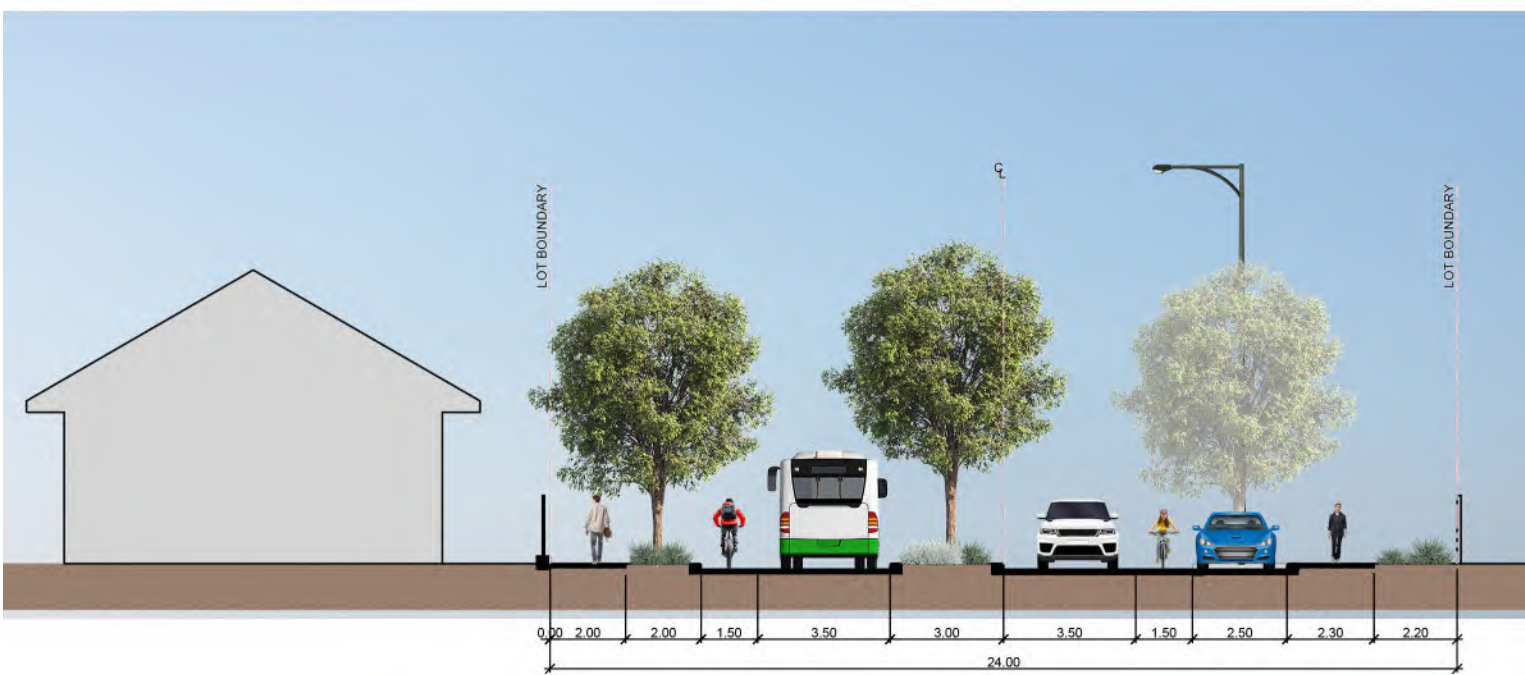


FIGURE 31

Zamia Rise connector near School site

NOTE : Landscape sections are only indicative. Final design of road cross sections will be determined during design development phase and engineer drawings and traffic management reports will take precedent.

Neighbourhood connector

- Parallel parking
- Bike lane
- Wide road to allow for bus and cars
- Footpath to both sides of the verge
- Grouping of trees to provide shade along the dual use path
- Street lighting to road
- Cluster of shade trees along footpath



6.0 LANDSCAPE TYPOLOGIES

6.4.4 MAJOR CITY STREETS

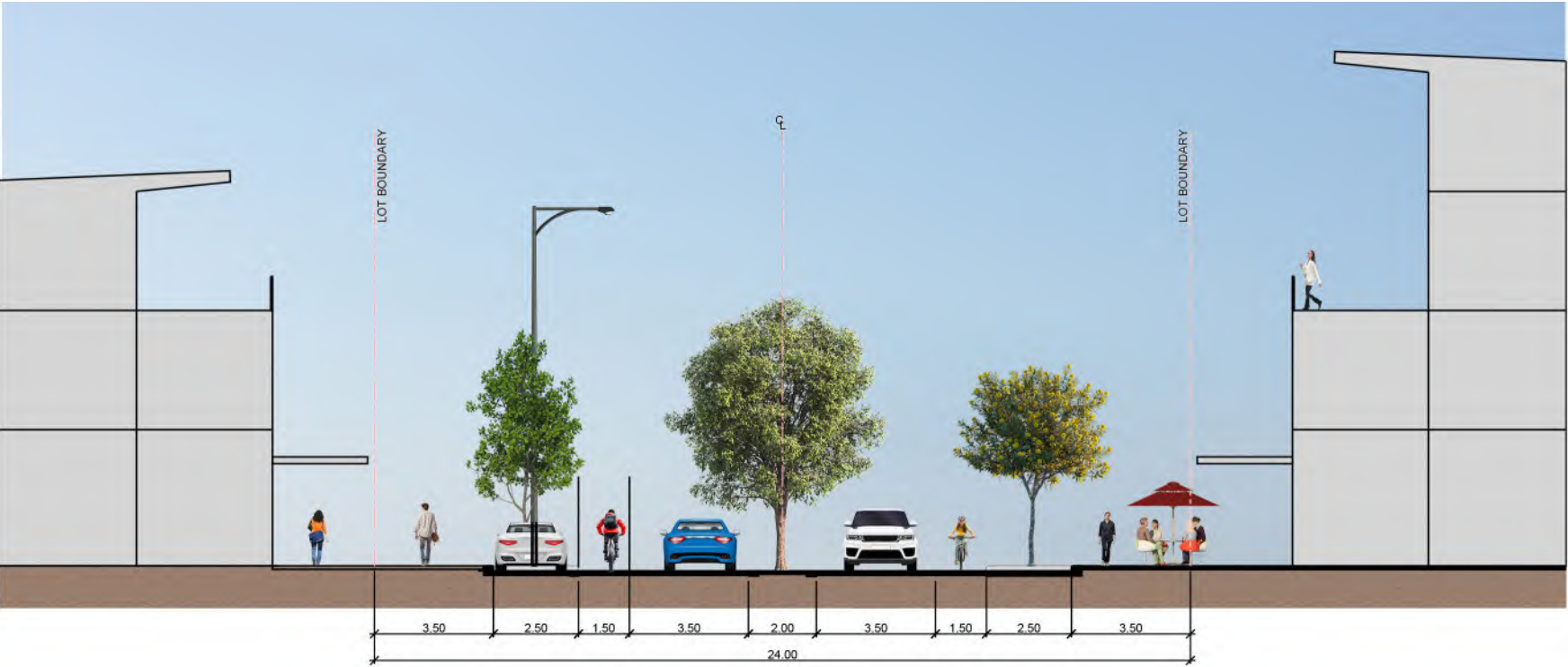


FIGURE 32
City Centre Typical Road

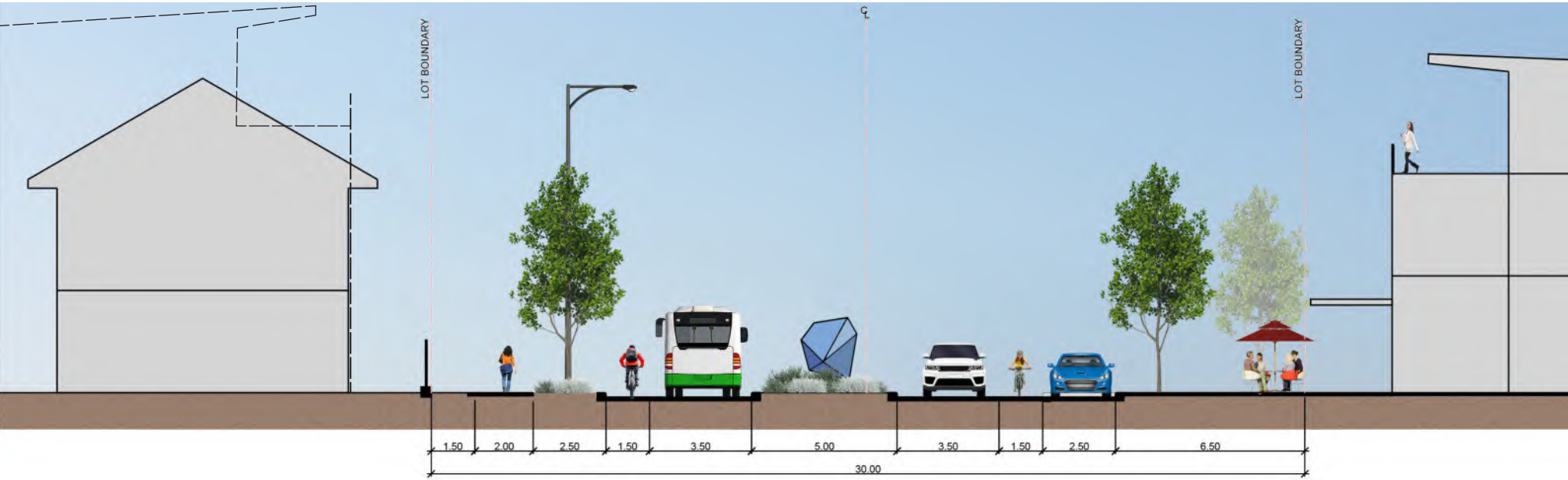


FIGURE 33
City Centre along Splendid Avenue

NOTE : Landscape sections are only indicative. Final design of road cross sections will be determined during design development phase and engineer drawings and traffic management reports will take precedent.

Major Streets within City Centre

- Allow for median tree planting with tree bollards
- Parallel parking
- Bike lane
- Wide verge to allow for alfresco areas
- Wide paved walkway with feature paving to highlight building entries and connections
- Potential art work to main crossover at Splendid Avenue
- Potential drainage to central median
- Street lighting



6.0 LANDSCAPE TYPOLOGIES

6.4.4 MAJOR CITY STREETS

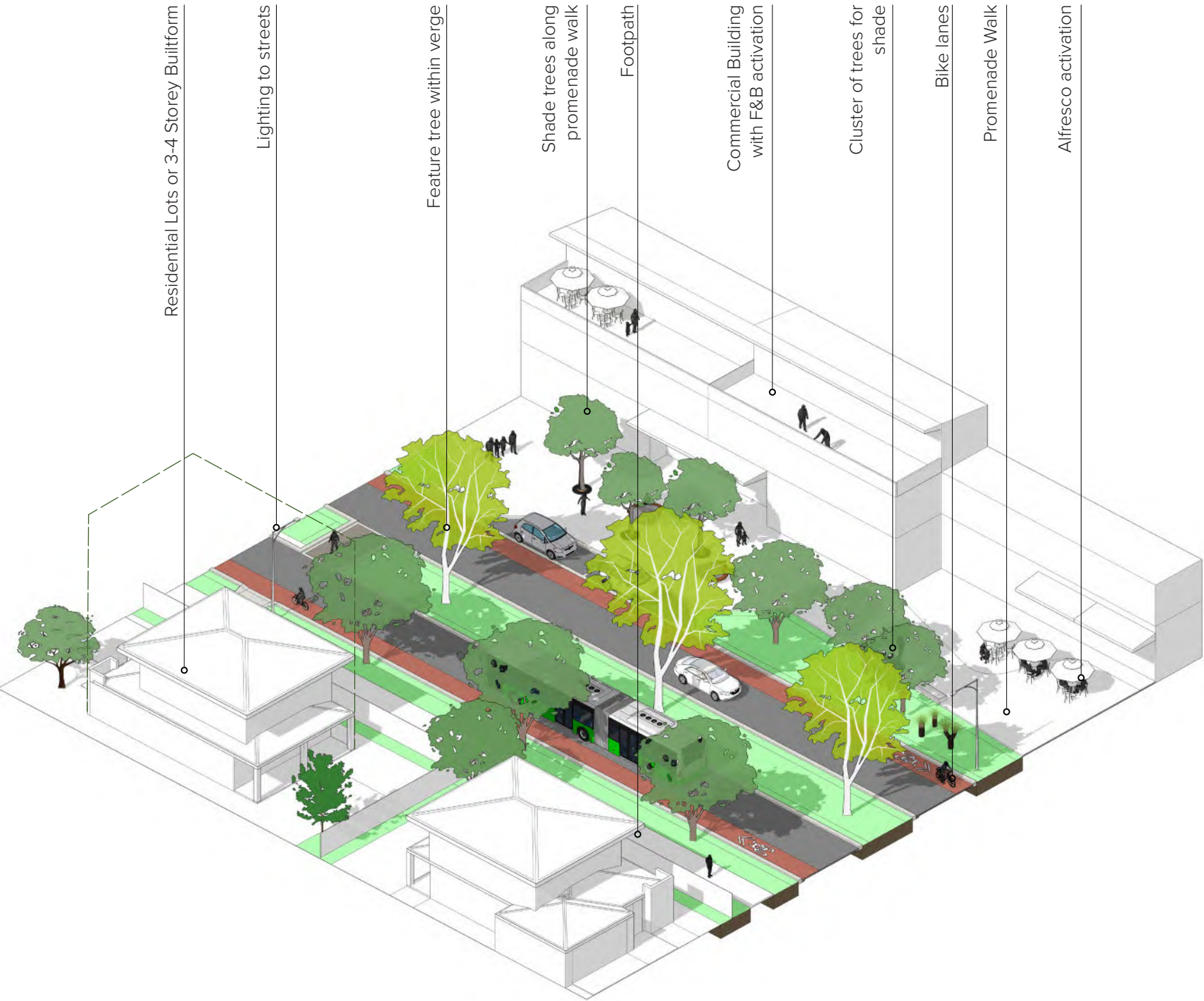
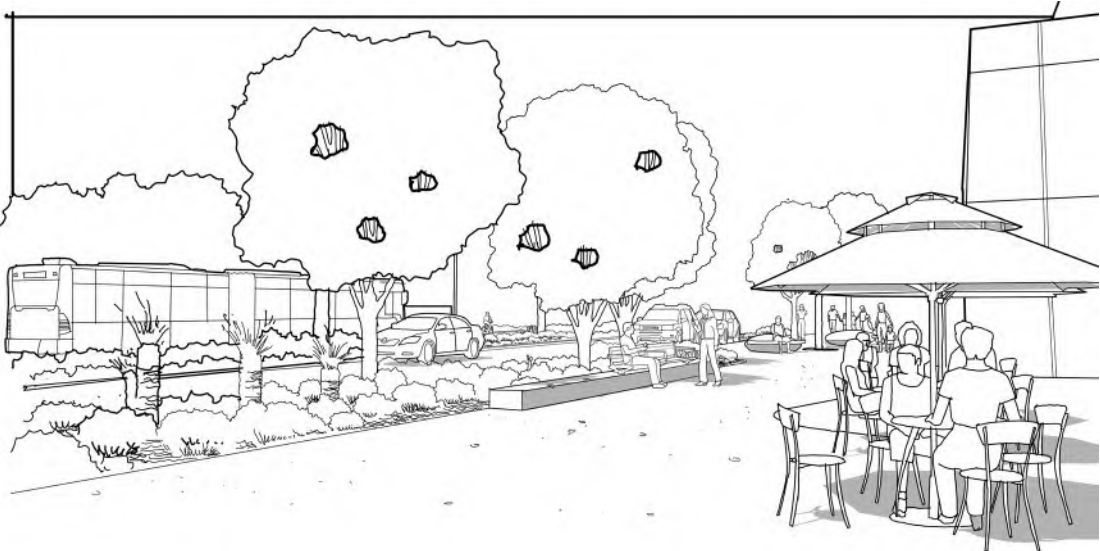


FIGURE 34



6.0 LANDSCAPE TYPOLOGIES

6.4.5 RESIDENTIAL STREETS - GREENLINKS

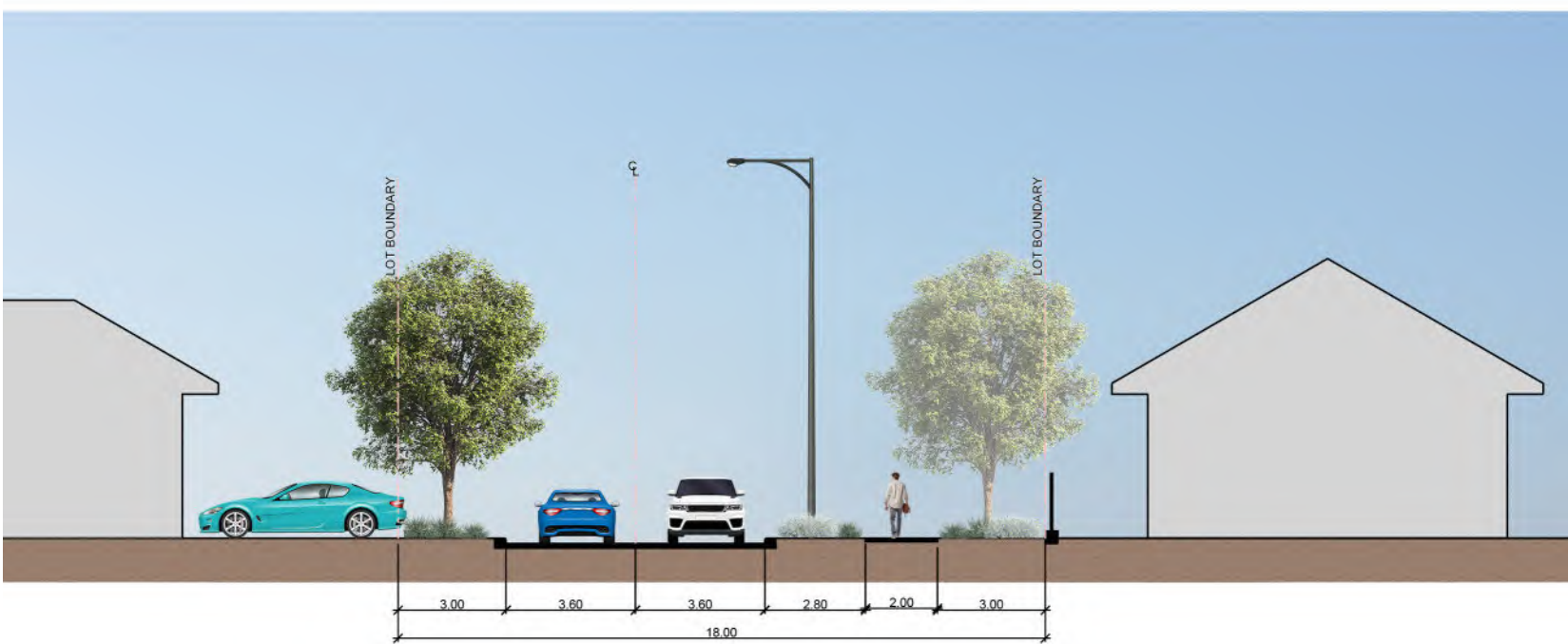


FIGURE 35

Widen Greenlink verge along side lots

NOTE : Landscape sections are only indicative. Final design of road cross sections will be determined during design development phase and engineer drawings and traffic management reports will take precedent.

Residential Streets - Greenlinks

- Road carriage to be 7.20 meters wide
- Wide verge to one side to allow for meandering path within clusters of shade trees
- Intimate seating nodes
- Street lighting
- Parklets to slow vehicle movement to create safer streets
- drainage to widen verge
- Cluster of assorted trees along median strip



6.0 LANDSCAPE TYPOLOGIES

6.4.5 RESIDENTIAL STREETS - GREENLINKS



FIGURE 36



FIGURE 30



6.0 LANDSCAPE TYPOLOGIES

6.4.5 RESIDENTIAL STREETS - GREENLINKS



FIGURE 37



6.0 LANDSCAPE TYPOLOGIES

6.4.6 RESIDENTIAL STREETS - TYPICAL

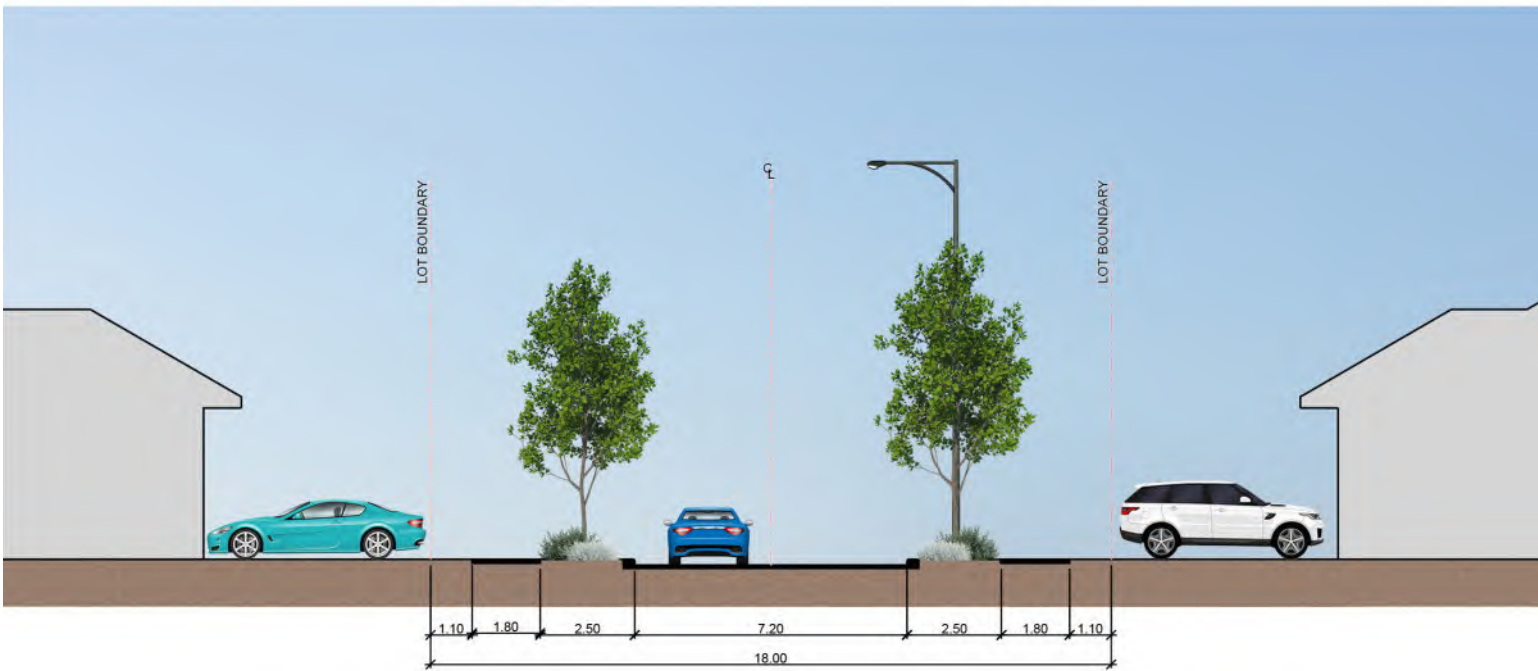


FIGURE 38
Residential Street - 18 metres wide

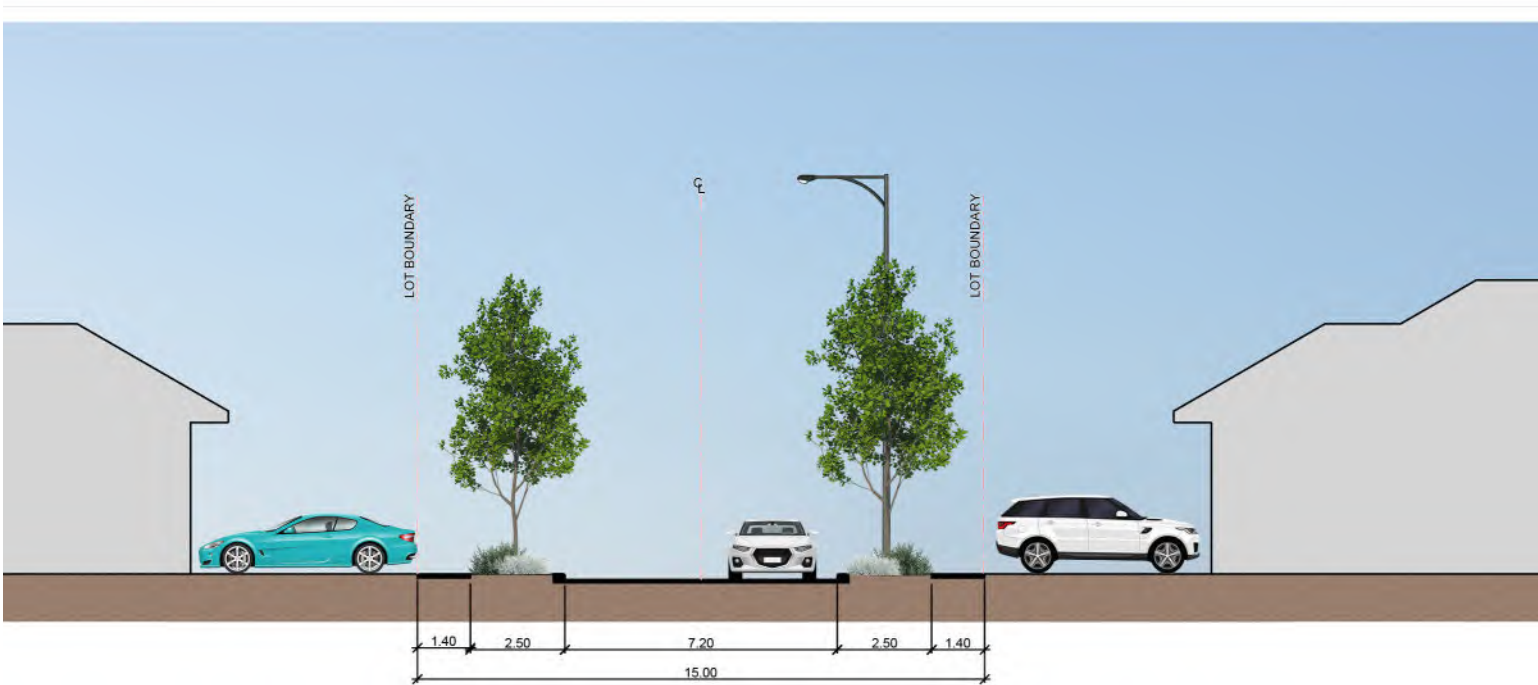


FIGURE 39
Residential Street - 15 metres wide

Residential Streets - Typical

- Road carriage to be 7.20 meters wide
- multi species trees to streets to create variety and colour
- Street lighting
- Parklets to slow vehicle movement to create safer streets
- drainage to widen verge
- footpaths to verge areas



6.0 LANDSCAPE TYPOLOGIES

6.4.6 RESIDENTIAL STREETS - PARKLETS STREET ENTRY



FIGURE 40

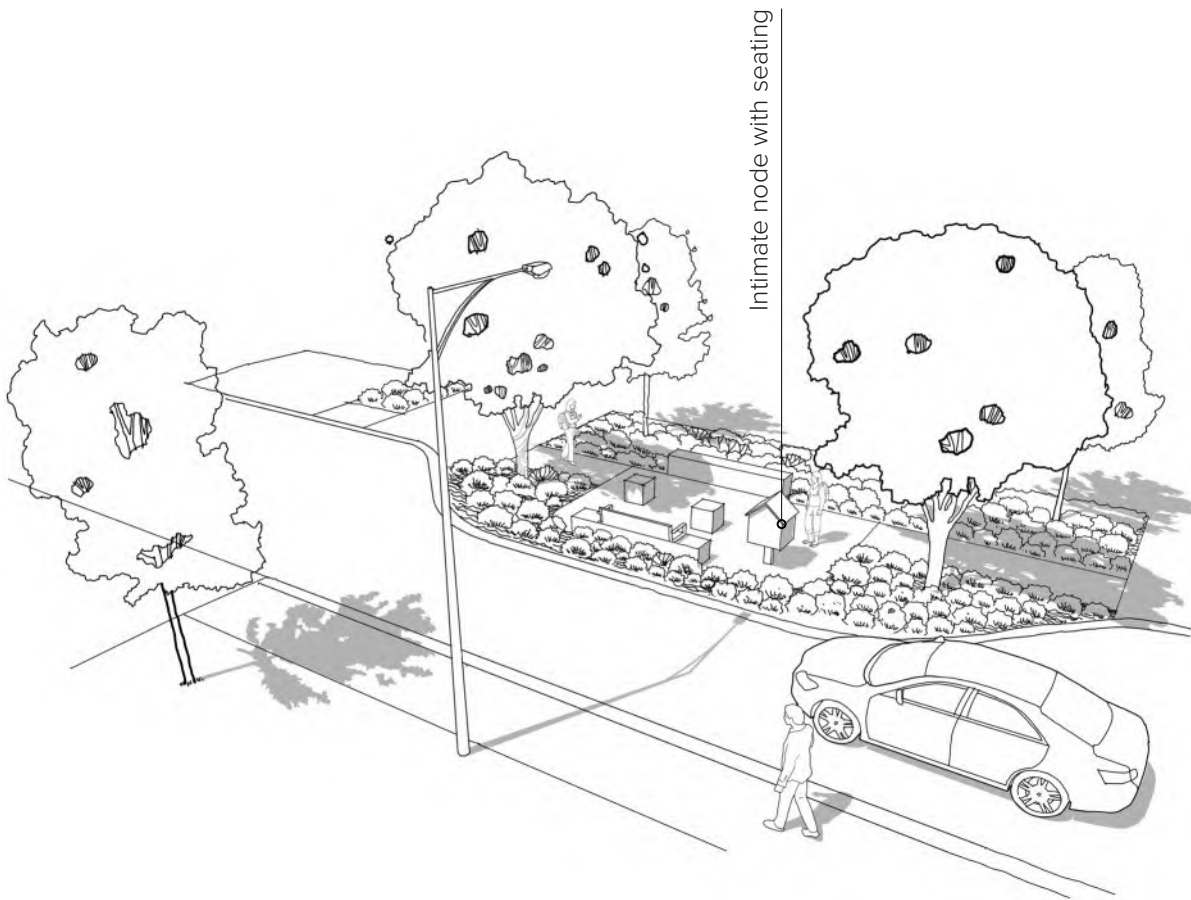


FIGURE 29



6.0 LANDSCAPE TYPOLOGIES

6.4.6 RESIDENTIAL STREETS - PARKLETS STREET ENTRY



FIGURE 41

6.0 LANDSCAPE TYPOLOGIES

6.4.6 RESIDENTIAL STREETS - PARKLETS STREET CENTRAL



FIGURE 42

7.0 PLANT PALETTE

DRAFT

7.1 TREE PALETTE

NATIVE TREES



Agonis flexuosa



Banksia attenuata



Banksia grandis



Banksia integrifolia



Banksia menziesii



Callistris preissii



Cupaniopsis anacardioides



Corymbia eximia Nana



Corymbia ficifolia



Eucalyptus drummondii



Eucalyptus gomphocephala



Eucalyptus tottiana



Eucalyptus utilis



Eucalyptus victrix



Ficus macrophylla



Hymenosporum flavum



Macrozamia riedei



Melaleuca lanceolata



Xanthorrhoea preissii

NONE NATIVE TREES



Elaeocarpus reticulatis



Metrosideros thomasi



Metrosideros excelsa



Olea europea



Pinus pinea



Plumeria species

7.0 PLANT PALETTE

DRAFT

7.2 SHRUB PALETTE

NATIVE SHRUBS



Acacia howittii
'Honey Bun'



Acacia cochlearis
'Rigid Wattle'



Acacia lasiocarpa
'Glow Wattle'



Acacia saligna prostrate
'Wattle'



Banksia blechnifolia
'Honey Baby'



Banksia sessilis
'Parrot Bush'



Conostylis candicans
'Cotton Heads'



Callistemon Little John
'Bottlebrush'



Calothamnus Emerald Carpet
'One Sided Bottlebrush'



Cycas revoluta
'Sago Palm'



Dianella caerulea
'Cassa Blue'



Dianella revoluta
'Seaspray'



Eremophila glabra
'Kalbarri Carpet'



Grevillea preissii
'Spider Net Grevillea'



Grevillea crithmifolia prostrate
'Grevillea'



Grevillea obtusifolia
'Gin Gin Gem'



Grevillea lanigera
'Mt Tamboritha'



Hemiandra pungens
'Snakebush'



Hibbertia racemosa
'Guinea Flower'



Hibbertia scandens
'Snake Vine'



Melaleuca nesophila
'Little Nessie'

NONE NATIVE SHRUBS



Myoporum insulare prostrate
'Boobialla'



Scaevola angustifolia
'Silky scaevola'



Westringea fruticosa
'Coastal rosemary'



Westringea damperii
'Shore westringia'



Melaleuca huegelii



Leucospermum cordifolium
'Pincushion'



Rapholepsis indica
'Indian Hawthorn'

7.0 PLANT PALETTE

7.3 IRRIGATION STRATEGY



FIGURE 43

POS 1	sqm
Irrigated Turf	925
Irrigated Shrub	1629
Unirrigated Conservation Bushland	0
Hardstand	882
Play / Active Area	510
Total Area	3496

POS 2	sqm
Irrigated Turf	6832
Irrigated Shrub	1689
Unirrigated Conservation Bushland	4000
Hardstand	3705
Play / Active Area	1967
Total Area	18193

POS 3	sqm
Irrigated Turf	1301
Irrigated Shrub	1447
Unirrigated Conservation Bushland	0
Hardstand	280
Play / Active Area	500
Total Area	3028

POS 4	sqm
Irrigated Turf	2790
Irrigated Shrub	3880
Unirrigated Conservation Bushland	16433
Hardstand	1530
Play / Active Area	800
Total Area	25433

POS 5	sqm
Irrigated Turf	2313
Irrigated Shrub	4978
Unirrigated Conservation Bushland	10179
Hardstand	1245
Play / Active Area	600
Total Area	19315

POS 6	sqm
Irrigated Turf	360
Irrigated Shrub	341
Unirrigated Conservation Bushland	0
Hardstand	229
Play / Active Area	0
Total Area	930

POS 7	sqm
Irrigated Turf	0
Irrigated Shrub	938
Unirrigated Conservation Bushland	0
Hardstand	457
Play / Active Area	0
Total Area	1395

POS 8	sqm
Irrigated Turf	1500
Irrigated Shrub	2000
Unirrigated Conservation Bushland	4500
Hardstand	1415
Play / Active Area	600
Total Area	10015

POS 9	sqm
Irrigated Turf	921
Irrigated Shrub	13355
Unirrigated Conservation Bushland	20208
Hardstand	1880
Play / Active Area	550
Total Area	36914

POS 10	sqm
Irrigated Turf	3885
Irrigated Shrub	7577
Unirrigated Conservation Bushland	21464
Hardstand	2171
Play / Active Area	1002
Total Area	36099

POS 11	sqm
Irrigated Turf	2547
Irrigated Shrub	482
Unirrigated Conservation Bushland	0
Hardstand	127
Play / Active Area	0
Total Area	3156

SPORTS FACILITIES	sqm
Irrigated Turf	43000
Irrigated Shrub	22170
Unirrigated Conservation Bushland	
Hardstand	15000
Play / Active Area	3000
Total Area	83170

APPENDIX D

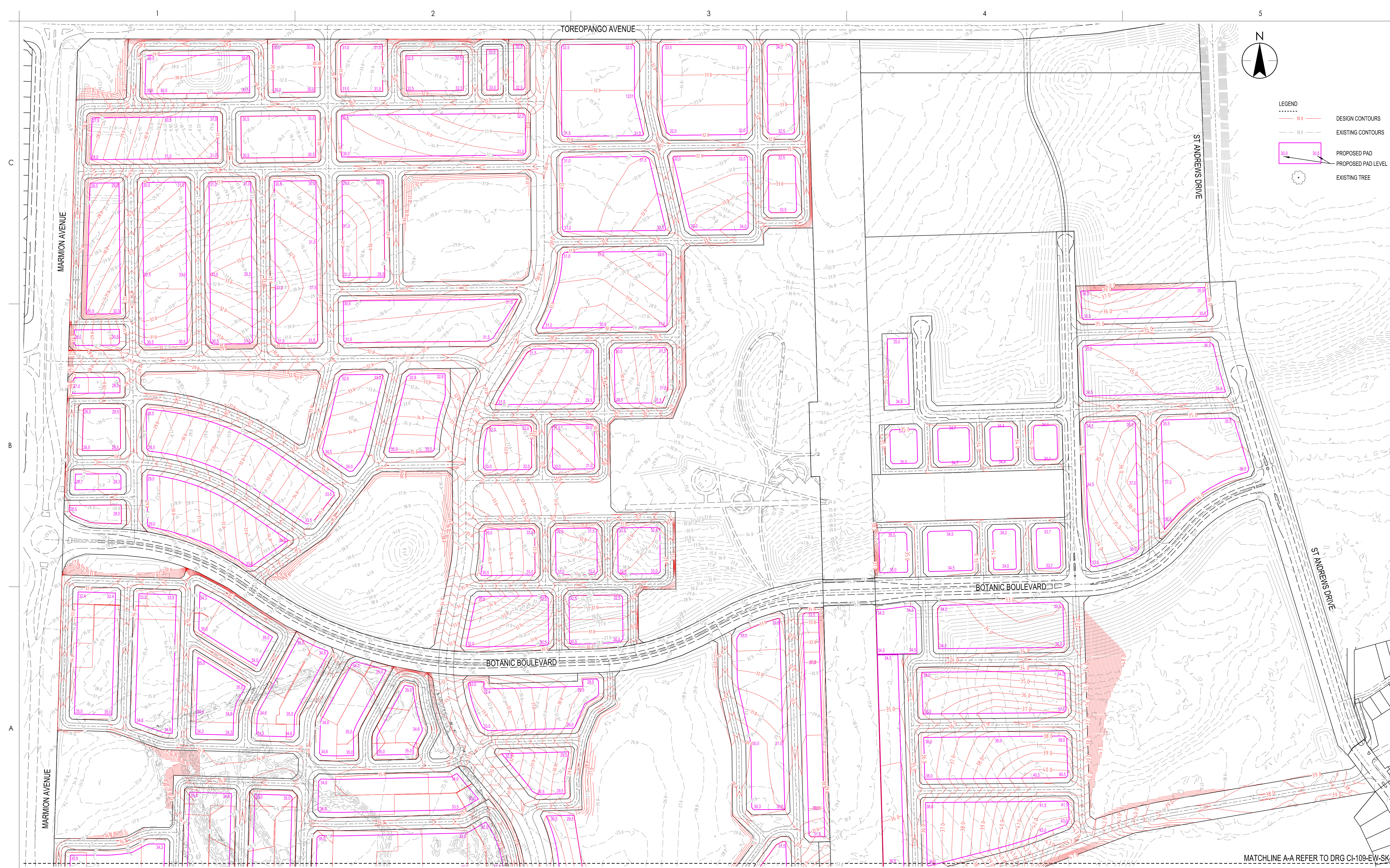
Yanchep Train Station Drainage Strategy (NEWest Alliance, 2020)



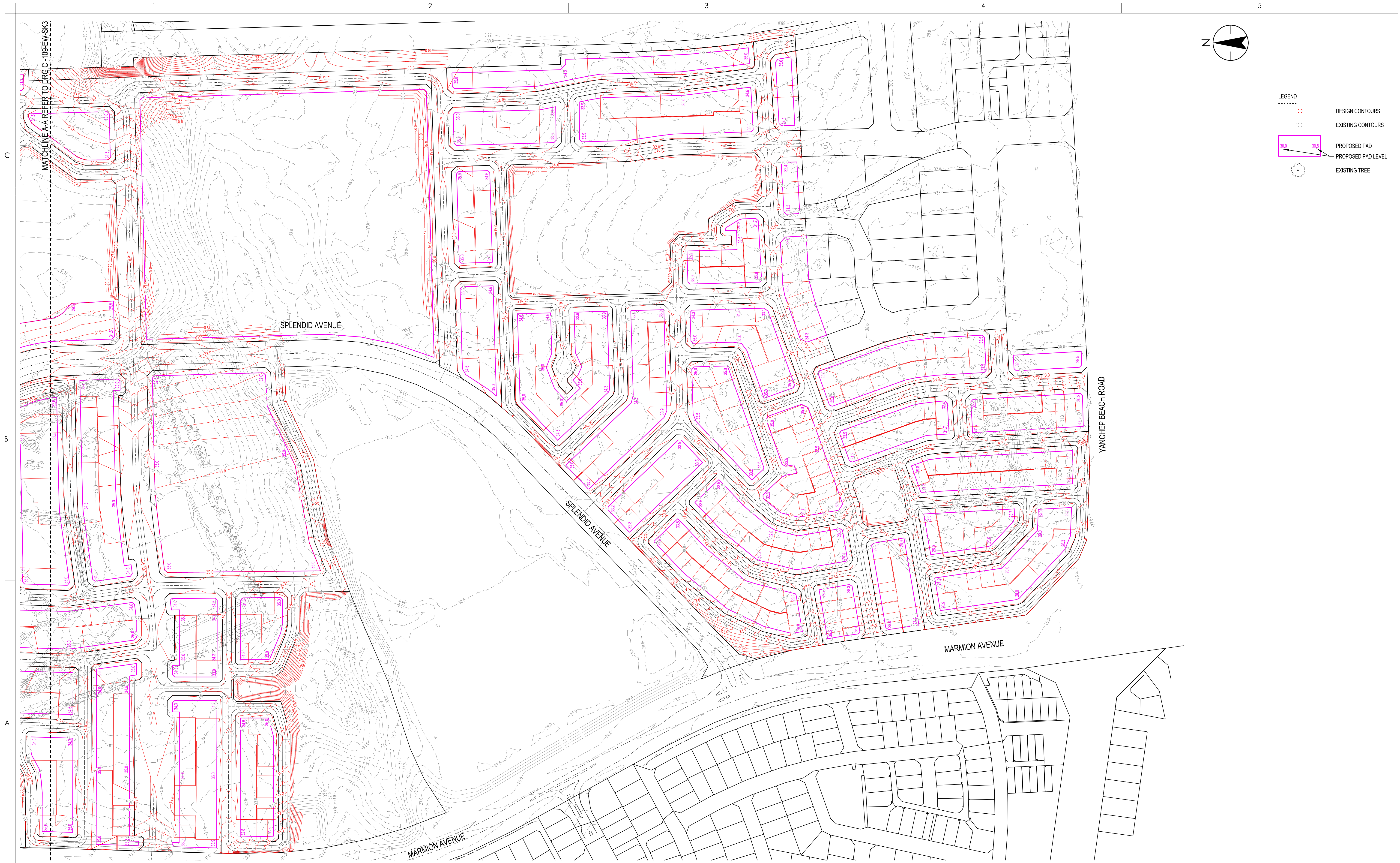
APPENDIX E

Engineering Drawings (Stantec, 2026)





Notes 1:2000 20 0 20 40 60 80 100 150 A1 1:4000 A3	Issue Status PRELIMINARY NOT FOR CONSTRUCTION This document is suitable only for the purpose noted above. Use of this document for any other purpose is not permitted.	Colour Disclaimer This drawing has been documented in colour. This drawing is required to be printed in colour. Failure to do so may result in loss of information. Black and white printing may be used if specific black and white documents have been obtained from Stantec. Notes	Client/Project Logo Stantec Stantec Australia Pty. Ltd. Ground Floor 224 Adelaide Terrace Perth, WA 6000 Tel: +61 8 6222 7000 Copyright Reserved The Copyright to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorised by Stantec is forbidden. The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.	Client/Project CLE YANCHEP PSP YANCHEP CITY CENTRE File Name: C SKETCH EARTHWORKS.DGN	Client/Project CLE YANCHEP PSP YANCHEP CITY CENTRE File Name: C SKETCH EARTHWORKS.DGN	Title EARTHWORKS SKETCH SHEET 1 OF 2 Project No. 304770604 WAPC No. - Scale 1:2000 @ A1 Revision A Drawing No. CI-109-EW-SK3
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Notes 1:2000 20 0 20 40 60 80 100 120 A1 1:4000 A3	A PRELIMINARY ISSUE Issued/Revision	KU By Appd YYYY.MM.DD	Issue Status PRELIMINARY NOT FOR CONSTRUCTION This document is suitable only for the purpose noted above. Use of this document for any other purpose is not permitted.	Colour Disclaimer This drawing has been documented in colour. This drawing is required to be printed in colour. Failure to do so may result in loss of information. Black and white printing may be used if specific black and white documents have been obtained from Stantec. Notes	Stantec Stantec Australia Pty. Ltd. Ground Floor 224 Adelaide Terrace Perth, WA 6000 Tel: +61 8 6222 7000 Copyright Reserved The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorised by Stantec is forbidden. The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.	Client/Project Logo Client/Project CLE YANCHEP PSP YANCHEP CITY CENTRE File Name: C SKETCH EARTHWORKS.DGN Dwn. Dsign. Chkd. YYYY.MM.DD	Client/Project CLE YANCHEP PSP YANCHEP CITY CENTRE File Name: C SKETCH EARTHWORKS.DGN Dwn. Dsign. Chkd. YYYY.MM.DD	Title EARTHWORKS SKETCH SHEET 2 OF 2 Project No. 304770604 Revision A WAPC No. - Drawing No. CI-109-EW-SK4 Scale 1:2000 @ A1

APPENDIX F

UNDO Nutrient Modelling Outputs





Project: AVH1022: Yanchep Town Centre - Pre-Development Date: 02 June, 2026

Subregion : Study Area				Area : 210 ha
Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	7.00	14.70	281.4	63.21
Rural living	0.00	0.00	0.0	0.00
Public Open Space	93.00	195.30	1,015.6	8.79
Road reserve	0.00	0.00	0.0	0.00
2,395.2 (kg/yr) Nitrogen input 103.50 (kg/yr) Phosphorus input 195.9 (kg/yr) Nitrogen export 0.69 (kg/yr) Phosphorus export				

Landuse	Percent (%)	Area (ha)
Light Industrial	60.00	8.82
Heavy Industrial	0.00	0.00
Commercial / Offices	0.00	0.00
Schools	0.00	0.00
Public buildings	40.00	5.88
Nitrogen input(kg/yr)		281.4
Phosphorus input(kg/yr)		63.21

Landuse	Percent (%)	Area (ha)
Native gardens	5.00	9.77
Non-native gardens	0.00	0.00
Not fertilised	0.00	0.00
Nature	95.00	185.54
Sport	0.00	0.00
Recreation	0.00	0.00
Golf course	0.00	0.00
Bowling green	0.00	0.00
Impervious	0.00	0.00
Water body	0.00	0.00

Nitrogen input(kg/yr) 1,015.6

Phosphorus input(kg/yr) 8.79

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	Does subregion contain onsite sewage disposal system? No
Depth to groundwater	10	
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Summary : Nutrient stripping devices

Treatment	Name	Size (m2)	Treated area (ha)	Treating	N removed (kg/ha/yr)	P removed (kg/ha/yr)
Load removed (kg/yr)					0.0	0.00
Net export (kg/yr)					195.9	0.69

Summary : Nutrient load exports

Region	Area (ha)	N export (kg/yr)	P export (kg/yr)
Study Area	210	195.9	0.69

Pre-treatment load		Load removed		Net load export	
195.9 (kg/yr) Nitrogen	0.69 (kg/yr) Phosphorus	0.0 (kg/yr) Nitrogen	0.00 (kg/yr) Phosphorus	195.9 (kg/yr) Nitrogen	0.69 (kg/yr) Phosphorus



Project: AVH1022: Yanchep Town Centre - Post-Development

Date: 02 June, 2026

Subregion : Residential

Area : 45.192 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	100.00	45.19	1,776.8	480.46
Industrial, commercial & schools	0.00	0.00	0.0	0.00
Rural living	0.00	0.00	0.0	0.00
Public Open Space	0.00	0.00	0.0	0.00
Road reserve	0.00	0.00	0.0	0.00

2,013.1
(kg/yr)
Nitrogen input

487.24
(kg/yr)
Phosphorus input

164.6
(kg/yr)
Nitrogen export

3.26
(kg/yr)
Phosphorus export

Size (m ²)	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
<400 m ²	64.00	28.92	679.5	199.06
400-500 m ²	34.00	15.37	1,008.1	257.54
501-600 m ²	2.00	0.90	89.2	23.86
601-730 m ²	0.00	0.00	0.0	0.00
>730 m ²	0.00	0.00	0.0	0.00
Multiple dwellings	0.00	0.00	0.0	0.00

Nitrogen input(kg/yr) 1,776.8

Phosphorus input(kg/yr) 480.46

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	
Depth to groundwater	10	Does subregion contain onsite sewage disposal system? No
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : Commercial/Service Commercial**Area : 18.543 ha**

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	100.00	18.54	393.1	90.77
Rural living	0.00	0.00	0.0	0.00
Public Open Space	0.00	0.00	0.0	0.00
Road reserve	0.00	0.00	0.0	0.00

490.0

(kg/yr)

Nitrogen input

93.55

(kg/yr)

Phosphorus input

40.1

(kg/yr)

Nitrogen export

0.63

(kg/yr)

Phosphorus export

Landuse	Percent (%)	Area (ha)
Light Industrial	43.00	7.97
Heavy Industrial	0.00	0.00
Commercial / Offices	57.00	10.57
Schools	0.00	0.00
Public buildings	0.00	0.00

Nitrogen input(kg/yr)

393.1

Phosphorus input(kg/yr)

90.77

Soil and drainage information

Type of drainage

InfiltrationDoes it contain imported fill? **No**

Soil type

Quindalup Dune

Depth to groundwater

10

Groundwater slope (%)

0.2

Soil PRI

12.235Does subregion contain onsite sewage disposal system? **No**

Subregion : Mixed Use
Area : 28.74900000000002 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	70.00	20.12	402.9	113.50
Industrial, commercial & schools	0.00	0.00	0.0	0.00
Rural living	0.00	0.00	0.0	0.00
Public Open Space	30.00	8.62	465.7	27.04
Road reserve	0.00	0.00	0.0	0.00

1,019.0
(kg/yr)
Nitrogen input

144.85
(kg/yr)
Phosphorus input

83.3
(kg/yr)
Nitrogen export

0.97
(kg/yr)
Phosphorus export

Size (m ²)	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
<400 m ²	0.00	0.00	0.0	0.00
400-500 m ²	0.00	0.00	0.0	0.00
501-600 m ²	0.00	0.00	0.0	0.00
601-730 m ²	0.00	0.00	0.0	0.00
>730 m ²	0.00	0.00	0.0	0.00
Multiple dwellings	100.00	20.12	402.9	113.50

Nitrogen input(kg/yr) 402.9

Phosphorus input(kg/yr) 113.50

Landuse	Percent (%)	Area (ha)
Native gardens	15.00	1.29
Non-native gardens	0.00	0.00
Not fertilised	0.00	0.00
Nature	0.00	0.00
Sport	40.00	3.45
Recreation	30.00	2.59
Golf course	0.00	0.00
Bowling green	0.00	0.00
Impervious	15.00	1.29
Water body	0.00	0.00

Nitrogen input(kg/yr) 465.7

Phosphorus input(kg/yr) 27.04

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	Does subregion contain onsite sewage disposal system? No
Depth to groundwater	10	
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : School

Area : 14.027999999999999 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	100.00	14.03	1,416.8	281.96
Rural living	0.00	0.00	0.0	0.00
Public Open Space	0.00	0.00	0.0	0.00
Road reserve	0.00	0.00	0.0	0.00

1,490.2
(kg/yr)
Nitrogen input

284.07
(kg/yr)
Phosphorus input

123.8
(kg/yr)
Nitrogen export

1.90
(kg/yr)
Phosphorus export

Landuse	Percent (%)	Area (ha)
Light Industrial	0.00	0.00
Heavy Industrial	0.00	0.00
Commercial / Offices	0.00	0.00
Schools	100.00	14.03
Public buildings	0.00	0.00

Nitrogen input(kg/yr) 1,416.8

Phosphorus input(kg/yr) 281.96

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	Does subregion contain onsite sewage disposal system? No
Depth to groundwater	10	
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : Botanic Garden

Area : 11.907 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	0.00	0.00	0.0	0.00
Rural living	0.00	0.00	0.0	0.00
Public Open Space	100.00	11.91	271.5	8.57
Road reserve	0.00	0.00	0.0	0.00

333.8

(kg/yr)

Nitrogen input

10.36

(kg/yr)

Phosphorus input

28.2

(kg/yr)

Nitrogen export

0.07

(kg/yr)

Phosphorus export

Landuse	Percent (%)	Area (ha)
Native gardens	80.00	9.53
Non-native gardens	0.00	0.00
Not fertilised	0.00	0.00
Nature	10.00	1.19
Sport	0.00	0.00
Recreation	0.00	0.00
Golf course	0.00	0.00
Bowling green	0.00	0.00
Impervious	10.00	1.19
Water body	0.00	0.00

Nitrogen input(kg/yr) 271.5

Phosphorus input(kg/yr) 8.57

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	Does subregion contain onsite sewage disposal system? No
Depth to groundwater	10	
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : Public Open Space

Area : 15.855 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	0.00	0.00	0.0	0.00
Rural living	0.00	0.00	0.0	0.00
Public Open Space	100.00	15.86	512.1	16.17
Road reserve	0.00	0.00	0.0	0.00

595.0

(kg/yr)

Nitrogen input

18.55

(kg/yr)

Phosphorus input

48.7

(kg/yr)

Nitrogen export

0.12

(kg/yr)

Phosphorus export

Landuse	Percent (%)	Area (ha)
Native gardens	80.00	12.68
Non-native gardens	0.00	0.00
Not fertilised	0.00	0.00
Nature	0.00	0.00
Sport	0.00	0.00
Recreation	15.00	2.38
Golf course	0.00	0.00
Bowling green	0.00	0.00
Impervious	5.00	0.79
Water body	0.00	0.00

Nitrogen input(kg/yr) 512.1

Phosphorus input(kg/yr) 16.17

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	
Depth to groundwater	10	Does subregion contain onsite sewage disposal system? No
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : Road Reserve

Area : 56.153999999999996 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	0.00	0.00	0.0	0.00
Rural living	0.00	0.00	0.0	0.00
Public Open Space	0.00	0.00	0.0	0.00
Road reserve	100.00	56.15	853.0	156.84

1,146.7
(kg/yr)
Nitrogen input

165.26
(kg/yr)
Phosphorus input

70.4
(kg/yr)
Nitrogen export

7.73
(kg/yr)
Phosphorus export

Landuse	Percent (%)	Area (ha)
Roads	70.00	39.31
Road reserve - impervious	0.00	0.00
Road reserve - native garden	10.00	5.62
Road reserve - non-native garden	10.00	5.62
Road reserve - turf	10.00	5.62
Road reserve - not fertilised	0.00	0.00

Nitrogen input(kg/yr) 853.0

Phosphorus input(kg/yr) 156.84

Soil and drainage information

Type of drainage	Piped drainage	Does it contain imported fill? No
Soil type	Quindalup Dune	Does subregion contain onsite sewage disposal system? No
Depth to groundwater	10	
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : PTA Land

Area : 3.255 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	0.00	0.00	0.0	0.00
Rural living	0.00	0.00	0.0	0.00
Public Open Space	100.00	3.26	13.0	0.00
Road reserve	0.00	0.00	0.0	0.00

30.0
(kg/yr)
Nitrogen input

0.49
(kg/yr)
Phosphorus input

2.8
(kg/yr)
Nitrogen export

0.00
(kg/yr)
Phosphorus export

Landuse	Percent (%)	Area (ha)
Native gardens	0.00	0.00
Non-native gardens	0.00	0.00
Not fertilised	0.00	0.00
Nature	100.00	3.26
Sport	0.00	0.00
Recreation	0.00	0.00
Golf course	0.00	0.00
Bowling green	0.00	0.00
Impervious	0.00	0.00
Water body	0.00	0.00

Nitrogen input(kg/yr) 13.0

Phosphorus input(kg/yr) 0.00

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	Does subregion contain onsite sewage disposal system? No
Depth to groundwater	10	
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : DFES Land

Area : 0.609 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	100.00	0.61	16.1	3.90
Rural living	0.00	0.00	0.0	0.00
Public Open Space	0.00	0.00	0.0	0.00
Road reserve	0.00	0.00	0.0	0.00

19.3
(kg/yr)
Nitrogen input

3.99
(kg/yr)
Phosphorus input

1.9
(kg/yr)
Nitrogen export

0.03
(kg/yr)
Phosphorus export

Landuse	Percent (%)	Area (ha)
Light Industrial	0.00	0.00
Heavy Industrial	0.00	0.00
Commercial / Offices	0.00	0.00
Schools	0.00	0.00
Public buildings	100.00	0.61

Nitrogen input(kg/yr) 16.1

Phosphorus input(kg/yr) 3.90

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	Does subregion contain onsite sewage disposal system? No
Depth to groundwater	10	
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Subregion : WAPC Land

Area : 15.70800000000002 ha

Landuse	Percent (%)	Area (ha)	Nitrogen (kg)	Phosphorus (kg)
Residential	0.00	0.00	0.0	0.00
Industrial, commercial & schools	80.00	12.57	331.8	80.42
Rural living	0.00	0.00	0.0	0.00
Public Open Space	20.00	3.14	35.2	0.85
Road reserve	0.00	0.00	0.0	0.00

449.1
(kg/yr)
Nitrogen input

83.63
(kg/yr)
Phosphorus input

36.8
(kg/yr)
Nitrogen export

0.56
(kg/yr)
Phosphorus export

Landuse	Percent (%)	Area (ha)
Light Industrial	0.00	0.00
Heavy Industrial	0.00	0.00
Commercial / Offices	0.00	0.00
Schools	0.00	0.00
Public buildings	100.00	12.57

Nitrogen input(kg/yr) 331.8

Phosphorus input(kg/yr) 80.42

Landuse	Percent (%)	Area (ha)
Native gardens	30.00	0.94
Non-native gardens	0.00	0.00
Not fertilised	0.00	0.00
Nature	70.00	2.20
Sport	0.00	0.00
Recreation	0.00	0.00
Golf course	0.00	0.00
Bowling green	0.00	0.00
Impervious	0.00	0.00
Water body	0.00	0.00

Nitrogen input(kg/yr) 35.2

Phosphorus input(kg/yr) 0.85

Soil and drainage information

Type of drainage	Infiltration	Does it contain imported fill? No
Soil type	Quindalup Dune	
Depth to groundwater	10	Does subregion contain onsite sewage disposal system? No
Groundwater slope (%)	0.2	
Soil PRI	12.235	

Summary : Nutrient stripping devices

Treatment	Name	Size (m2)	Treated area (ha)	Treating	N removed (kg/ha/yr)	P removed (kg/ha/yr)
Biofilter	Small Event (first 15 mm) treatment	11230	56.15	Sandy soils - Runoff only (infiltration on lots)	13.8	1.85
Detention infiltration basin	Minor/Major FMAs	20635	56.15	Sandy soils - Runoff only (infiltration on lots)	2.0	0.13
Load removed (kg/yr)					15.8	1.98
Net export (kg/yr)					584.8	13.28

Summary : Nutrient load exports

Region	Area (ha)	N export (kg/yr)	P export (kg/yr)
Residential	45.192	164.6	3.26
Commercial/Service Commercial	18.543	40.1	0.63
Mixed Use	28.749000000000002	83.3	0.97
School	14.027999999999999	123.8	1.90
Botanic Garden	11.907	28.2	0.07
Public Open Space	15.855	48.7	0.12
Road Reserve	56.153999999999996	70.4	7.73
PTA Land	3.255	2.8	0.00
DFES Land	0.609	1.9	0.03
WAPC Land	15.708000000000002	36.8	0.56

Pre-treatment load

Load removed

Net load export

600.6

(kg/yr)

Nitrogen

15.26

(kg/yr)

Phosphorus

15.8

(kg/yr)

Nitrogen

1.98

(kg/yr)

Phosphorus

584.8

(kg/yr)

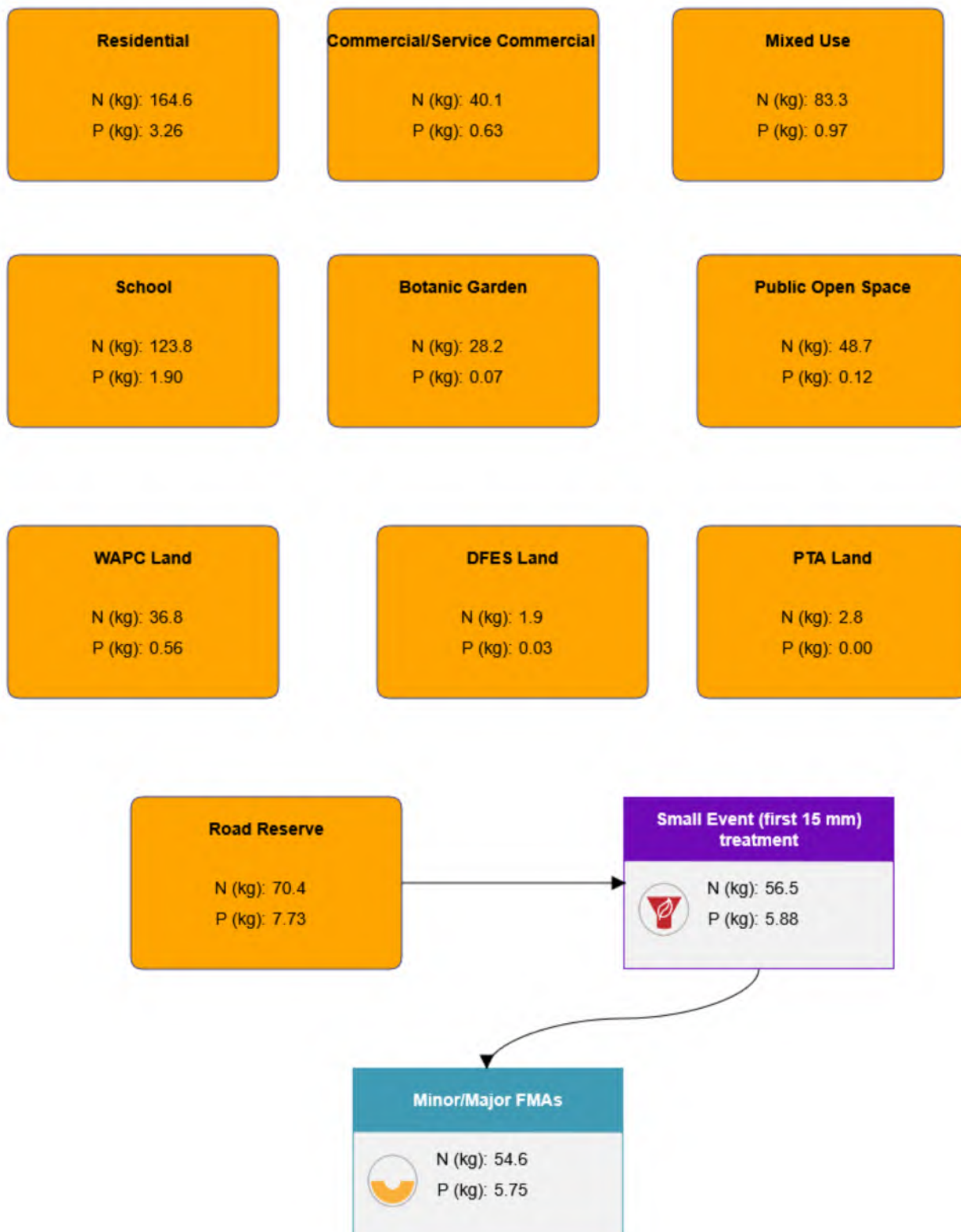
Nitrogen

13.28

(kg/yr)

Phosphorus

Treatment Diagram





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