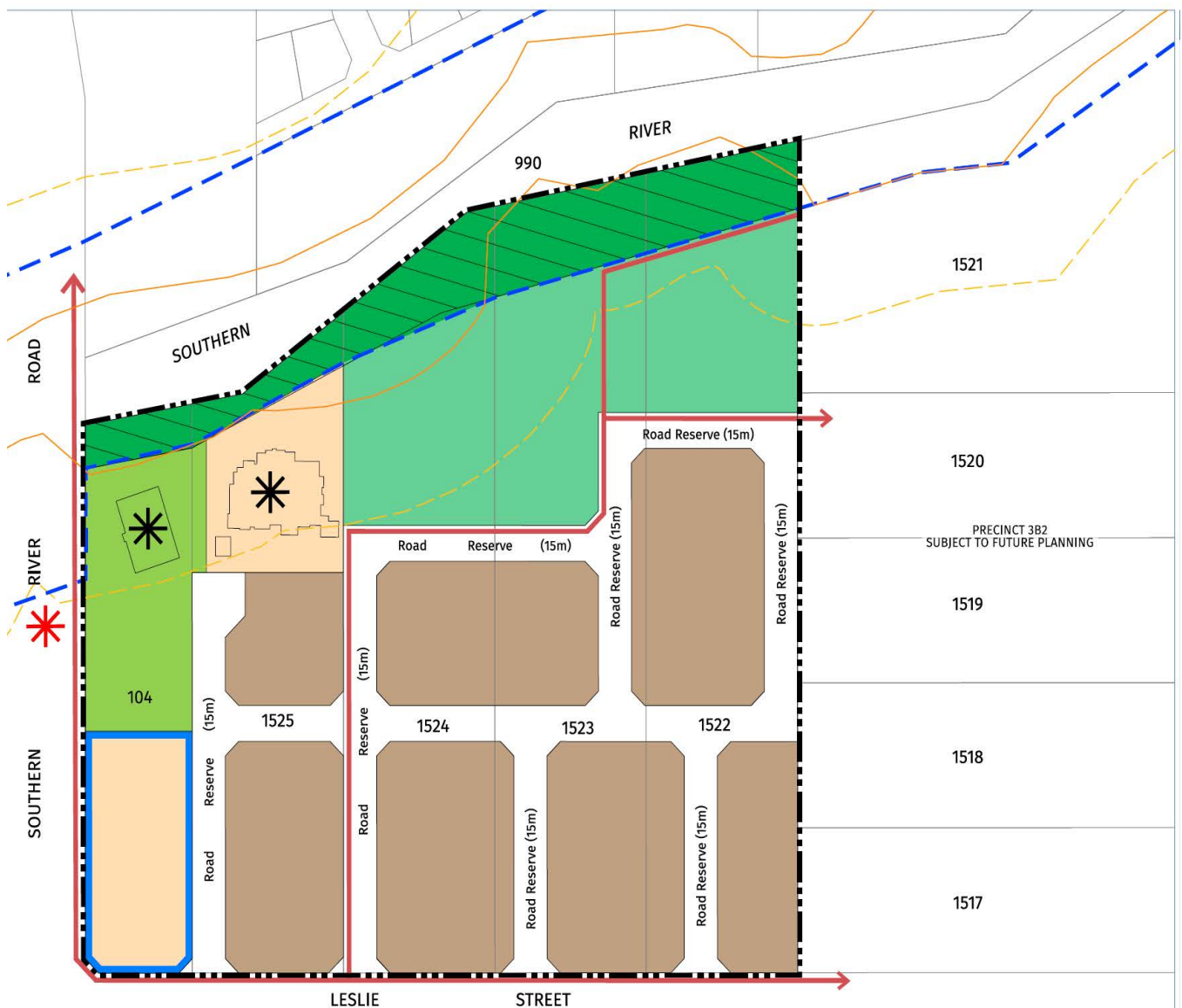




DOCUMENT CONTROL

CONTROL VERSION	DATE	STATUS	DISTRIBUTION	COMMENT
A	28.11.2022	Draft	Internal	QA
B	12.12.2022	Draft	Client	Review
C	16.12.2022	Final	Local Government	Lodgement
D	28.05.2024	Final	Local Government	Updated for Lodgement
E	24.12.2024	Final	Local Government	Updated based on Comments
F	19.02.2025	Final	Local Government	Updated based on Comments
G	24.06.2026	Final	Local Government	Updated to include modifications

Prepared for:	Auswide International Investments	Date:	24 June 2026
Prepared by:	JS	Job No:	HD 22377
Reviewed by:	CP	Ref:	22377 – LSP – Version G

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ENDORSEMENT PAGE

This Structure Plan is prepared under the provisions of the City of Gosnells
Local Planning Scheme No.6

IT IS CERTIFIED THAT THIS STRUCTURE PLAN
WAS APPROVED BY RESOLUTION OF
THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

.....30 June 2026..... Date

Signed for and on behalf of the Western Australian Planning Commission:

..........

An officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005* for that purpose, in the presence of:

.....*Anne Woodin*..... Witness

02 JULY 2026

Date

02 JULY 2036

Date of Expiry



TABLE OF AMENDMENT(S)

AMENDMENT NO.	SUMMARY OF AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC



EXECUTIVE SUMMARY

This Structure Plan has been prepared for the various landholdings in Southern River Precinct 3B1 in response to the Schedule of Modifications received from the Western Australian Planning Commission (WAPC) for the Southern River Precinct 3B Local Structure Plan (SPN/2164) (see **Appendix A**). The amended Structure Plan area is approximately 9.4434ha and consists of Lots 104, 1525, 1524, 1523, and 1522 Leslie Street, Southern River. The Structure Plan area includes approximately 0.8665 hectares of MRS 'Parks & Recreation' regional reservation along the banks of Southern River. The subject area is situated approximately 22km south-east of the Perth CBD and 4km south west of the Gosnells City Centre. The Structure Plan provides the rationale, justification and planning framework to guide and facilitate the development of the subject land for urban purposes and has been prepared in accordance with the provisions of the City of Gosnells Local Planning Scheme No. 6 (LPS 6). This Structure Plan also forms part of a request to lift the MRS Urban Deferment over the subject area, in addition to a concurrent local planning scheme amendment to 'Residential Development' zone. This Structure Plan demonstrates that the subject land can be developed for the urban land use consistent with current planning framework.

The Structure Plan has been prepared on the basis of Urban Deferred zoning, as designated under the Metropolitan Region Scheme. The Structure Plan area is part of the broader precinct 3B and is situated opposite the Southern River Precinct 3A Structure Plan.

The Structure Plan Summary Table below details the nature and key outcomes of the Structure Plan.

Item	Data	Structure Plan Ref (section no.)
Total area covered by the Structure Plan	9.4434ha	Part 1 Section 1
Area of each land use proposed: Residential	3.9973 ha	Part 3 Section 3.4
Total estimated lot yield	117 lots	Part 3 Section 3.4
Estimated number of dwellings	117	Part 3 Section 3.4
Estimated residential site density	12.39 dwellings per site hectare	Part 3 Section 3.4
Local centre	4817m ²	Part 3 Section 3.5
Private clubs, institutions and places of worship	5830m ²	Part 3 Section 3.6
Parks and Recreation Local open space	1.8186 ha 0.7305 ha	Part 3 Section 3.2

TABLE 1 – STRUCTURE PLAN SUMMARY TABLE



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PART ONE - IMPLEMENTATION



1 STRUCTURE PLAN AREA

This Structure Plan shall apply to Lots 104, 1525, 1524, 1523 and 1522 Leslie Street, Southern River being the land contained within the inner edge of the line denoting the Structure Plan Map (**Plan 1**).

2 OPERATION

The date the Structure Plan comes into effect is the date that it is approved by the WAPC.

3 STAGING

The Structure Plan is likely to be developed in stages according to market demand. There are no specific triggers for staging of development. Servicing will be extended with each of the individual stages of development.

4 SUBDIVISION AND DEVELOPMENT REQUIREMENTS

4.1	Residential Density	Residential densities applicable to the Structure Plan Area shall be as shown on the Structure Plan Map. Subdivision and development within the Structure Plan is generally to achieve a minimum dwelling density target of 12.89 dwellings per site hectare.
4.2	Land Use Permissibility	Land use permissibility within the Structure Plan area shall be generally in accordance with the corresponding zone or reserve under Local Planning Scheme No. 24 (LPS 24).
4.3	Public Open Space	A minimum of 10% public open space in accordance with WAPC Liveable Neighbourhoods is required at the time of subdivision and/or development. The location for public open space is shown on the Structure Plan map. The final design of the public open space is subject to detailed subdivision design.
4.4	Local Development Plans	It is not necessary to prepare a Local Development Plan as no lots are proposed directly adjacent to public open space.
4.5	Development Contributions	The landholdings within the Structure Plan are subject to the City of Gosnells LPS 24 Schedule B Special Control Area No.2 - Development Contribution Areas (SCA2).
4.6	Notifications on Title	For applications for subdivision of land, the City of Gosnells shall recommend to the Western Australian Planning Commission that a condition be imposed for a notification to be placed on the Certificate of Title(s) to advise of the following: i) A notification, pursuant to Section 165 of the Planning and Development Act 2005, is to be placed on the Certificate(s) of Title of the proposed lot(s) with a Bushfire Attack Level (BAL) rating of 12.5 or higher, advising of the existence of a bushfire hazard.
4.7	Local Centre	The permissible land uses within the northern portion of the Local Centre on Lot 104 as show on the Structure Plan Map, is to be restricted to the following use classes: – Place of Worship – Club Premises



		– Child Care Premises – Educational Establishment – Single Dwelling – Grouped Dwelling – Consulting Rooms – Office <u>Other Requirements</u> If required by the City of Gosnells or WAPC, a Local Development Plan shall be prepared in respect of the Local Centre which shall address: – Use Class(s); – Vehicular access & car parking; – Orientation of development; – Landscaping; – Retail Floor Space; and – Design of buildings. The maximum amount of Planning Land Use Categories 5 (PLUC 5) shop/retail floor space shall be limited to 600m² NLA. Should a Local Development Plan or development application propose PLUC 5 shop/retail floor space in excess of 600m², a Retail Sustainability Assessment shall be provided to support the variation and approval shall be at the discretion of the City of Gosnells.
4.8	Further Studies Required	Prior to commencement of subdivision and/or development, the City of Gosnells will require the preparation and approval of the following: – Wetland and Conservation Management Plans; – Urban Water Management Plan; – Landscape Management Plan;

PLAN 1 – STRUCTURE PLAN MAP

PART TWO - EXPLANATORY REPORT



1 PLANNING BACKGROUND

1.1 INTRODUCTION AND PURPOSE

This Structure Plan has been prepared in accordance with Regulation 15 of the *Planning and Development (Local Planning Schemes) Regulations 2015* ('the Regulations'), to guide future subdivision and development. The Structure Plan has also been prepared in accordance with the Schedule of Modifications received from the Western Australian Planning Commission (WAPC) for the Southern River Precinct 3B Local Structure Plan (SPN/2164) (see **Appendix A**).

The Structure Plan has been prepared by Harley Dykstra on behalf of Auswide International Investments to support the lifting of Urban Deferment under the Metropolitan Region Scheme that currently applies to the structure plan area. The ultimate objective of this proposal is to facilitate the subdivision and development of the land primarily for residential purposes.

The Structure Plan provides a Statutory Planning Framework to guide the future development of the land, as required by Part 3 of LPS 24 for land zoned Urban Development. The intended land uses within the proposed Structure Plan Area include the following:

- Approximately 1.8186 ha of Parks and Recreation Reserve under the Metropolitan Region Scheme;
- Approximately 0.7305 ha of Local Open Space designated as Local Scheme Reserve;
- Approximately 0.4812 ha of Local Centre designated as Local Scheme Zone;
- Approximately 0.5819 ha of Private Clubs, Institutions and Places of Worship as a Local Scheme Zone; and
- Approximately 73 residential lots at density codings of R30;

This proposal is accompanied by a Structure Plan Map (**Plan 1**) prepared in accordance with the *Planning and Development (Local Planning Scheme) Regulations 2015*, which is included at Part One of this Report.

The Explanatory Section of this Structure Plan Report includes a detailed description of the proposal, provides an evaluation of the relevant town planning, environmental, bushfire management, local water management, and traffic considerations applicable to the land, and details the rationale supporting the proposed Structure Plan.

This Structure Plan has been formulated by Harley Dykstra in collaboration with specialist consultants who have provided input in relation to matters as follows:

BIOSCIENCE	- Wetland Management Strategy - Riparian Restoration Strategy
OVERSBY CONSULTING	- Local Water Management Plan
PERITAS CONSULTING	- Servicing Report
UDLA	- Landscape Strategy
STANTEC	- Transport Impact Assessment
ENVISION BUSHFIRE PROTECTION	- Bushfire Management Plan

Copies of the relevant consultant reports and drawings are appended to this submission and key findings incorporated within the body of the report. Previous work undertaken by consultants as part of the submitted Local Structure Plan for Precinct 3B is acknowledged where relied upon.



1.2 LAND DESCRIPTION

1.2.1 Location & Context

The Structure Plan area is comprised of Lot 104, 1525, 1524, 1523 & 1522 Leslie Street, Southern River which is currently identified as 'Urban Deferred' and reserved partially as 'Parks and Recreation' under the Metropolitan Region Scheme (MRS). The area is situated approximately 20 kilometres south east of the Perth Central Business District, 8 kilometres north west of Armadale City Centre, and 3 Kilometres south east of Gosnells Train Station. Access to all lots is provided from Leslie Street while Lot 104 also has access from Southern River Road. An aerial locality plan is included at **Figure 1** below and an aerial photograph of the subject land is included at **Figure 2** (overleaf).

The immediate surrounding locality consists of the following:

- Land to the south east is generally characterised by 'General Rural' lots ranging between 1ha and 2ha in area.
- Land on the opposite side of Leslie Street has been developed for residential purposes.
- Land to the north west has been or is in the process of being developed for residential purposes.



FIGURE 1 – AERIAL LOCALITY PLAN (SUBJECT LAND OUTLINED IN RED)



FIGURE 2 – AERIAL PHOTOGRAPH (SUBJECT LAND OUTLINED IN RED)

1.2.2 Area and Land Use

The Structure plan area is located within the City of Gosnells and has a total land area of 9.4434ha and is comprised of predominantly lifestyle lots ranging between 1ha and 2ha in area.

Lot 104 Leslie Street Southern River is currently used as a 'Place of Worship' while a large dwelling has been developed on a portion of Lot 1525. Activities on the other land uses are best described as rural pursuits (e.g. agistment of horses).

The surrounding land is progressively being developed for residential purposes, consistent with the current zonings and approved Structure Plans. In particular, it is noted land on the opposite side of Leslie Street has been developed for residential purposes in recent years as part of the Southern River Precinct 3A.

1.2.3 Legal Description and Ownership

As previously mentioned, the Structure Plan Area comprises Lots 104, 1525, 1524, 1523 & 1522 Leslie Street, Southern River. **Table 1** provides a summary of the land while a copy of the Certificates of Title are included at **Appendix B**.



LOT NO.	PLAN / DIAGRAM	VOLUME	FOLIO	REGISTERED PROPRIETOR(S)	AREA (HA)
104	416689	2979	973	Auswide International Investments (Southern River) Pty Ltd	1.1186
1525	3314	328	157A	Mohammed Tahir Patel	1.7214
1524	3314	373	50A	Auswide International Investments (Southern River) Pty Ltd	2.0519
1523	3314	1326	273	Auswide International Investments (Southern River) Pty Ltd	2.2295
1522	3314	1326	272	Auswide International Investments (Southern River) Pty Ltd	2.3220

TABLE 1 – LAND OWNERSHIP DETAILS

1.3 PLANNING FRAMEWORK

1.3.1 Zoning and Reservations

The following section outlines the designations under the relevant state and local planning framework.

1.3.1.2 Metropolitan Region Scheme

The Structure Plan Area is subject to the Metropolitan Region Scheme (MRS). The MRS is the statutory land use planning scheme for the Perth Metropolitan Area. The primary purpose of the MRS is to reserve and zone land and control development on reserved and zoned land at the Regional level. The MRS reflects the agreed strategic direction for land in the metropolitan region and facilitates changes to planning controls at the local level and subsequent local area planning. The various zones and reservations applicable across the Structure Plan Area are illustrated in **Figure 3** overleaf. The Structure Plan Area is predominantly identified as 'Urban' while a strip of land fronting Southern River is Reserved as 'Regional Open Space,' with Bush Forever site No.246 contained within a portion of each lot.

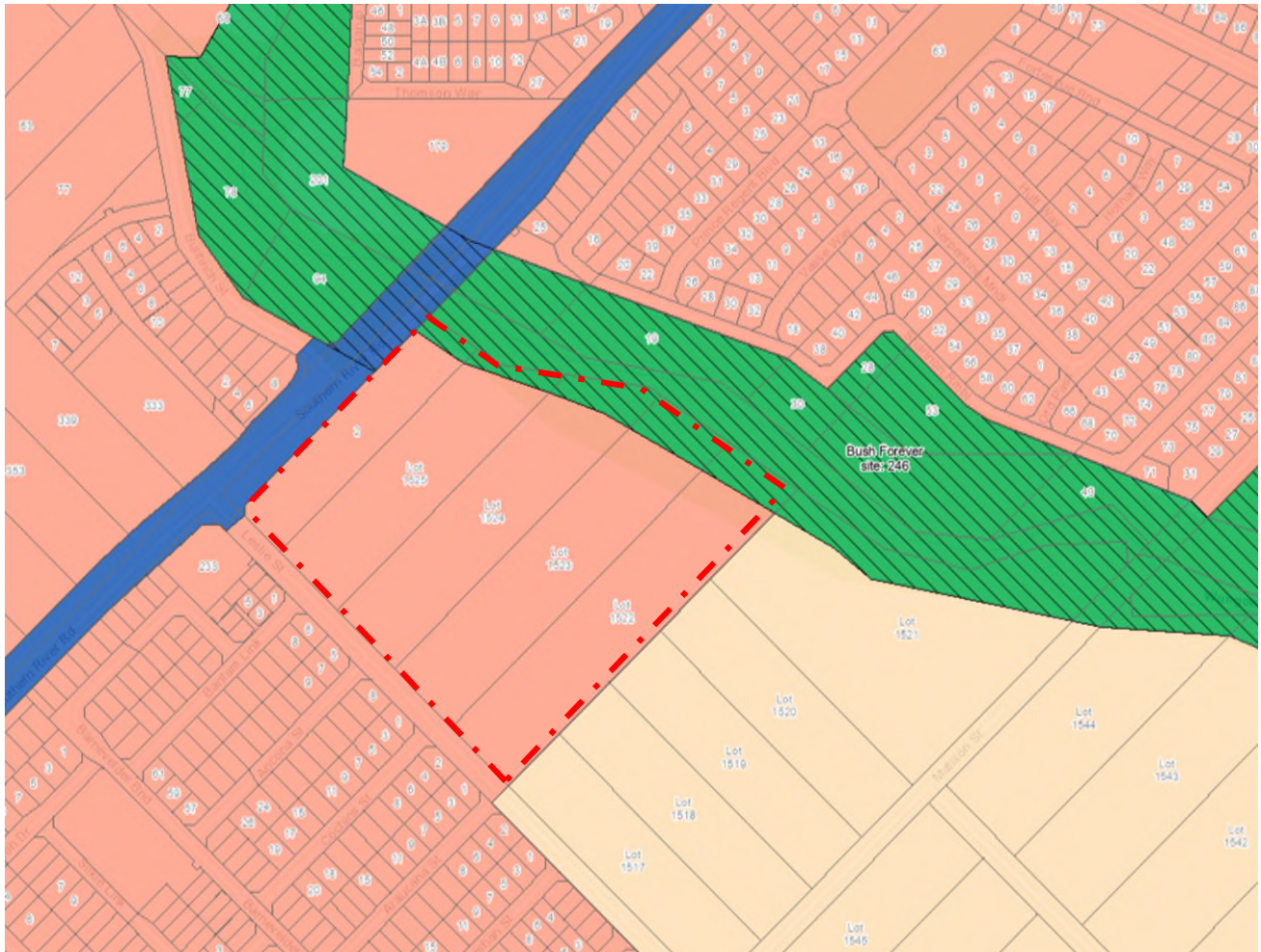


FIGURE 3 – METROPOLITAN REGION SCHEME ZONING (SUBJECT LAND OUTLINED IN RED)

1.3.1.3 City of Gosnells Local Planning Scheme No. 24

The subject land is primarily zoned Urban Development and partially zoned Private Community Purposes with the north eastern portion of the site reserved as Public Open Space under the City of Gosnells Local Planning Scheme No. 24 (LPS 24) (**Figure 4**).

The planning context, under LPS 24, is such that land to the east is zoned General Rural, with land to the south and west zoned Residential. Land immediately north is zoned Parks and Recreation, with land further north zoned Residential R20.

LPS 24 also identifies the subject land as being within the Development Contribution Area 2 (DCA2). The contribution scheme requires the payment of developer contribution fees, at set rates, upon the completion of subdivision or development within the scheme area. These fees are then used to fund key infrastructure items that assist in the overall development of the scheme area. DAC2 is detailed in Schedule B of LPS 24.



FIGURE 4 – LPS 24 ZONING MAP (SUBJECT LAND OUTLINED IN RED)

1.3.2 Regional and Sub-Regional Spatial Framework

1.3.2.1 Perth and Peel @ 3.5 Million

Perth and Peel @ 3.5 million is a high-level spatial framework and strategic plan that provides a vision for the future growth of the Perth metropolitan region towards a population of 3.5 million residents.

The land subject to this Structure Plan is identified as ‘Urban Deferred’ in the South Metropolitan Peel Sub-Regional Planning Framework while the strip of land fronting Southern River is identified as ‘Open Space’ (Figure 5).

The Urban Deferred status under the MRS has been lifted as part of this Structure Plan process to facilitate subdivision and development.

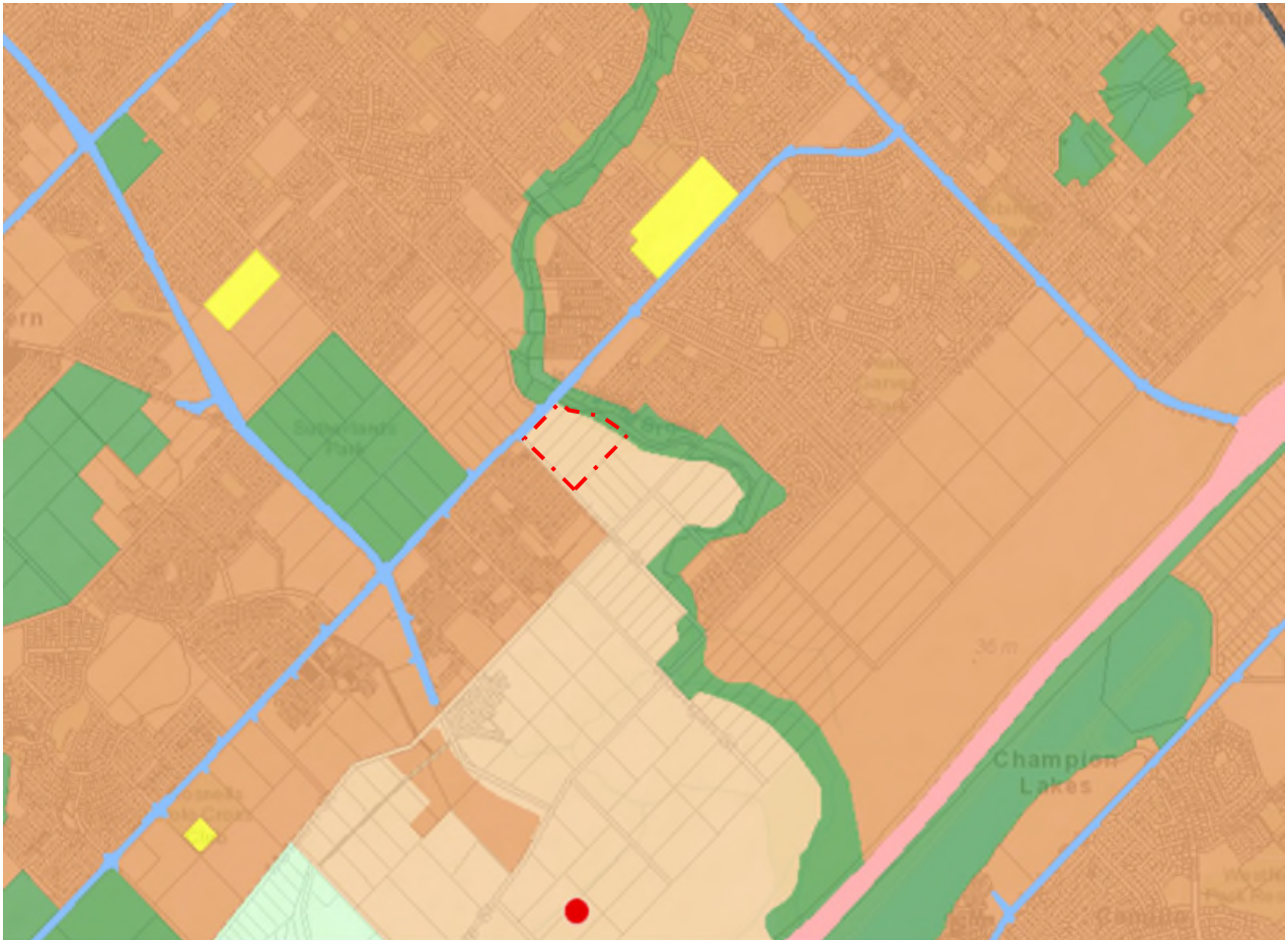


FIGURE 5 – SUB REGIONAL FRAMEWORK (SUBJECT LAND OUTLINED IN RED)

1.3.3 Planning Strategies and Structure Plans

1.3.3.1 Southern River/Forrestdale/Brookdale/Wungong District Structure Plan

The Southern River/Forrestdale/Brookdale/Wungong District Structure Plan (DSP) was adopted by the Western Australian Planning Commission in 2001. The Southern River, Forrestdale, Brookdale and Wungong area is complex to plan for future development. To address complexities comprehensively, the Western Australian Planning Commission prepared the Southern River/Forrestdale/Brookdale/Wungong District Structure Plan in consultation with the City of Gosnells, City of Armadale, and other key stakeholders. As stated in the Structure Plan, the primary purpose of the District Structure Plan is to provide a broad framework for land use and development including major community facilities, conservation areas, Bush Forever sites, open space, and potential areas for development. The following extract from the DSP describes its function:

“The District Structure Plan provides a guide to the future development of the study area and management of key environmental issues. It includes potential development areas, road networks, major community facilities, conservation and Bush Forever areas, and a neighbourhood structure. It also provides proposals for the implementation of the plan such as zoning mechanisms, staging and financial management arrangements.”



The DSP identifies the subject land as predominantly for urban development, with two neighbourhood centres being identified within the Structure Plan Area at the intersection of Leslie Street and Southern River Road, and Leslie and Matison Streets. Open space is also identified for the land abutting the Southern River.

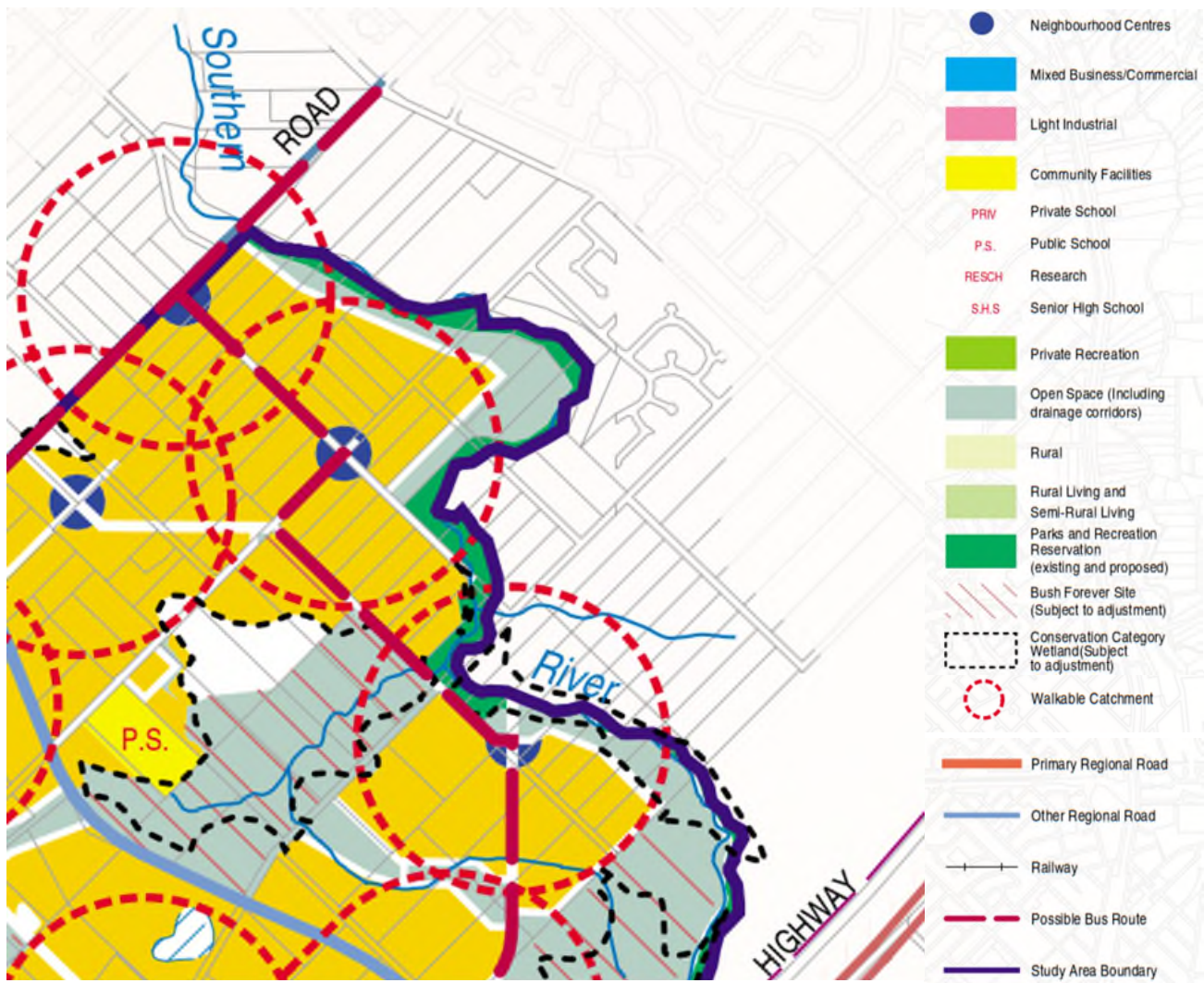


FIGURE 6 – SOUTHERN RIVER/FORRESTDAL/BROOKDALE/WUNGONG DISTRICT STRUCTURE PLAN EXTRACT

1.3.3.2 Southern River Precinct 3 Guide Plan

The City of Gosnells Southern River Precinct 3 Guide Plan was prepared subsequently to the Southern River/Forrestdale/Brookdale/Wungong District Structure Plan, to resolve regional and/or localised issues concerning land use and infrastructure within Precinct 3. The Guide Plan is generally consistent with the DSP but applies to a small precinct of approximately 365ha within the DSP. Precinct 3 is bound by Southern River Road, Ranford Road, Matison Street, the kennel area, Passmore Street, and Southern River.

The Precinct 3B1 Structure Plan Area (outlined in red on **Figure 7** overleaf) is predominantly identified as 'Residential'. Land on the corner of Leslie Street and Southern River Road is designated as 'Local Centre' while land fronting Southern River is denoted as 'Wetland' and 'Parks and Recreation Reservation'. Whilst the Conservation Category / Resource Enhancement wetland is incorrectly represented on the Guide Plan, the Structure Plan represents the actual boundaries, as the plan has been informed by available wetland mapping. In preparing this Structure Plan, due regard has been given to the designations under the Southern River Precinct 3 Guide Plan.

SOUTHERN RIVER PRECINCT 3B1 STRUCTURE PLAN Lot 104, 1525, 1524, 1523, & 1522 Leslie Street, Southern River

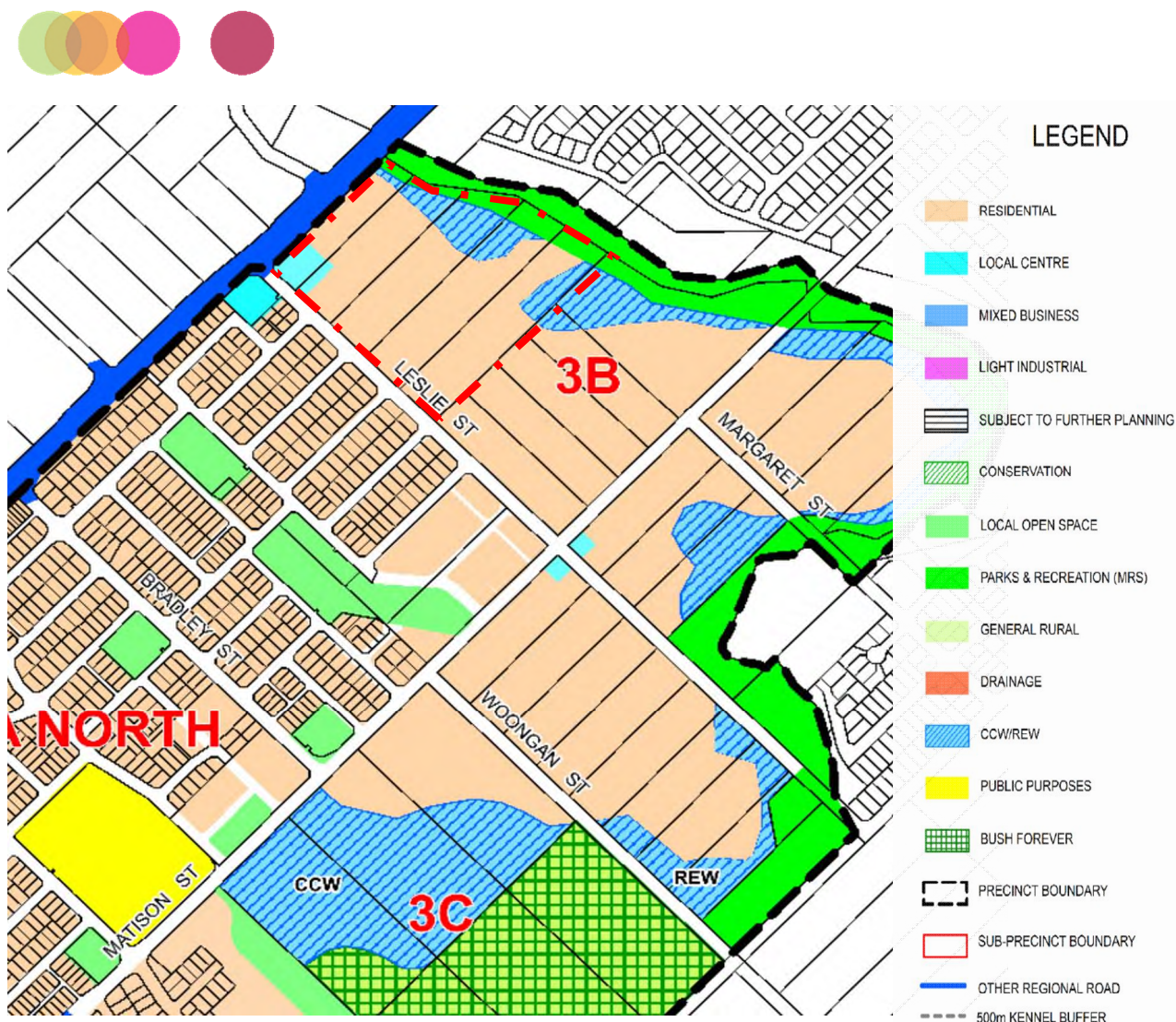


FIGURE 7 – SOUTHERN RIVER PRECINCT 3 GUIDE PLAN

1.3.4 State Planning Policies

1.3.4.1 State Planning Policy 2.0 – Environment and Natural Resources Policy

State Planning Policy 2.0 seeks to integrate environmental and natural resource management with broader land use planning, to protect, conserve and enhance the natural environment and to promote sustainable management of natural resources. Ultimately, the policy includes a number of measures that seek to achieve these three outcomes.

The proposed Structure Plan has been designed to take these measures into account by seeking to limit the impact on the environmentally sensitive Conservation Category Wetlands. These are located in the northern portion of the subject area, abutting the Southern River. Management of this area is achieved by preventing residential development within 50m of the Conservation Category Wetland, through the implementation of a 50m buffer. Further, the provision of the Public Open Space abuts this area, preventing fragmentation.

1.3.4.2 State Planning Policy 3.7 – Planning in Bushfire Prone Areas

State Planning Policy 3.7 (SPP 3.7) seeks to guide the implementation of effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure. SPP 3.7 applies to strategic planning proposals, including Structure Plans over land designated as bushfire prone by the Map of Bushfire Prone Areas prepared by the Department of Fire and Emergency Services. An extract from the Map of Bushfire Prone Areas Mapping, as it relates to the subject land is included at **Figure 8** below.

SOUTHERN RIVER PRECINCT 3B1 STRUCTURE PLAN

Lot 104, 1525, 1524, 1523, & 1522 Leslie Street, Southern River



Section 6.3 of the Policy states that any strategic planning proposal within a designated bushfire area is to be accompanied by a Bushfire Management Plan. Accordingly, a BMP has been prepared by Envision Bushfire Protection in accordance with SPP 3.7 and is included at **Appendix C**. Further details are included at Section 3.8 of this report.



FIGURE 8 – BUSHFIRE PRONE AREAS MAPPING

1.3.4.3 State Planning Policy 7.0 – Design of the Built Environment

State Planning Policy 7.0 seeks to “address design quality and built form outcomes in Western Australia”, and it does so by providing the framework for design and built environment. The policy includes a number of design principles, of which some are relevant to the Structure Plan process.

The Structure Plan has been prepared in accordance with the design principles in the following manner:

- The design enhances and responds to the natural features of the site, including its topography and the Conservation Category Wetland. This has been achieved by ensuring lots can generally be orientated “side-on” to the slope, thereby minimising retaining, and through the protection of a significant portion of vegetation, as detailed above.
- The structure plan includes the sufficient provision of an unrestricted public open space area that is adequately sized and located within proximity to all lots.
- The design accounts for good water management principles, protection of environmental features, and provides for opportunities to consider tree retention and protection, thereby achieving sustainable development outcomes.
- The road network is legible with clear connections to important features including the local centre and the surrounding road network.



1.3.4.4 Liveable Neighbourhoods

The WAPC's *Liveable Neighbourhoods* is an operational policy that guides the design and assessment of structure plans (regional, district and local) and subdivision for new urban areas in the metropolitan area and country centres, on greenfield and large urban infill sites. Liveable Neighbourhoods states that Structure Plans should address the following:

- Walkable neighbourhood catchments of approximately 400-450m radius around proposed neighbourhood and town centres, superimposed over the structure plan;
- Density targets expressed as dwellings per site hectare;
- Existing and proposed commercial centres;
- Proposed natural features to be retained;
- Proposed street block layout;
- Proposed street network, including street types and path networks;
- Proposed transportation corridors, public transport network and cycle and pedestrian networks;
- Proposed land uses, including distribution of higher, medium and lower-density residential;
- Proposed schools and community facilities;
- Public parkland; and
- Proposed urban water management measures.

Relevant consideration pertaining to the abovementioned planning elements has been addressed in this report. Therefore, this Structure Plan is considered to demonstrate compliance with the intent of Liveable Neighbourhoods. Some of the key outcomes in relation to the above include a street block design that is legible, the protection of the environmentally sensitive vegetation and the appropriate provision of public open space.

1.3.5 City of Gosnells Local Planning Policies

1.3.5.1 Local Planning Policy No.3.3 – Southern River Precinct 3 Planning Framework

The City of Gosnells Local Planning Policy No. 3.3 (LPP 3.3) has been prepared for the following purpose:

“Council has adopted a precinct-based approach to the planning of Southern River, dividing the area into five precincts. This Policy applies to the planning required for the development of Southern River Precinct 3 (SR Precinct 3), as depicted in Figure 1.

For development of SR Precinct 3 to occur in an orderly and proper manner, there are various planning requirements that need to be addressed, including amendments the Metropolitan Region Scheme (MRS) and Local Planning Scheme No. 24 (LPS 24) and preparation of localised structure plans and applications for subdivision.

This Policy establishes a local planning framework to appropriately address these requirements.”

The policy divides Precinct 3 into 6 sub precincts as shown in **Figure 9** below. The subject site is contained within sub-precinct 3B. A Structure Plan for Precinct 3B was prepared and lodged however as requested by the Western Australian Planning Commission, the Structure Plan boundary has been modified to change the boundary so as to only undertake planning for the lots subject to this application and the associated reserve areas. It is on this basis that this Structure Plan has been prepared.

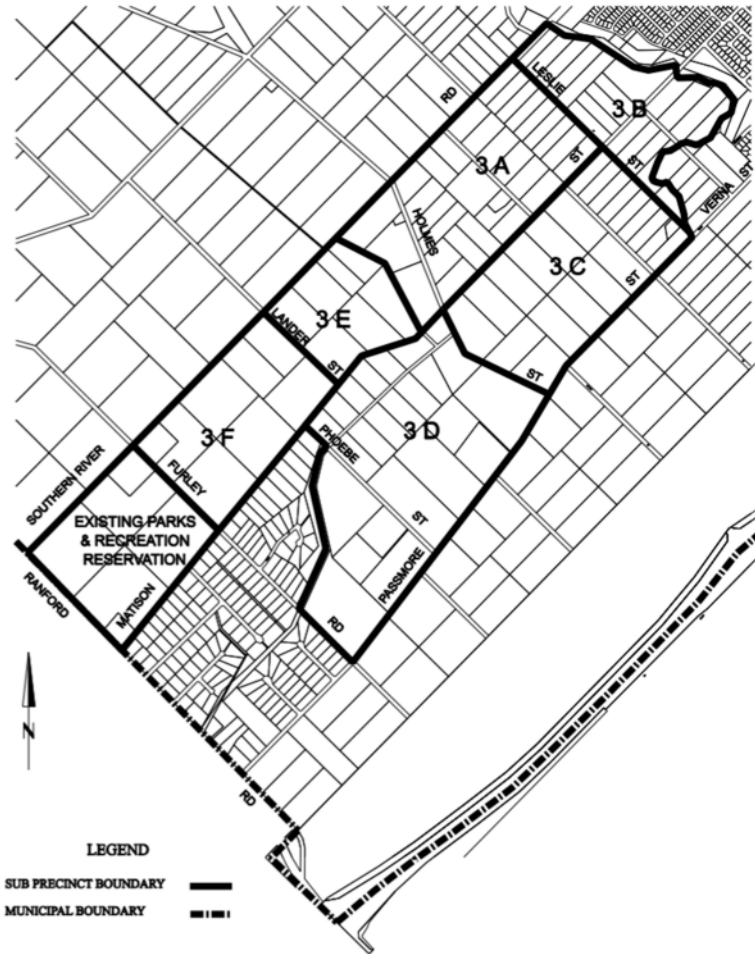


FIGURE 9 – LOCAL PLANNING POLICY 3.3

1.3.5.2 City of Gosnells Local Planning Policy No. 3.4 – Developer Contribution Arrangements

Local Planning Policy 3.4 serves the purpose of guiding the establishment and operation of the City administered development contribution arrangements.

DCAs typically involve five phases:

- Establishment of the arrangement
- Assessment of planning proposals for land in the arrangement area
- Collection of contributions
- Expenditure of arrangement funds
- Monitoring/Review of the operation of the arrangement

Attachment E of LPS 6 lists the Developer Contribution Arrangement for Southern River Precinct Plan 3.

1.3.5.3 City of Gosnells Local Planning Policy No. 4.7 – Public Open Space and Streetscapes

Local Planning Policy 4.7 seeks to establish standards for the provision and development of new areas of public open space and streetscapes. The objectives are as follows:

SOUTHERN RIVER PRECINCT 3B1 STRUCTURE PLAN

Lot 104, 1525, 1524, 1523, & 1522 Leslie Street, Southern River



- (a) *To provide for well-designed POS and streetscapes, including appropriately located and integrated areas of POS.*
- (b) *To provide for tree planting under certain circumstances.*
- (c) *To establish requirements for the creation and maintenance of POS and streetscapes.*
- (d) *To prioritise the retention of existing appropriately sized trees in POS and streetscapes where practical.*

The proposed Structure Plan ensures that all measures of this policy can be met. In particular, an area of passive open space and of conservation open space has been provided that will be able to offer opportunities for unstructured active recreation and the protection of natural assets, respectively. Furthermore, compliance with *Liveable Neighbourhoods* provisions are demonstrated above and below in sections 3.1 and 3.2.

1.3.5.4 Pre-Lodgement Consultation

The preparation of this Structure Plan has been informed by the Schedule of Modifications received from the WAPC for the Southern River Precinct 3B Structure Plan (**Appendix A**).

Extensive consultation has been undertaken with the City of Gosnell's Strategic and Statutory Planning officers (along with the City's technical services officers) and the Department of Planning Lands and Heritage (DPLH) prior to and during the preparation of this Structure Plan. Discussions have also taken place with DPLH in relation to the lifting of the Urban Deferred status.

Accordingly, this Structure Plan has been informed by extensive pre-lodgement consultation.



2 SITE CONDITIONS AND CONSTRAINTS

2.1 LANDFORM AND SOILS

2.1.1 Topography

The area is relatively flat with elevations between 18-20m AHD with minor undulations peaking at 20m AHD in the south eastern corner. The foreshore of the Southern River slopes steeply in most locations towards the channel bed.

2.1.2 Geology

The subject site is located on the Swan Coastal Plain within the Bassendean dune system, an area characterised by low dunes of siliceous sand interspersed with poorly drained areas of wetlands. Soils in this area tend to be a deep bleached grey colour with a pale-yellow B horizon or a weak iron-organic hardpan at depths greater than 2m.

Underlying the Bassendean formation is the Guilderton formation, which consists of successive layers of soils formed from erosion of the scrap in the east. Rivers and streams have mostly carried the eroded material, which is deposited from the water. The Guilderton formation is characterised by poor drainage due to the low permeability of the sub-soil clays, preventing the downward infiltration of rainfall. This can result in water logging and surface indentation in winter months.

The geology at the site as per the Geological Survey of Western Australia 1:50000 Environmental Geological Series Armadale Map part of sheet 2033 I and part of sheet 2133 IV is:

- **S8** – SAND – very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz moderately well sorted of eolian origin.
- **SP1** – PEATY SAND – Grey to black, fine to medium grained, moderately sorted quartz sand, slightly peaty of lacustrine origin.
- **Ms4** – SANDY SILT – Cream to pale brown alluvium, clayey in part, fine to medium grained sand, of alluvial origin

Geotechnical investigations were carried out by Bioscience in 2012, with the geotechnical report included as part of **Appendix D**. The Soil profile was found to consist of mainly sand over sandy clay and clayey sand, with depths ranging from 1m to 3.1m. This soil profile typical of the Southern River area and does not show the presence of hydric soils that would be expected in a wetland.

The location of these soils is identified overleaf in **Figure 10**, which is sourced from Bioscience (2022).

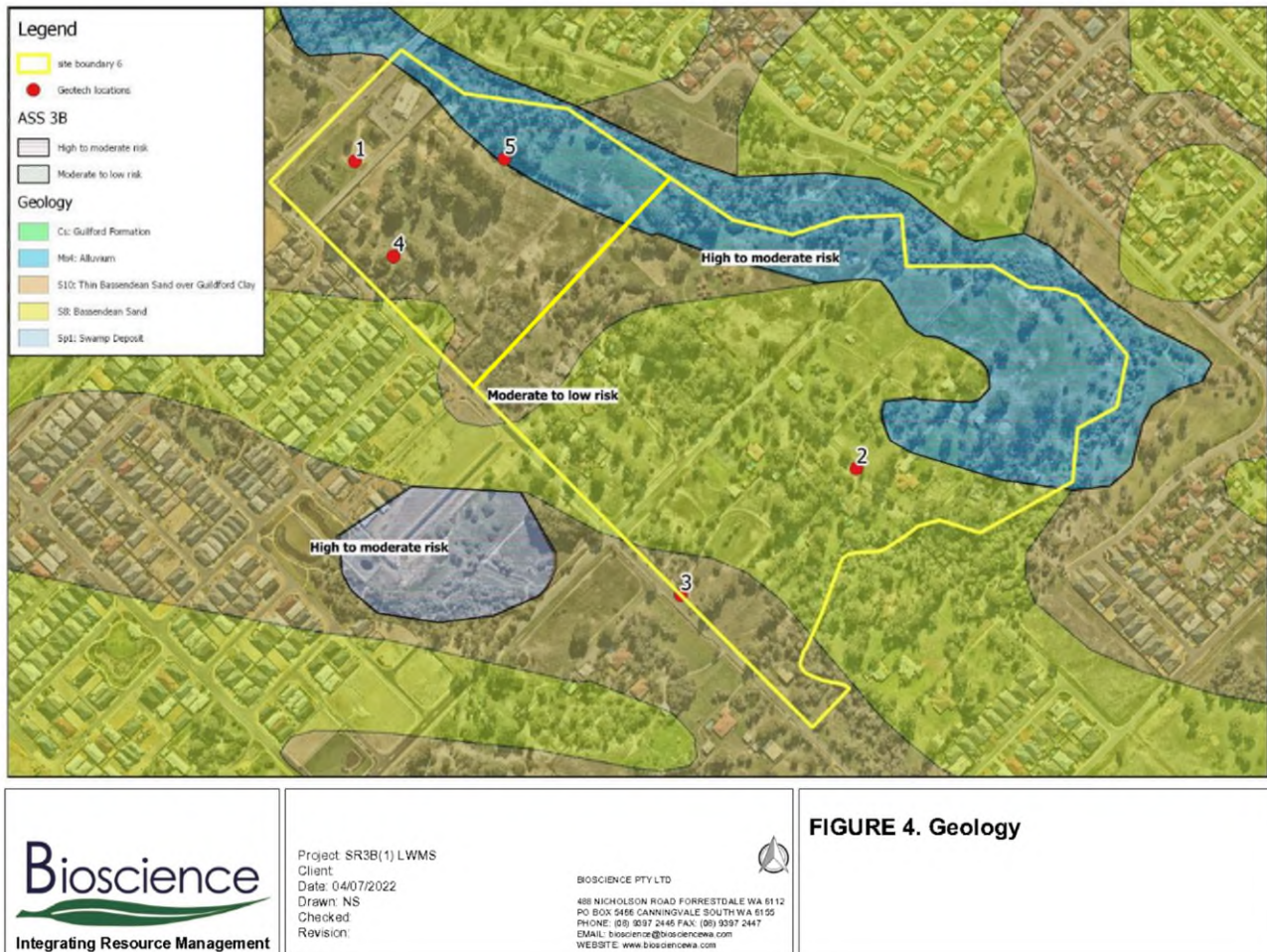


FIGURE 10 – GEOLOGY

2.1.3 Acid Sulphate Soils

Acid sulfate soils (ASS) are naturally occurring soils which contain iron sulphides, most commonly pyrite (DEC, 2009b). Regional ASS risk mapping indicates that the majority of the site is classified as having a moderate to low risk of ASS occurring within 3m of the natural soil surface. The area denoted as the conservation wetland is classified as having a high to moderate risk of ASS occurring within 3m of natural soil surface.

Once detailed earthworks designs and depths of trenching/excavation are known, and therefore the likelihood of disturbance below 3 m of the natural soil as part of the construction process, an investigation to determine the actual presence of ASS may be undertaken. It is important to minimise the disturbance of acid sulphate soils to prevent any detrimental impacts on the environment. It is anticipated that the proposed development will result in a nil or nominal disturbance of ASS as the area of the proposed development is located in the moderate to low risk area.

2.2 HYDROLOGY

Oversby Consulting has prepared a Local Water Management Strategy (LWMS) which is attached at **Appendix D**. The key considerations are outlined in the following sections, with other sub consultant reports referenced if necessary.



2.2.1 Regional Hydrology

The hydrology of the Southern River is typically characterised by Bassendean sand dunes of low relief hosting a superficial aquifer which is about 30m thick. Groundwater contours parallel to Leslie Street are approximately 18m AHD and decline towards Southern River to 14m AHD.

Southern River acts as a local discharge point for the superficial aquifer of the Bassendean sand dunes.

2.2.2 Precinct 3B Hydrology

David and Willis Associates (DWA) have completed preliminary calculations to determine the redevelopment flow regime from Precinct 3B to Southern River. As the catchment size is small and pre-developed scenario could be considered 'rural', the rational method has been used to determine pre-development peak flow rates. A summary of the calculations are depicted in Table 1 of the LWMS.

2.2.3 Groundwater

From the installation of pit logs, Bioscience was able to undertake groundwater monitoring to determine that groundwater ranges from 1.3m (BGL) to 4.3m (BGL) at winter peaks with a 2-2.6m variance noticed between peak and troughs in water levels. These results are typical of Bassendean sands within the Swan Coastal Plain.

The PH in the precinct was found to be mostly neutral (6.72) with the phosphorous levels relatively low at 0.31mg/L. Nutrients such as phosphate and nitrate can occur in elevated concentrations in the area. Bioscience recommends that the groundwater quality be improved post development. This can be achieved by avoiding the use of subsoil drainage that can mobilise and alter groundwater levels.

2.2.4 Surface Water

Sampling has been taken at Southern River Road, which demonstrated that water quality diminishes slightly going downstream.

There is limited pre-development surface water quality samples available from the 3B1 Precinct, and as such, additional water quality monitoring should be completed and included within subsequent UWMPs. However, it is anticipated that all water runoff will be contained within the drainage infrastructure network.

2.2.5 Wetlands

A review of the *Geomorphic Wetlands on the Swan Coastal Plain* dataset (DBCA 2020) indicates that almost the entirety of the site contains Multiple Use Wetlands (UFI 15792), with the area adjacent to the Southern River, and the river its self is mapped as Conservation Category Wetland (CCW) (UFI 16154).

CCWs are typically afforded a 50m wide buffer from surrounding development or incompatible land uses. The Structure Plan accommodates this 50m buffer and supporting landscape plans indicate appropriate treatments for the wetland buffer area in accordance with the City of Gosnells LPP 4.7. On this basis there would be no impacts on the CCW and the proposed land use and associated development appropriately responds to the presence of the CCW.

Surface water and groundwater impacts to the CCW can be managed through engineering and design in the preparation and implementation of future water management plans. The requirement to undertake preparation of more detailed water management plans to support the development is generally imposed as a condition of development.

The location of the wetlands is identified below in **Figure 11**, which is sourced from Bioscience (2022).



FIGURE 11 – GEOMORPHIC WETLANDS

2.2.6 Southern River Foreshore

The Structure Plan Area contains a substantial frontage to Southern River. River foreshores reserved for parks and recreation are protected as public resources that should be available for public access, conservation and recreation. Public open space (POS) is primarily located along the Southern River boundary, and in part, will support the drainage infrastructure.

Further information on retention basins will be discussed in section 3.7.

2.3 BIODIVERSITY AND NATURAL ASSETS

Bioscience prepared an Environmental Impact Assessment in 2015 which is attached at Appendix E of the LWMS. The key considerations are outlined in the following sections, with other sub consultant reports referenced if necessary.

2.3.1 Vegetation and Flora

The subject site is located within the Swan Coastal Plain Biogeographic Region of the South-West Botanical Province. This region has historically been cleared for stock grazing, resulting in the 'completely degraded' condition. No Declared Rare Fauna or Priority flora was identified during site visits and preliminary flora assessments. An EPA guidance 51 flora survey has not been undertaken as it was not considered appropriate due to the degraded nature of the site. Further, three Bush Forever sites are located within close proximity to the site being 246, 464 and 125.



Given the limited significant flora or vegetation values within the site, the objective for future management will be principally focused around protecting and rehabilitating the vegetation associated with the CCW (UFI 16154) and the 50m buffer which extends within the site, through the implementation of a 'Parks Recreation and Drainage' reserve which encapsulates the significant flora and vegetation values of the wetland. The proposed Structure Plan will provide an opportunity to rehabilitate a portion of the 50 m buffer.

On this basis the Structure Plan has adequately responded to flora and vegetation considerations.

2.3.2 Fauna

A desktop study of potential rare and endangered fauna listed under the *Wildlife and Conservation Act* and *EPBC Act 1999* was undertaken by an analysis of NatureMap. A site visit was then undertaken by Bioscience whereupon no significant fauna habitat was identified due to the largely degraded nature of the site. Fauna habitat values within the site are generally limited, primarily providing habitat that is suitable for common and widespread native species with non-specific habitat requirements, with the exception of large trees available to Carnaby's Cockatoos. It is therefore likely that Carnaby's Cockatoo's visit the area, however, their visitation is most likely to be brief due to the lack of nesting sites.

2.3.3 Wetland Management Strategy

A Wetland Management Strategy (WMS) has been prepared by Bioscience in order to enhance and maintain the quality of the wetlands within the Southern River 3B1 development, which comprises of wetlands CCW 15737. The intent is to return the wetland to a functioning wetland area, while creating habitat for native wildlife and ecological linkage to surround bushland. This will be achieved via the strategic use of different flora to reduce biological and hydrological impacts which have incurred since European settlement.

The objectives of this WMS are as follows:

- a) Create wetland conditions with irrigation to assist with the establishment a new plant stock;
- b) Restore and rehabilitate vegetation communities and create wildlife corridors to ensure the long-term viability of native flora and fauna;
- c) Investigate ground water levels and runoff to wetland area;
- d) Monitor and examine water quality and impacts. Investigate ways to maintain good water quality and prevent contamination;
- e) Create habitat for native fauna, such as the river rat;
- f) Amalgamate recreational needs with conservation values;
- g) Create a dual use pathway and nature scape playground;
- h) Promote conservation to local schools and residents through education and community involvement; and
- i) Keep stakeholders informed and involved in all management processes.

The management commitments are outlined in Table 3 of the WMS, attached at **Appendix E**.

2.3.4 Riparian Restoration Strategy

The site is currently extremely degraded, and as such, a Riparian Restoration Strategy has been prepared by Bioscience in order to create suitable conditions to support the native revegetation of the riparian zone.

It has been identified that the riparian zone mainly consists of invasive grasses and bulbs, with no seasonal inundation or waterlogging present. In order to enhance this, the site will require water flow into the wetland function area to enable the establishment of native wetland plant species.



The Plan attached at **Appendix F** outlines the required earthworks, weed suppression and mechanical and biological stabilisation to ensure that effective rehabilitation is taking place.

2.4 BUSHFIRE HAZARD

Bushfire hazards have been identified within and outside the site, associated with the Forest (Class A) vegetation within the portion of the 50 m wetland buffer to be revegetated to a similar standard to the existing wetland vegetation and ceded to the State under a 'Park Recreation and Drainage' reserve in addition to the existing private landholdings surrounding the site.

A Bushfire Management Plan has been prepared by Envision to address the requirements of SPP 3.7 – *Planning in Bushfire Prone Areas* and the associated *Guidelines* in support of this application to amend the Structure Plan. The Bushfire Management Plan addresses proposed development within the Structure Plan Area and is included as **Appendix C**.

From a bushfire hazard management perspective, the key consideration as part of future development within the site is to ensure future development areas will be able to accommodate the separation necessary to ensure built form achieves a bushfire attack level (BAL) rating of BAL-29 or less. This BAL rating will need to be achieved without requiring clearing or modification of vegetation in areas where remnant vegetation is proposed to be retained and allow for revegetation of the wetland buffer. This area is expected to be revegetated to a Forest condition.

In order to achieve a BAL rating of 29 or less on proposed lots 68-76, the vegetation on the adjacent eastern lot will need to be removed and managed at subdivision stage, either by the progress of development or by an agreement between landowners.

No further environmental impacts (such as clearing of vegetation) beyond those outlined, will be required in order to implement the development across the site, consistent with the proposed Structure Plan.

On this basis the Structure Plan has adequately responded to the bushfire risk considerations.

2.5 HERITAGE

2.5.1 Indigenous heritage

In accordance with the Aboriginal Heritage Due Diligence Guidelines (DAA 2013), a search of the AHIS online database (DPLH 2020) was undertaken. Registered Aboriginal Site 3511 has been identified within the site, which represents a mythological, camp and hunting place. Site 3511 does not form part of a restricted area and it is therefore envisaged that development will not impact on the heritage of the area.

2.5.2 Non-Indigenous heritage

A desktop review of the Australian Heritage Database (Department of the Environment 2019) and the State Heritage Office database (Heritage Council 2019) confirms that there are no European heritage sites within the subject area.

2.6 OTHER LAND USE CONSTRAINTS AND OPPORTUNITIES

2.6.1 Site Contamination

A review of the Department of Water and Environmental Regulation (DWER) Contaminated Sites Database (DWER 2018) concluded that no known contaminated sites are located within the vicinity of the subject site.

Historic agricultural land uses, primarily low-intensity activities such as cattle grazing are considered unlikely to raise any significant contamination risk concerns for the site. Therefore, no further actions from an environmental contamination perspective are required for the proposed development.

SOUTHERN RIVER PRECINCT 3B1 STRUCTURE PLAN

Lot 104, 1525, 1524, 1523, & 1522 Leslie Street, Southern River



2.6.2 Sewage Sensitive Areas

The entirety of the site is classified as a sewage sensitive area by the *Government Sewerage Policy* (DPLH 2019), due to its proximity to a significant wetland. However, as the site will be connected to the Water Corporation's reticulated sewer network, no further management actions in relation to the policy will be required.



3 LAND USE AND DEVELOPMENT REQUIREMENTS

3.1 LAND USE

3.1.1 Design Overview

The Structure Plan design has been developed having regard to the evolving strategic planning objectives for the locality, site specific environmental assessment, detailed engineering investigation, local water management and bushfire planning. Due to the importance of the wetlands, particular regard has been given to ensure its protection.

The Structure Plan has been prepared to guide the development of the subject site for residential subdivision, a local centre and the continued operation of the existing place of worship. The Structure Plan will facilitate the development of a high quality, liveable urban precinct offering a diversity of lot products with access to a local centre and useable public open space.

The design is based upon integrating with the existing Leslie Street and the interface of the environmentally sensitive wetlands and the Southern River foreshore. Detailed structure planning has been informed by an integrated approach with inputs from specialist consultants to appropriately address planning, environmental, water management and bushfire management objectives. A significant amount of landscaping throughout the site will also enhance the natural amenity of the area and its relationship with the Conservation Category Wetland.

Collectively, these factors have influenced the proposed road and lot layout, as depicted on the Structure Plan included as **Plan 1** in Part 1 of this report. Further details relating to the relevant design opportunities and constraints are provided below.

3.1.2 Integration with Adjoining Lots

The Structure Plan area adjoins development to the south of Leslie Street known as Precinct 3A, which forms part of the Southern River Precinct 3. This area of residential development is zoned Residential, which is different to the subject site.

The proposed Structure Plan design provides for appropriate integration with the adjacent residential development whilst respecting the Conservation Category Wetland in the northern portion of the site through the provision of public open space. Consideration has also been given to Lots 1517-1521 (Precinct 3B2) to the east of the subject site, with this Structure Plan not deterring the potential development of these lots.

3.2 PUBLIC OPEN SPACE (POS)

A Landscape Master Plan has been prepared by UDLA for the design of the open space area (**Appendix J**). UDLA has had significant input into the design of the POS to ensure that it is sufficient and useable.

The design and location of Public Open Space within the Structure Plan area is intended to achieve the following aims:

- Increasing passive interaction opportunities with other residents as a means to address social isolation and improve wellbeing;
- Be compatible with local water management requirements and accommodate drainage integrated with landscaping to improve useability and amenity for residents;
- Encourage maximum surveillance of POS areas to discourage opportunities for anti-social behaviour;



- Integration with adjoining vegetation at the Southern River foreshore to maximise ecological linkages and to ensure consolidation of vegetation, as opposed to fragmentation; and
- Enhance the Conservation Category Wetland through the provision of a buffer, whilst also providing passive recreation.

The wetland buffer will incorporate planting to a 'Class A - Forrest' vegetation classification and will be revegetated in line with City's Policy 6.2.2 and associated Guidelines. Uniform fencing will be used to separate the wetland from the public recreation area.

A total of 0.7305 ha of creditable Public Open Space has been provided within the Structure Plan area. The POS calculations at **Table 2** illustrate that the subject land is required to provide 0.6525 ha of land for public open space, in accordance with the 10% site contribution required by Liveable Neighbourhoods. Minor adjustments of the final POS credits will be undertaken as part of preparing an UWMP.

It should be noted that the CCW buffer has been included as part of Regional Open Space Reserves, following advice from DBCA that the existing Parks and Recreation Reserve is to be extended to protect this area.

Public Open Space Schedule		
Total Land Area		9.4434 ha
Deductions		
Conservation Category Wetland		0.0345
Regional Open Space Reserves		1.8186
Uncredited POS (Incl. 1 in 1 year basins)		0.0000
Activity Centres, Commercial, Retail		1.0650
Surplus Restricted Public Open Space (Wetland Buffer)		0.000
Total:		2.91681
Gross Subdivisible Area:		6.5253
POS Requirement:		0.6525
Restricted Public Open Space		
Drainage Swales		0.0800
Total Restricted POS		0.0800
Maximum 20% Credit		0.1305
Public Open Space Calculation		
To Comprise		
Minimum 80% unrestricted Open Space		0.52216
Maximum 20% restricted Open Space		0.13054
Public Open Space Provided		
	Unrestricted	Restricted
POS Area	0.6505	0.0800
Total Open Space Provided:		0.7305 ha (11.19%)

TABLE 2 – POS CALCULATIONS

Based on the above POS calculations, more than 10% of the gross subdividable area has been provided as creditable POS. We note that whilst the unrestricted portion exceeds the minimum requirement, the purpose of this exceedance is to provide a POS area that is of a suitable dimension to ensure its usability.



3.3 MOVEMENT NETWORKS

3.3.1 Traffic Generation

The proposed subdivisional road network within the approved Local Structure Plan has been designed to service future residential subdivision and development at a density of R25-R30 while the proposed private driveways on Lot 104 will service the Place of Worship.

The anticipated increase to traffic volumes has been estimated by Stantec in the Traffic Impact Assessment attached at **Appendix G**. Overall, it is concluded that the proposed road network is able to satisfactorily cater for the projected number of vehicle movements. Therefore, the Structure Plan Area will have no adverse impact on traffic operations.

3.3.2 Proposed Movement Network

The Transport Impact Assessment at **Appendix G** further considers and justifies the movement network proposed as part of this Structure Plan.

Access and egress to the site will be provided through the existing Leslie Street. A total of four access points will be provided off Leslie Street into the proposed development. The area will then be serviced by a series of internal roads. The proposed access arrangements appropriately service the existing residential dwelling on Lot 1525 and the mosque on Lot 104.

Trips generated by the proposed development are anticipated to be primarily journey to work trips as the proposed Structure Plan mainly incorporates residential development. It can be expected that the destinations of these trips will be similar to current workplaces for the City of Gosnell's population.

3.3.3 Public Transport

The subject site is easily accessible to public transport, with two bus stops located within close proximity. The approximate locations of the bus stops are demonstrated in Figure 8 of the Traffic Impact Assessment. These bus stops provide 20–60-minute frequency during weekdays and 60 minutes on Saturdays. The area is also serviced by the Armadale Train Line and the Gosnells Train Station which are located approximately 2km to the north of the site and are accessible via public transport along Southern River Road.

3.3.4 Pedestrian and Cyclist Facilities

There is an existing footpath along the north side of Southern River Road and an existing shared path along the south side of Southern River Road and west of Leslie Street.

A dual use path is proposed as part of this Structure Plan to provide a connection to the broader network envisaged by the approved Structure Plan framework.

3.4 RESIDENTIAL

3.4.1 Land Use and Residential Density

The Structure Plan has regard for the broader Precinct 3B, taking into consideration the Schedule of Modifications received from the WAPC. Consideration has also been given to the immediate context, which includes the existing place of worship, residential dwelling and the Conservation Category Wetland.

The proposed residential density is consistent with the strategic direction of the Sub-Regional Planning Framework which promotes higher densities in undeveloped areas zoned for urban use, particularly in areas close to transit corridors and high amenity. On this basis, the Structure Plan is proposed for residential development at a density coding of R25 and R30. Given there is an expected yield of 117 lots, in real terms,



the Structure Plan area achieves a residential density, in an area of high amenity, of 12.39 dwellings per site hectare.

3.4.2 Residential Lot Layout

The road network has been designed to facilitate the creation of regular shaped lots, capable of accommodating standard residential dwellings, with direct access to a public street. A suitable mix of lot types are proposed, including a standard 10m x 30m R25 product which responds to the current market demand in regard to lot depths and widths.

An indicative Lot Yield Plan has been attached at **APPENDIX I**.

3.4.3 Residential Lot Size

Residential densities within the Structure Plan area range from R25 to R30. This provides an opportunity for a diversity of housing types and styles. Pursuant to the provisions of the Residential Design Codes these densities will allow for a range of lot sizes:

- R25: Minimum 300m² and average of 350m²
- R30: Minimum 260m² and average of 300m²

3.5 LOCAL CENTRE

A Local Centre is provided at the intersection of Southern River Road and Leslie Street. This location will maximise commercial exposure to passing trade and will provide an opportunity for an entry point statement into Leslie Street.

3.6 PRIVATE COMMUNITY PURPOSE

In accordance with the Private Community Purpose zone, the existing Mosque on Lot 104 will continue to function and operate as it currently does in accordance with recent approvals.

3.7 STORMWATER MANAGEMENT

The LWMS at **Appendix D** has been prepared to address the relevant water management considerations for the LSP. The LWMS is prepared in accordance with Better Urban Water management (BUWM) (WAPC 2008), and in compliance with the design objectives contained within the District Water Management Strategy ('DWMS').

The LWMS outlines strategies and management techniques to address the following:

- Water Conservation and efficiency of use
- Stormwater management
- Protection and management of the Wetland
- Management of groundwater levels and quality
- Monitoring requirements
- Implementation (i.e. roles and responsibilities).

Implementation of the LWMS will be facilitated by an urban water management plan required as a condition of development approval. This will also address the requirements of the Swan River Trust.



3.7.1 Precinct Stormwater Design

Drainage has been designed so that water flows are managed, with water treatment achieved and major storms controlled prior to release. All flows up to the 1 EY are to be treated to reduce nutrients, sediments and other contaminant prior to discharge offsite. Above the 1 EY, the main function is to control the flow of drainage water throughout the subject land and its release from the subdivision at agree rates. This water will predominantly be captured and infiltrated while protecting lots from internally generated flooding.

Section 7 of the LWMS details the peak flow rates for the 1 EY, 20% EP and 15 AEP and details the pre vs post development flows.

3.7.1.1 1 EY Storm Event

Proposed lots will use on lot storage to infiltrate the 1-hour duration (1-year ARI storm event of 15mm). If the soak wells are exceeded by other 1EY events, they will flow out to the road network. Treatment of the stormwater will take place in the vegetated bioretention basin located in the POS, which will be fitted with subsoil drainage to ensure the basin remains free from localised groundwater mounding. There is no discharge of water from the basin in the 1 EY – the water level rises to 0.26m and then infiltrates.

3.7.1.2 20% AEP

The pit and pipe network is designed to transport the flow from the internal and external road network and from lot runoff to the POS basin. The entire 20% AEP is contained within the basin, with the peak flow rate modelled as 0.001m³/s, which is all discharged as pipe flow to the rock spreader. The 20% AEP basins will be planted with suitable native vegetation. Notably, there will be no flow from the open space to the R&R areas.

3.7.1.3 1% AEP

The subject area has been designed to safely manage the 1% AEP flood event so that impacts on the subject land and downstream infrastructure (the environment and people's safety) are minimised. The roads are graded to direct flow overland to the basin POS area. The ultimate road low point will be adjacent to the POS, with overflow into the POS basin. Stormwater will fill both the planted 20% AEP portion of the basin and the surrounding designated floor storage area, which is likely to be turf and/or garden beds with a total depth of 1.2m.

3.7.2 Public Open Space and Basins

The Public Open Space (POS) within this Precinct is located along the Southern River and, in part, will support the drainage infrastructure. The drainage system within the precinct proposes to manage stormwater through bioretention systems and drainage basins in the POS for the 1 EY storm event, 20% AEP and 1% AEP.

The proposed basins are demonstrated in the LWMS at **Appendix D**, which includes an indicative basin size. The basin has been designed with 1 in 6 battered slopes to a maximum depth of 1.2m. Further, the basin has been designed to capture advice from DWER, which stipulates that the basin should be designed by utilising natural topographic features such as surface depressions and existing flow paths. Consideration should also be given to the Conservation Category wetland within the POS area.

3.8 BUSHFIRE MANAGEMENT

The design of the Structure Plan Area has been informed by the Bushfire Management Plan (BMP), prepared by Envision at **Appendix C**. The BMP complies with *SPP 3.7 – Planning in Bushfire Prone Areas* and the associated Guidelines.



Provision of appropriate separation distances between future built form and bushfire hazards will need to be accommodated as part of future design work at subdivision application stage. Landscaped areas and access ways will be designed and maintained to a low threat standard. Vehicle access will accommodate egress to at least two destinations. This will be implemented through future subdivision and/or development approval.

3.9 SERVICING

A servicing report has been prepared by Peritas in support of development over the subject site. The report demonstrates that there are no servicing capacity issues anticipated as a result of developing the subject site. Further details relating to available services is included in the below sections, with the full report attached at **Appendix H**.

3.9.1 Roads and Paths

The proposed road hierarchy servicing the Structure Plan Area is included in Figure 3 of the Transport Impact Assessment prepared by Stantec consisting of the following:

- Distributor A – Southern River Road
- Access Road – Leslie Street
- Local Distributor – Gay Street
- Distributor B – Bullfinch Street

The Transport Impact Assessment prepared by Stantec concludes that the proposed road network will provide for satisfactory intersection operation under the forecast full development traffic flows in 2031.

3.9.2 Wastewater Disposal

The Water Corporation has confirmed that there is a reticulated sewer service network in the area. There is a DN225 sewer main located outside the southern corner of the subject site in the northern verge of Leslie Street, with a DN100 sewer main located in the southern verge of Leslie Street. The site has no existing sewer connections, however, Water Corporation has confirmed that the existing wastewater infrastructure is sufficient to accommodate the proposed development without any upgrades.

Each new lot will be connected to reticulated sewer from the 225DN sewer main to the south of Leslie Street which will be owned and operated by the Water Corporation. All work associated with the provision of sewer reticulation will be undertaken at the expense of the developer.

3.9.3 Water Supply

A 100CI potable water pipe is located immediately outside the subject site along the northern verge of Leslie Street, with a 150CI pipe located along the southern verge of Leslie Street. There are currently five potable water connections to the subject site, one to each of the lots.

The Water Corporation has advised that there are no constraints to the provision of adequate potable water supply. Water reticulation will be provided at the expense of the developer.

3.9.4 Power

There is underground and overhead HV and LV infrastructure running in the verge of Leslie Street and Southern River Road. The proposed development within the Structure Plan Area is able to be supplied with a power connection via the existing network. Confirmation of this and detailed designs will be obtained from Western Power at the time of development, however it is anticipated that upgrades to this network will be required to service the development.



3.9.5 Telecommunications

Existing communications infrastructure has been identified along Leslie Street, Southern River Road and surrounding local streets. Telecommunications facilities can be supplied to the proposed development, subject to the developer paying connection fees.

3.9.6 Natural Gas

A medium pressure gas main runs along the eastern verge of Southern River Road and the northern verge of Leslie Street which has capacity to service the proposed development.

3.10 DEVELOPER CONTRIBUTION ARRANGEMENTS

As referenced in this Structure Plan report, the Structure Plan area is contained within Development Contribution Areas 5.

Attachment E in LPS 6 outlines that all landowners within the DCA 5 shall make a contribution to the cost of common infrastructure and administrative items. In addition to this, there are certain sub-precinct cost contributions.

3.11 IMPLEMENTATION

The proposed Structure Plan has been prepared in accordance with the requirements of the *Planning and Development (Local Planning Schemes) Regulations 2015*. Further, the Structure Plan complies with the applicable State and Local Planning Policy Framework as set out in Section 1.3 of this Report.

The *Planning and Development (Local Planning Schemes) Regulations 2015* stipulates the manner by which the Structure will be processed by the City of Gosnells and thereafter, the Western Australian Planning Commission to enable final approval.



APPENDICES INDEX

APPENDIX NO.	NATURE OF DOCUMENT
A	WAPC Correspondence
B	Certificates of Title
C	Bushfire Management Plan
D	Local Water Management Strategy
E	Wetland Management Strategy
F	Riparian Restoration Strategy
G	Traffic Impact Assessment
H	Servicing Report
I	Lot Yield Plan
J	Landscaping Plan

APPENDIX A | WAPC CORRESPONDENCE

Schedule of Modifications

Southern River Precinct 3B Local Structure Plan SPN/2164

1. The Local Structure Plan (LSP) is to be modified to change the boundary so as to only undertake planning for Lots 1522-1526 (inclusive) and associated reserve areas (see **Attachment B**).

In modifying the boundary of the LSP it must be demonstrated that both the area to be structure planned and the area remaining can be planned for and developed independent of one another.

To achieve this the plan is to demonstrate:

- (a) a minimum 10% public open space can be provided;
 - (b) appropriate wetland buffers can be accommodated in accordance with Environmental Protection Authority (WA) requirements;
 - (c) bushfire mitigation, in accordance with *State Planning Policy 3.7 - Planning in Bushfire Prone Areas*, can be achieved without imposing management requirements on neighbouring landowners or the local government;
 - (d) the road network to service Lots 1522-1526 (inclusive) can be provided within the modified LSP boundary, in this regard the extension of Araucana Street is to be provided within the boundary of Precinct 3B2; and
 - (e) all drainage can be accommodated and treated within the modified LSP boundary.
2. The LSP is to be modified to designate a 'Private Clubs, Institutions and Place of Worship' land use classification over that part of Lot 1526 which accommodates the Masjid Ibrahim Mosque.
3. In addition to the technical appendices already supplied, the applicant is prepare and submit the following technical documents to support the modified LSP:
 - (a) foreshore management plan;
 - (b) wetland management plan; and
 - (c) landscape management plan.
4. As a result of modifications 1 and 2, the LSP documentation (planning report and supplementary technical reports) is to be amended to the satisfaction of the Department of Planning, Lands and Heritage on the advice of stakeholder agencies including, but not limited to, the City of Gosnells, the Department of Biodiversity, Conservation and Attractions and the Department of Fire and Emergency Services.
5. The LSP documentation is to be audited to reconcile inconsistencies, typographical errors, etc.

NOTES

1. Local Centre indicated (refer to Part 1 Implementation)

2. Areas containing Arancane Gardens subject to further planning to determine appropriate land use and employment potential location for public open space.

3. Road and intersection design to be further investigated at detailed subdivision stage.

4. Local Access Roads shown are indicative only and subject to detailed design at subdivision. The roundabout requirement at Leslie Street and Arancane Street is subject to further investigation.

5. Road widening requirements for intersection to be determined by detailed subdivision.

6. For Lots 1522 & 1526 on appropriate interface with Resource Enhancement Wetland for development of detailed subdivision stage. Further planning and design to be undertaken to determine appropriate land use and employment potential location for public open space.

7. Area subject to further planning to determine appropriate land use and employment potential location for public open space.

8. Provision of a roundabout, including any required road widenings, to be given further consideration at the detailed subdivision design stage. Provision of no roundabout will need to be supported by an updated Transport Assessment and approved by the local authority.

Proponent will address all issues raised in submissions (i.e. REVI buffer issue, bushfire management etc) to obtain Southern River Precinct 3B1 Structure Plan approval

Road C which will form the boundary between 3B1 & 3B2 to be realigned so as to be contained on Proponent's land (enclosed in red box)

3B1 Lots 1522 - 1526 Leslie St

- Unified land syndicate eager to subdivide immediately.
- Coordinated planning vision with professional project consultant team.
- No significant constraints to independent urban subdivision from 3B2.

3B2

- Fragmented landownership, no unity with landowners having no clear unified vision for future urbanisation.
- Complex planning, environmental and bushfire issues still need to be resolved requiring landowners to have a coordinated approach.
- Allocation of land uses not clear.
- Landowners not interested in subdividing in short term.
- Landowners have no professional representation or technical advisors.

Access arrangement shall be subject to negotiation with the City of Gosnells. It is unlikely that Lot 1517 will be able to provide for ceding of land to create road reserve.

LEGEND

Metropolitan Region Scheme

Region Scheme Reserves

Parks & Recreation

Other

Notice of Delegation

Bush Forever

Local Scheme

Local Scheme Reserves

Local Open Space

Local Scheme Zones

Local Centre

Residential R25

Residential R30

Residential R40

Other

Structure Plan Boundary

Resource Enhancement Wetland

Swan River Trust Boundary

Existing Lot Numbers and Boundaries

Principle Shared Path

(Principle land holder to be determined at subdivision)

Approved Left In/Left Out

Crossover for Place of Worship

Road Closure

(Proposed Public Open Space)

Subject to further Planning

(Part 1 Implementation)

Roundabout

Road B Access Road B

Road C Access Road C

Road D Access Road D



Plan No.: 21620-1
Revision: REV.0
Scale: 1:400 @ A3

0 5 10

SOUTHERN RIVER PRECINCT 3B STRUCTURE PLAN
LESLIE STREET, SOUTHERN RIVER

veris

PLAN 1

APPENDIX B | CERTIFICATES OF TITLE

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

1326

272

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 1522 ON PLAN 3314

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

AUSWIDE INTERNATIONAL INVESTMENTS (SOUTHERN RIVER) PTY LTD OF 8 DARWINIA LOOP CANNING VALE

(T N287200) REGISTERED 30/3/2016

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1326-272 (1522/P3314)
PREVIOUS TITLE: 1182-524
PROPERTY STREET ADDRESS: LOT 1522 LESLIE ST, SOUTHERN RIVER.
LOCAL GOVERNMENT AUTHORITY: CITY OF GOSNELLS



WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

1326

273

RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

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BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 1523 ON PLAN 3314

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

AUSWIDE INTERNATIONAL INVESTMENTS (SOUTHERN RIVER) PTY LTD OF 8 DARWINIA LOOP, CANNING VALE

(T N074322) REGISTERED 27/7/2015

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1326-273 (1523/P3314)
PREVIOUS TITLE: 1182-524
PROPERTY STREET ADDRESS: LOT 1523 LESLIE ST, SOUTHERN RIVER.
LOCAL GOVERNMENT AUTHORITY: CITY OF GOSNELLS

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

2979

973

RECORD OF CERTIFICATE OF TITLE

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BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 104 ON DEPOSITED PLAN 416689

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

AUSWIDE INTERNATIONAL INVESTMENTS (SOUTHERN RIVER) PTY LTD OF 9-11 HARVARD WAY, CANNING VALE

(AF O371530) REGISTERED 20/3/2020

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP416689
PREVIOUS TITLE: 346-83A
PROPERTY STREET ADDRESS: 2 LESLIE ST, SOUTHERN RIVER.
LOCAL GOVERNMENT AUTHORITY: CITY OF GOSNELLS

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

328

157A

RECORD OF CERTIFICATE OF TITLE

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BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 1525 ON PLAN 3314

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

MOHAMMED TAHIR PATEL OF 2904 ALBANY HIGHWAY, KELMSCOTT

(T L779072) REGISTERED 9/11/2011

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 328-157A (1525/P3314)
PREVIOUS TITLE: 1254-795
PROPERTY STREET ADDRESS: LOT 1525 LESLIE ST, SOUTHERN RIVER.
LOCAL GOVERNMENT AUTHORITY: CITY OF GOSNELLS

WESTERN



AUSTRALIA

TITLE NUMBER

Volume

Folio

373

50A

RECORD OF CERTIFICATE OF TITLE

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BGRoberts
REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 1524 ON PLAN 3314

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

AUSWIDE INTERNATIONAL INVESTMENTS (SOUTHERN RIVER) PTY LTD OF 2904 ALBANY HIGHWAY,
KELMSCOTT

(T M180940) REGISTERED 8/2/2013

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 373-50A (1524/P3314)
PREVIOUS TITLE: 1254-795
PROPERTY STREET ADDRESS: LOT 1524 LESLIE ST, SOUTHERN RIVER.
LOCAL GOVERNMENT AUTHORITY: CITY OF GOSNELLS



APPENDIX C | BUSHFIRE MANAGEMENT PLAN

Bushfire Management Plan

Southern River Precinct 3B1

Southern River Road and Leslie Street

March 2026



LIMITATIONS STATEMENT

This Bushfire Management Plan ('BMP') has been prepared for a Structure Plan to guide future subdivision at the Southern River Precinct 3B1 at Southern River Road and Leslie Street (**the Site**), located within the City of Gosnells.

Envision Bushfire Protection Pty Ltd

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P: 0428 066 147

Email: admin@envisionbp.com.au

Version Control

Southern River Precinct 3B1 Southern River Road and Leslie Street			
Version	Date	Author	
V1	6 December 2021	Anthony Rowe	Submission
V2	26 August 2022	Anthony Rowe	Revised Structure Plan; Updated to Guidelines v1.4
V3	5 December 2022	Anthony Rowe	Revised structure plan
V4	23 October 2023	Anthony Rowe	Corrected Figure 5 Woodland at south east corner (post development) replaced with Scrub.
V5	15 December 2023	Anthony Rowe	Revised BAL accounting for 50m (forest) CCW
V6	13 September 2024	Anthony Rowe	Revised structure plan
V7	29 November 2024	Anthony Rowe	Inclusion of stormwater retention basin as Scrub – revised BAL contour
V8	08 March 2026	Anthony Rowe	WAPC modifications replace Urban Deferred to Urban MRS and General Rural to Urban Development LPS #24.

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Disclaimer

In undertaking this work, the authors have made every effort to accurately apply the available information at the time of writing following the instructions of the regulatory authorities and applying best practice as described by the Fire Protection Association Australia. Any conclusions drawn or recommendations made in the report are made in good faith, and the consultants take no responsibility for how this information and the report are subsequently used.

Envision Bushfire Protection accepts no liability for a third party's use of, or reliance upon, this specific report.

Envision Bushfire Protection accepts no liability for the inaction of the owner to provide or maintain the bushfire protection measures identified in this report. Vegetation is dynamic, building materials may distort, and the accumulation and the location of flammable materials near the building may affect the potential for damage or loss of a building to occur.

Failure to maintain the property and/or building to these standards may compromise an insurance policy if currently covering any of your assets or those of any third party that may be consequentially affected due such

failure. If not insured, and if you are seeking insurance, this report may not influence the decision of any insurer not to offer cover.

Importantly the measures contained in this report cannot guarantee human safety or an absence of harm or that the building will not be damaged or would survive a bushfire event on every occasion. This is due to the unpredictable nature of fire behaviour (knowledge in this field continues to develop) and the unpredictable nature of extreme weather conditions.

Scope of this report

Envision Bushfire Protection has been engaged to provide expert bushfire safety and planning advice.

The scope of the advice has been to assess the proposal for compliance with the policy measures described in State Planning Policy 3.7 and identify appropriate mitigation measures to be considered by the determining authority. This is described in a Bushfire Management Plan and prepared with regard to the Department of Planning Lands and Heritage templates.

Client relationship

I was engaged to provide expert bushfire safety and planning advice. My relationship with the client is a standard commercial contract, and no private, personal, or other matter has influenced the content of the BMP or my findings.

STATEMENT OF CONFORMITY – PLANNING AND DEVELOPMENT ACT 2005



Anthony Rowe Level 3 - BPAD36690

Principal



The signatory declares that this Bushfire Management Plan meets the requirements of State Planning Policy 3.7 (2015) and the Guidelines for Planning in Bushfire Prone Areas v1.4.

NOTE: SPP 3.7 Bushfire (2024) and the Planning for Bushfire Guidelines (2024) became operational on the 18 November 2018. The introduction of the new SPP 3.7 enable the decision makers discretion to make its decision on SPP3.7 (2015) and the Guidelines for Planning in Bushfire Prone Areas v1.4.

SPP 3.7 Bushfire (2024) and the Planning for Bushfire Guidelines (2024) make no substantive changes to the assessment consideration that have applied to Structure Plan. Siting and design, vehicle Access and Water have not changed, as they would apply to the proposal.

SUMMARY

This BMP has been prepared to support the consideration of a Structure Plan to guide future subdivision of a 9.5 ha land parcel Southern River Precinct 3B1. The site is located at Southern River Road and Leslie Street (the site).

The site is within the City of Gosnells and located within a Bushfire Prone Area (OBRM October 2021). Because the site is within a Bushfire Prone Area, the Structure Plan is required to be accompanied by a Bushfire Management Plan to demonstrate the intended development can comply with State Planning Policy 3.7 *Planning in Bushfire Prone Areas*.

The Policy Intent for SPP 3.7, ***is to implement effective risk based landuse planning and development to preserve life and reduce the impact of bushfire on property and infrastructure.***

SPP 3.7 is a risk management arrangement that utilises AS3959:2018 to determine the bushfire risk and uses compliance with the intent of each bushfire protection criteria 'Element', as the required risk treatments.

This BMP has been prepared in accordance with the WAPC *BMP template to support a BAL Contour assessment for structure plans where the lot layout is known and subdivision applications* and the *Model Subdivision Conditions Schedule May 2020*.

The following headings follow the structure and the investigations of the WAPC template.

1. Proposal details (addressed in Section 1)

The proposed structure plan will facilitate the subdivision at Southern River Precinct 3B1. The precinct is 9.5 ha (formerly General Rural Zone land) and is bounded by Southern River Road (west), Leslie Street (south), the Southern River channel (north –Southern River foreshore) and rural living lots at the east boundary (predominantly grassland, and zoned General Rural).

Southern River Road (west) and Leslie Street (south) are both sealed public through roads compliant with the IPWEA Subdivision Guidelines.

The internal road arrangement (to be ceded) provides a perimeter road to the Southern River foreshore and no cul-de-sacs or battle axe lots are proposed. There is no reliance upon future road connections.

The site has access to the reticulated water supply network and hydrants are provided in Leslie Street.

2. Environmental considerations (addressed in Section 2)

The site is predominantly cleared and in grassland condition, with scattered scrub. The exception is along the Southern River area. Scrub vegetation adjoins the east boundary.

A Public Open Space (POS) is to be provided as the foreshore to the Southern River. The 50 m CCW within the POS is to be revegetated for conservation purposes (assumed as Forest) as an augmentation of the Southern River foreshore. The balance of the POS will be managed for recreation to a Low Threat (excluded) state but will include a stormwater retention basis to be retained as Scrub.

3. Bushfire assessment results (addressed in Section 3)

A Bushfire Attack Level assessment following Method 1 AS 3959:2018, and the DPLH *Visual guide for bushfire risk assessment in Western Australia*, and using an FFDI of 80, has been undertaken.

The indicative BAL (at completion) is shown on Figure 6. It has included the revegetated CCW along the southern River, and Scrub, and the present vegetation at the east boundary, adjacent the south east residential cell. All residential cells have a developable area not exceeding BAL 29. The development of the south east residential cell is deferred until BAL 29 can be achieved at its east boundary. A restrictive covenant will be applied, restricting habitable development from occurring within the cell if >BAL 29 (BAL 40-BAL FZ). This enables a habitable building can occur as soon as BAL 29 can be achieved, following an arrangement with or development of the adjoining land (east).

4. Identification of bushfire hazard issues (addressed in Section 4)

The potential risk to the site is flame contact, ember attack and radiant heat from forest vegetation located retained in the CCW at the north of the site. Habitable buildings will be separated from the CCW (Forest) and

Scrub stormwater retention basin by a road (providing separation and access for emergency services). The facing habitable buildings will be required to be constructed commensurate to their BAL rating BAL 29 or less.

There is also a potential risk of flame contact and radiant heat from grassland and isolated scrub east of the site, but this is expected to be removed at subdivision, either by the progress of development to the east of the east boundary or by an agreement between landowners to remove the threat. The facing habitable buildings will be required to be constructed commensurate to their BAL rating BAL 29 or less.

The site is connected to a reticulated water supply and hydrants within the public roads enable emergency services to undertake fire suppression.

The nearest brigade is located in Maddington (7.5 km), but potentially conflicting priorities means no reliance should be placed upon brigade intervention to suppress a bushfire. A benefit from the AS3959 construction standard, resistance to ember attack, is to increase the passive resistance of a building to avoid significant damage and loss; to reduce the dependence upon the brigade.

5. Assessment against the bushfire protection criteria (addressed in Section 5)

The future subdivision arrangement has been compared with the Acceptable Solutions (provision) associated with the four Bushfire Protection Criteria elements: Location, Siting and Design, Access, and Water.

Element 1 Location - this provision requires that a strategic proposal can demonstrate upon completion, the area will be classified as a low or moderate Bushfire Hazard Level.

The site is within an urban area and considered to have a moderate bushfire hazard level. It is expected that all future buildings in the e designated residential area can achieve a BAL not exceeding BAL-29.

Element 2 Siting and Design – this provision requires that a planning application should demonstrate the habitable buildings will not be exposed to a BAL greater than BAL-29.

Figure 6 illustrates the extent of the BAL extending into the site from the north boundary with Southern River.

A standard WAPC condition of subdivision approval will apply a notification on all land titles with a BAL greater than BAL-12.5 alerting that bushfire construction standards AS3959:2018 will apply to habitable buildings.

The south eastern residential cell adjoins isolated Scrub and grass (at the east boundary). A routine WAPC restriction on habitable building development within BAL-40 and BAL-FZ will apply. This will defer the placement of a habitable building at the residential cell until from the east is removed. This may arise from the progress of residential development on the adjoining land, or by an agreement (perpetual management for the first 13 m), when the BAL at the east boundary is no greater than BAL 29.

Element 3 Vehicle Access –

A3.1 Public roads: *Public roads are to meet the minimum technical requirements in Table 6, Column 1.*

All roads within the site are to be ceded as public roads, with a proposed road reserve of 15 m, capable of complying with the technical requirements in Table 6 column 1.

A3.2a Multiple access routes: *Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access).*

The site access will be from Leslie Street, which is a west to east, connecting Southern River Road through to Matison Street. Southern River Road provides for travel north south and multiple connections to the urban Perth road network. Matison Street offers alternate routes via connection to Ranford Road (west east)

A3.3 Through-roads: *All public roads should be through-roads*

The roads are arranged as through roads connecting to Leslie Street. The arrangement provides for perimeter roads located to separate the residential area from the Southern River foreshore.

A3.4a Perimeter roads: *A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more lots are being proposed*

A perimeter road reserve 15 m wide will separate the residential cells from classified vegetation excepting for the south east residential cell, which joins the east boundary and adjacent grass and Scrub.

The south east residential cell will not be developed until the Scrub class vegetation is managed removed negating the requirement for a Fire Service Access Route

Element 4 Water – this provision requires the availability of water for firefighting purposes.

The site has access to a reticulated water supply. Hydrants are to be installed in Leslie Street and will be required as part of the technical requirements for the new roads to be ceded: hydrants provided in accordance with the Water Corporation standard No. 63.

Additional Bushfire Management Strategies (addressed in section 5.2)

No measures additional to the matters addressed in the Bushfire Protection Criteria have been identified.

The site is located within the urban area of the City of Perth, at the suburb of Southern River, and is supplied with urban utilities including, power, water, and telecommunications. The roads are maintained in good condition.

The nearest fire brigade is located within 7.5 km by road to the site. These are attributes conducive to a quick response from emergency services with adequate resources to undertake fire suppression to minimise the potential for damage by bushfire.

Spatial representation of the bushfire management strategies (Figure EX 1)

The key features demonstrating compliance with the bushfire protection measures are identified on the *Spatial representation of the bushfire management strategies*.

These actions are reflected in the following *Responsibilities for implementation and management of the bushfire measures*.

6. Responsibilities for implementation and management of the bushfire measures

The structure plan guides the subsequent subdivision. The following instructions (Subdivision Requirements) are provided for guidance of the subdivision in Section 6 of this BMP.

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References

1. PROPOSAL DETAILS

1.1 Introduction

The site is located within an area identified as bushfire prone (OBRM 2021).

A structure plan is being prepared as part of facilitating and guiding the subdivision. The structure plan addresses a range of planning issues for the purpose of demonstrating the suitability of the site for further division. Because the site is within a mapped (declared) bushfire prone area the structure plan is required to include a Bushfire Management Plan that assesses the potential for the subdivision, and the subsequent development, to comply with the Policy Intent and bushfire protection measures identified in State Planning Policy 3 .7 *Planning in Bushfire Prone Areas* (SPP 3.7) and its Guidelines v1.4.

The purpose of this Bushfire Management Plan (BMP) is to assess the capability of the site to support a future development that can comply with the requirements of the SPP3.7.

The intent of SPP 3 .7 is to implement effective, risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure.

The risk is assessed by AS3959:2018 and the corresponding treatments are demonstrated by satisfying each element in the Bushfire Protection Criteria, either by Acceptable Solutions or by Performance Principle. Demonstrating compliance with the Acceptable Solutions, at completion, is an acceptable residual risk. Alternatively, a Performance Principle (alternative solution) can be accepted by the precautionary principle where the residual risk at completion avoids a significant adverse impact.

1.2 Site and Proposal Description

Address	Southern River Precinct 3B1 Southern River Road and Leslie Street			
Local Government Area	City of Gosnells			
Local Planning Scheme Zone #24	Urban Development Zone and Parks and Recreation Zone along the Southern River foreshore (extending 40 m into the site)			
Bushfire Season	1 December – 12 May (precise dates may vary annually)			
Development proposal	Structure Plan for subdivision 114 R30 lots.			
Land description site	A large holding of predominantly vacant land (MRS Urban and LPS Urban Development). The site faces houses along Leslie Street, and at the north west corner is a place of worship facing Southern River Road. The site contains a sparse distribution trees (< 30%) over unmanaged grasses - classed as grassland.			
Adjoining Land uses	North	East	South	West
Within 150 m	Southern River foreshore, CCW 50m buffer to Southern River (retained as forest), the POS as Grassland and includes a detention basin shrubland	General Rural/Grassland and Scrub (to be residential)	Residential	Residential

Within 2.5 km	Residential	Rural Living/ Pasture/ Residential	Residential	Residential
Road Access	The residential development will gain access from Leslie Street			
Water supply	The site has access to a reticulated water supply and a hydrant network will be established within the site.			
Tele communications	The site is within the Telstra 4G network			
Emergency services	The nearest fire brigades are • Maddington Fire and Rescue Service 1961 Albany Highway Maddington (7.5 km) • Gosnells Volunteer Fire Service 16 Horley Road Beckenham (10 km)			
Minor Development	N/A			
Unavoidable development	N/A			
Vulnerable Development	N/A			
High risk land use	N/A			

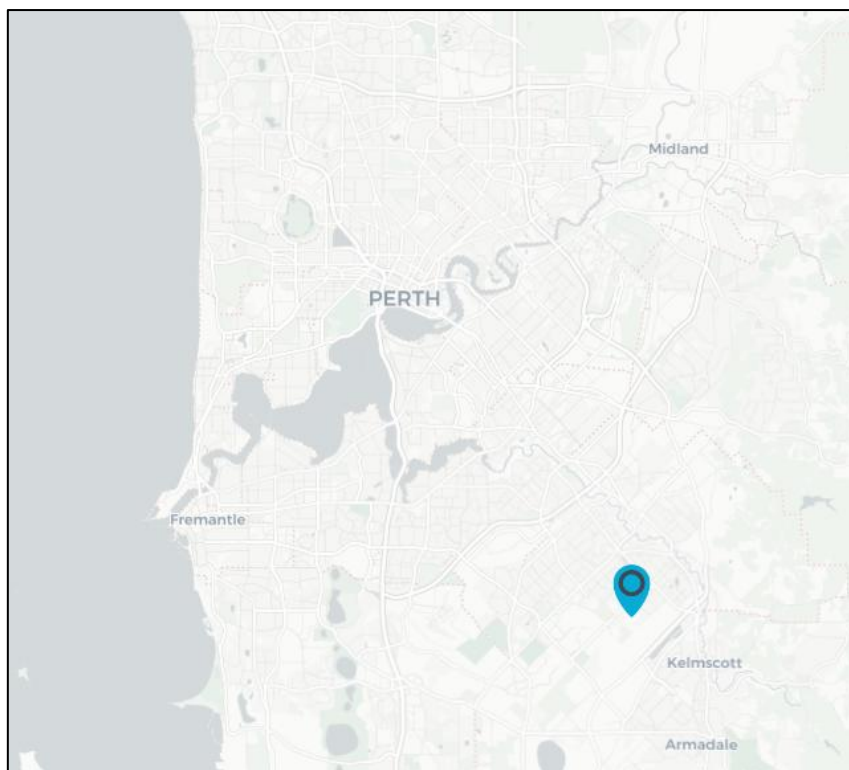


Plate 1: Site in Locality (National Map)

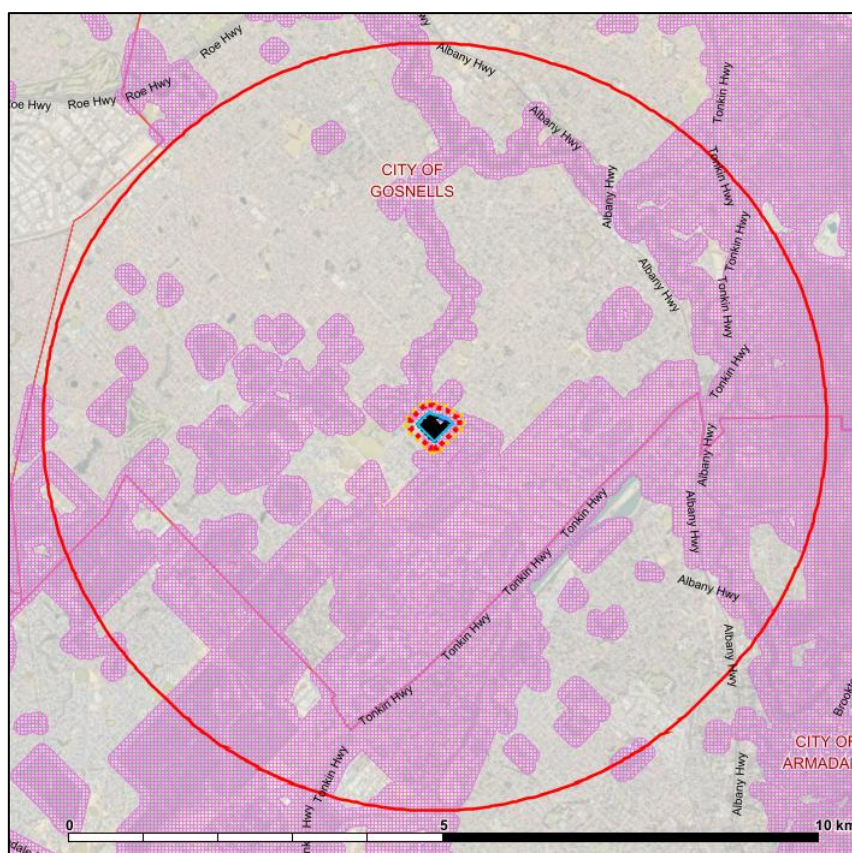


Plate 2: OBRM Bushfire Prone Area (Pink area)

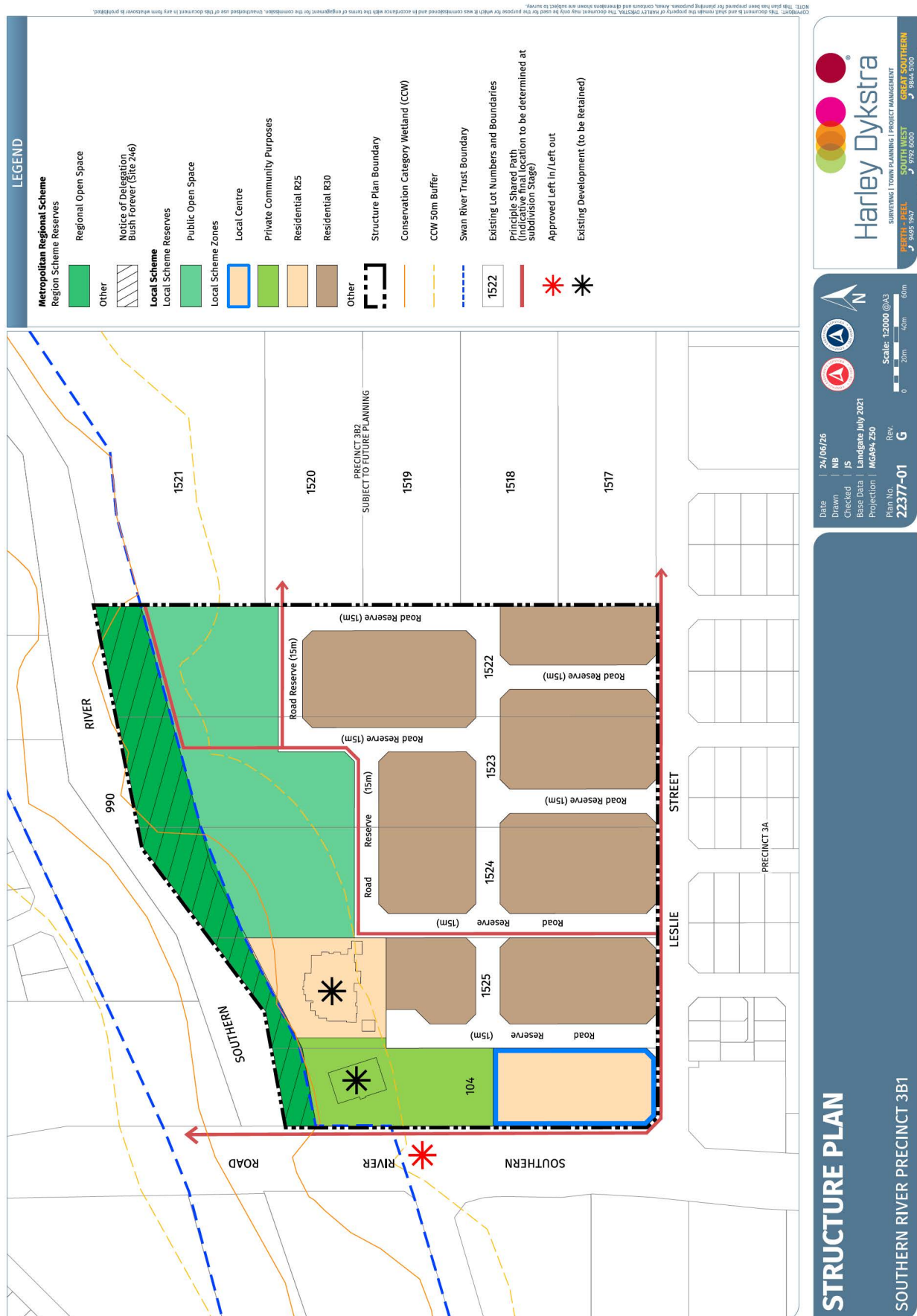


Plate 3a: Structure Plan



Plate 3b: Proposed Landscape Plan - Forest to the extent of the 50m CCW buffer

1.3 Regulatory Compliance Requirements

Planning and Development Act 2005 - SPP 3.7

On 7 December 2015, the State Government introduced by Gazette, a state map of Bushfire Prone Areas by order under the *Fire and Emergency Services Act 1998* and introduced development controls in Bushfire Prone Areas through the *Planning and Development Act 2005*. These controls were authorised by State Planning Policy 3.7 (Planning in Bushfire Prone Areas) regulations introduced under Part 10A Schedule 2 of the *Planning and Development (Local Planning Scheme) Regulations 2015* and guided by the *Guidelines for Planning in Bushfire Prone Areas*.

The proposal is a Structure Plan (Strategic Planning Proposal), where the lot lay out is known. Because the proposed lots are known the capability of the lot to comply with the Policy Intent can be assessed and the relevant WAPC template joins the considerations for subdivision.

Planning and Development (Local Planning Schemes) Amendment Regulations 2015 (Schedule 2)

Structure plans are approved by the West Australian Planning Commission on assessment by the local government based on appropriate planning principles.

State Planning Policy 3.7 Planning in Bushfire prone areas.

The State Planning Policy, Regulations, and Guidelines now form the foundation for fire risk management planning in WA at a community and land development level. The Policy Intent of SPP 3.7 is ***to preserve life and reduce the impact of bushfire on property and infrastructure***.

Section 4 of SPP 3.7 provides the policy is to be read in conjunction with the Local Planning Schemes) Amendment Regulations 2015, supplementary provisions of a scheme (if present), the supporting Guidelines and the Australian Standard AS3959.

Applicable clause from SPP 3.7, addressing structure plans where the lot layout is known the includes:

SPP 6.3: Any strategic planning proposal is to be accompanied by a Bushfire Hazard Level (BHL) assessment (Guidance provided by a WAPC Position Statement) and Bushfire attack Level Contour Map illustrating a developable area < BAL 29 can be achieved and demonstrating the bushfire hazard issues can be addressed in compliance with the Policy Intent. *In this instance a moderate BHL can be achieved in accordance with the Position Statement, the proposal can achieve the intended development without exceeding BAL 29, road access and water are compliant with the acceptable solutions in the bushfire protection criteria.*

SPP 6.4: The information required to accompany subdivision applications is to include a BAL contour Map, the identification of any hazard resulting from the BAL Contour Map and an assessment against the bushfire protection criteria that demonstrates the capability of the subsequent development to comply with the Policy Intent. *In this instance the Structure Plan can demonstrate a developable area (BAL Contour Map) can be achieved on each lot*

SPP 6.11: Precautionary Principle. If a landowner/proponent cannot satisfy the performance principles of the relevant policy measures (intent) through either the acceptable solutions outlined in the Guidelines, or through the alternative solutions (Performance Principle) the application may not be approved. *The proposal can achieve compliance with the Acceptable solutions and will not rely on the Precautionary Principle.*

Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design

This Position Statement is to be read in conjunction with SPP 3.7.

It provides that consideration should be given to the level of bushfire exposure that adjoins or is within the subject site and where lot(s) contain BAL-40 or BAL-FZ, that sufficient area by an APZ within the site, can achieve BAL-29 at a habitable building

Bush Fires Act 1954

Section 33 of the *Bush Fires Act 1954* recognises the responsibility of all landowners to prevent the spread of bushfire. The City of Gosnells issues a Firebreak Notice annually. The City can issue a notice upon the landowner to act as and when specified in the notice with respect to anything which is upon the land, and

which in the opinion of the local government or its duly authorised officer, is, or is likely, to be conducive to the outbreak of a bushfire or the spread or extension of a bushfire.

An owner who fails to comply with a notice is guilty of an offence (Penalty: \$5,000). The local government may in addition carry out the required works of the notice and recover the costs incurred by application to a Court.

Individual lot owners will rely upon the management of the neighbours' land, through the Bush Fires Act 1954, until the land is developed, to become excluded as a bushfire threat.

The Bush Fires Act 1954 is also applicable to the land to the east of the site until it is developed. The owner of the land east of the site, like all landowners, is responsible for preventing the ignition and spread of bushfire from their site. The City can issue a notice, at any time, upon a landowner where there is a foreseeable risk.

2. ENVIRONMENTAL CONSIDERATIONS

2.1 Native Vegetation – Modification and Clearing

A fundamental consideration in the assessment of development under SPP 3.7 is to avoid instances where bushfire risk management measures would conflict with or be limited by other biodiversity management measures.

In accordance with the Department of Planning Lands and Heritage template (BMP template to support a BAL Contour Assessment) a review of the listed databases has been undertaken as part of this assessment to identify whether restrictions or other specific considerations may apply that would affect the implementation of any bushfire protection initiatives that may otherwise be identified.

Table 1: Ecological database assessment.

Is the land affected by:	Yes/No/NA	If yes - describe
Conservation Wetland or buffer (DBCA-019 DBCA-017)	Yes	Multiple use wetland at northern boundary.
RAMSAR Wetland (DBCA-010)	No	
Threatened and Priority Flora (DBCA-036)	No	Not identified on SLIP
Threatened and Priority Fauna (DBCA-037)	Yes	Priority Fauna
Threatened Ecological Communities (DBCA-038)	Yes	Threatened
Bush Forever (COP-071)	Yes	Northern boundary
Environmentally Sensitive Area (DWER-046)	Yes	Northern boundary
Regionally Significant Natural Areas (DWER-070)	No	Not identified on SLIP
Conservation Covenant (DPIRD-023)	N/A	
Does the proposal require the removal of restricted vegetation?	Yes	No

The site is largely grassland with isolated area of scrub, trees less than 6 m tall. The site with the except of the public open space, which will augment the Southern River (CCW 50 m forest) to create an expanded foreshore, the rest will be cleared of vegetation, displaced by the future residential development.

Scrub and grassland on land east of the site that is zoned Residential is expected to be cleared before subdivision and the issue of titles.

2.2 Re-vegetation/Landscape Plans

The Public Open Space is an augmentation of the Southern River to expand the foreshore and is assumed, as a worst case, that the 50 m CCW will be revegetated to a Forest condition. The balance of the POS will be retained as managed by the City (agreed).

Revegetation is to be undertaken in accordance with the Landscape Plan Plate 3b. It includes a stormwater retention basin that has been classified as scrub within the POS (excluded) and it has been followed in the BAL contour Plan Figure 6.

3. BUSHFIRE ASSESSMENT

3.1 Bushfire Attack Level Assessment (Inputs)

The following assessment has applied the methodologies described in AS3959:2018, the Guidelines, and has used the Fire Protection Association Australia accredited practitioner methodology for the preparation of Bushfire Attack Level (BAL) assessments.

All vegetation within 150 m (context) of the site has been classified following Clause 2.2.3 (AS3959:2018) to determine the predominant vegetation affecting the behaviour at the locality. The Bushfire Attack Level is determined by the **predominant** vegetation within 100 m of the site boundary (for subdivision), or around the development site (building envelope) or the external face from a habitable building.

The classifications of vegetation used in AS3959:2018 are based on foliage cover, measured as a percentage of a hectare and by the fuel (vegetation) height.

Foliage cover: The portion of the ground that would be shaded by foliage when the sun is shining directly overhead, expressed as a percentage for each stratum or identifiable layer of vegetation

AS 3959:2018

Layer/ Stratum	Description	Hazard
Bark	Tight/fine – course/ribbon	Spotting and ember attack potential
Canopy	Trees taller than 6 m	Influences the flame height
Elevated fuel	Trees and Shrubs up to 6 m	Influences the flame height
Near surface	Grasses and shrubs taller than 100 mm and up to 2 m	Influences the rate of spread
Surface	On ground material, leaves, twigs, bark	Influences the rate of spread

From CFA (Vic) Overall fuel assessment guide 2010

AS3959:2018 prescribes six categories of Bushfire Attack Level (BAL): BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40, and BAL-FZ. In addition, BAL-FZ describes only performance solutions where the separation from classified vegetation (on completion) is less than 10 m. The BAL level is used for determining the siting of development (to be less than BAL-40) and in turn the construction standard that is equivalent to the BAL at the proposed building location.

This assessment has followed the guidance of AS3959:2018. This includes:

- A recognition of excluded vegetation types described at cl.2.2.3.2 (e) and (f), but the underlying vegetation should still be classed e.g., an orchard may be excluded but not the grassland within it.
- A separate plot is applied if there is a variation in the slope greater than 5.0°

- For various vegetation classes a representation that is less than 10%, does not constitute the predominant class. Foliage cover referred to in AS3859:2018 for various classes is based on the foliage cover for that class as a percentage of one ha. (shadow cast is not representative of foliage cover).
- The measurement point and the most influential vegetation class (presenting the highest BAL at the building) is used for the determination of the BAL at the building (Figure 2.2 AS3959:2018).
- Consideration of the predominant vegetation is to consider the likelihood of regeneration.
- Orchards, and single tree rows (planted in a row less than 10 m wide) is determined by underlying the near surface fuel.

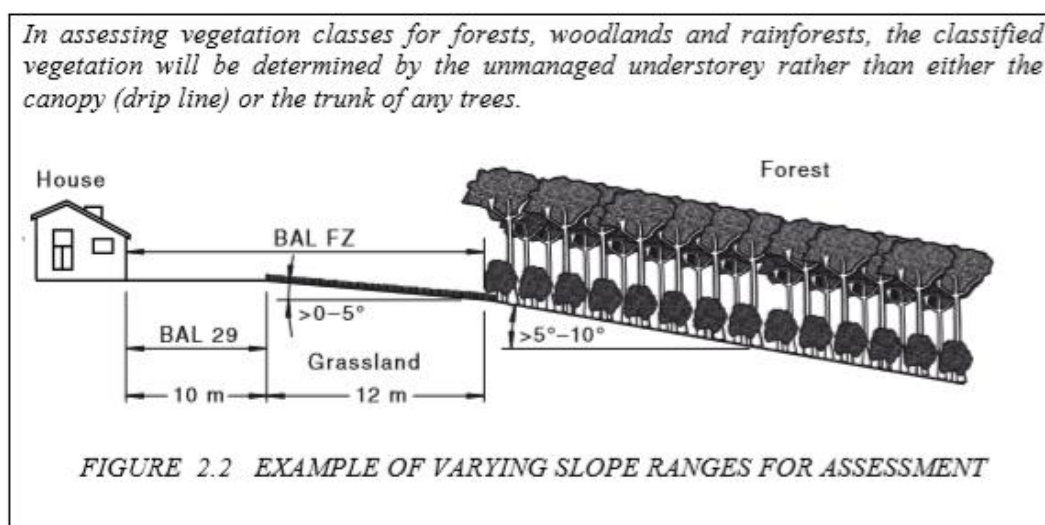


Plate 4: Effective Slope and measurement taken from AS3959:2018

Effective slope under each vegetation plot was assessed in accordance with the methodology detailed in AS3959:2018 Construction of buildings in bushfire prone areas (AS 3959) (Standards Australia, 2018 Bushfire Fuels). Slope data was measured on site and cross referenced with Landgate elevation data.

Photo evidence Site Assessment & Site Plans

The assessment of this site / development was undertaken on 10 October 2021 and 31 January 2022 by a BPAD Accredited Practitioner for the purpose of determining the Bushfire Attack Level in accordance with AS 3959 - 2018 Simplified Procedure (Method 1).

Figure 1: Location



Figure 2: Topography

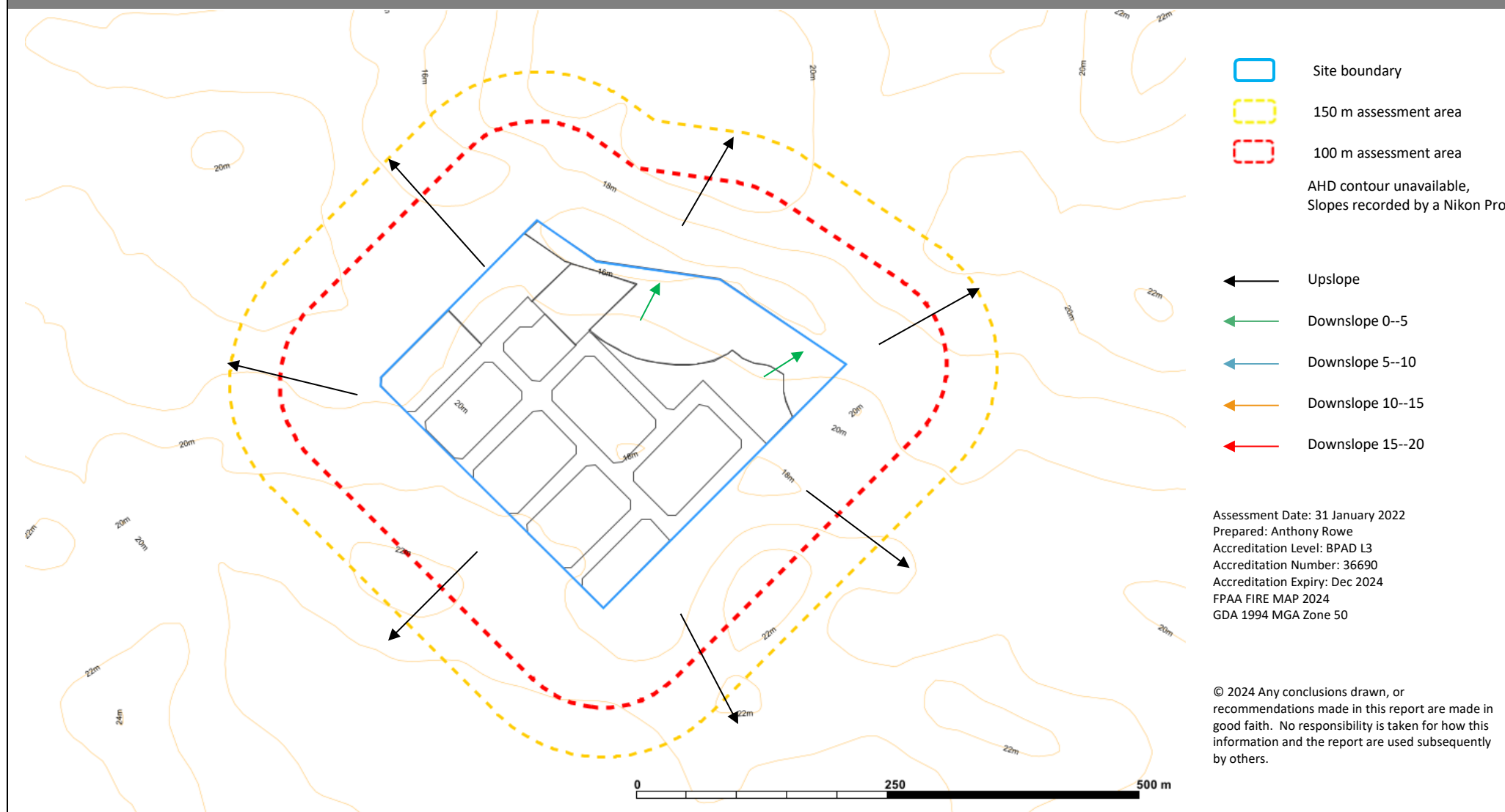


Figure 3: Vegetation Classification

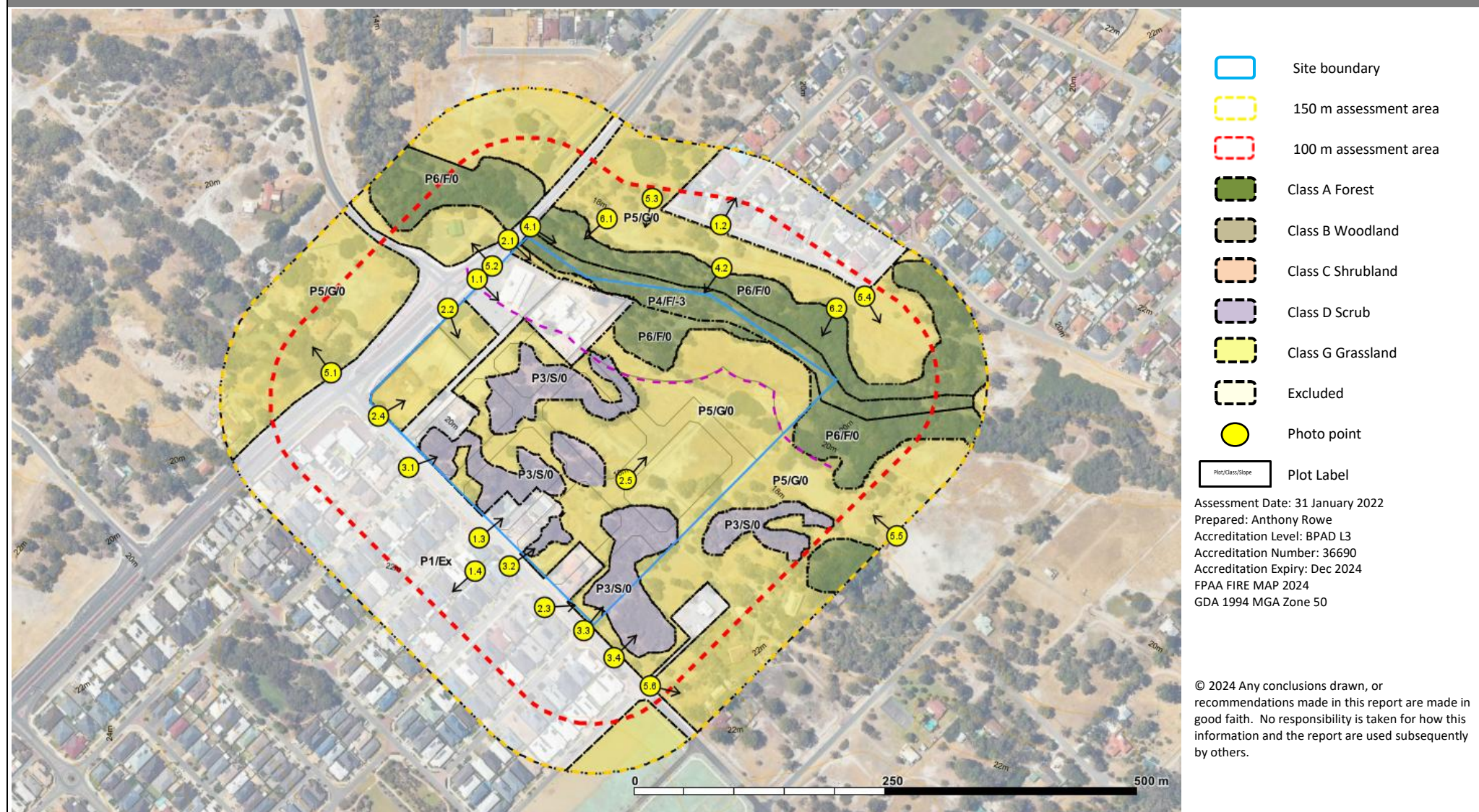
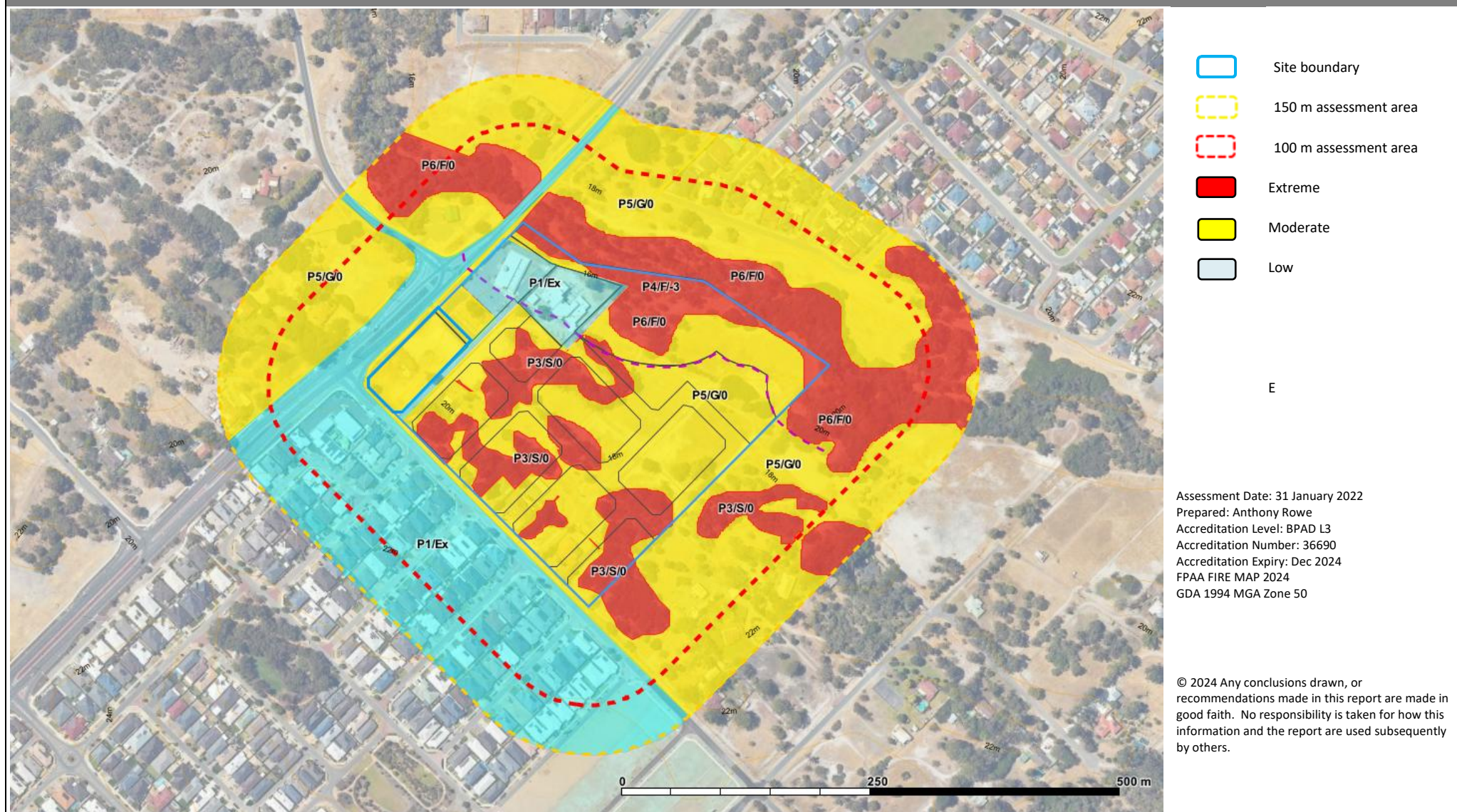


Figure 4: Bushfire Hazard Level

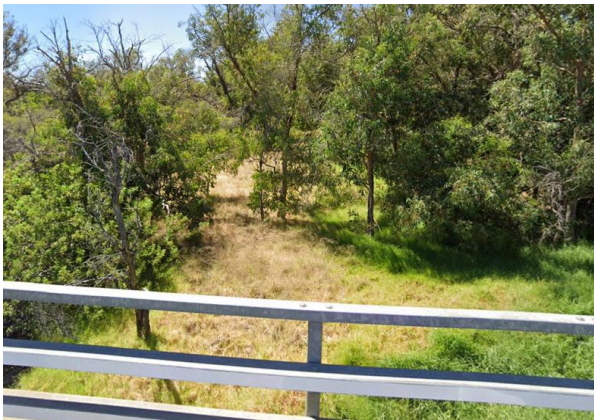


PLOT: 1					
Vegetation Classification		PHOTO ID: 1.1		PHOTO ID: 1.2	
Excludable - 2.2.3.2(e) Non Vegetated Areas					
Slope					
NA					
Description (AS3959)					
2.2.3.2 Exclusions – Low threat vegetation and non-vegetated areas					
e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.					
Observation/Justification for classification		PHOTO ID: 1.3		PHOTO ID: 1.4	
Fuel Hazard	Surface	Near surface	Elevated	Bark	
Low	✓	✓	✓	✓	
Moderate					
High					
Very High					
Extreme					
Post development					
Excluded					
Comment:					

PLOT: 2								
Vegetation Classification		PHOTO ID: 2.1		PHOTO ID: 2.2				
Class G Grassland – Open herbfield G-27								
Slope								
Flat upslope								
Description (AS3959)								
All forms (except tussock moorlands) including situations with shrubs and trees if the overstorey foliage cover is less than 10%. Includes pasture and cropland.								
Observation/Justification for classification								
Fuel Hazard	Surface					Near surface	Elevated	Bark
Low						✓	✓	✓
Moderate								
High	✓							
Very High								
Extreme								
Post development								
To be displaced by urban development - Excluded								
Photo 2.1, Grassland at north boundary retained,.								
Comment: Photo 2.1 Grassland adjacent to north boundary and forest (Plot 4) will be retained otherwise the grassland in Plot 2 will be displaced by urban development.								

PLOT: 2					
Vegetation Classification		PHOTO ID: 2.5			
Class G Grassland – Open herbfield G-27					
Slope					
Flat upslope					
Description (AS3959)					
All forms (except tussock moorlands) including situations with shrubs and trees if the overstorey foliage cover is less than 10%. Includes pasture and cropland.					
Observation/Justification for classification					
Fuel Hazard	Surface	Near surface	Elevated	Bark	
Low		✓	✓	✓	
Moderate					
High	✓				
Very High					
Extreme					
Post development					
To be displaced by urban development - Excluded					
Comment: Photo 2.5 Central grasslands to be displaced by urban development.					

PLOT: 3						
Vegetation Classification			PHOTO ID: 3.1		PHOTO ID: 3.2	
Class D Scrub - Closed scrub D-13					 Envision Southern River SP 10 Oct 2021, 11:43:44	
Slope						
Flat						
Description (AS3959)						
Found in wet areas and/or areas affected by poor soil fertility or shallow soils; >30% foliage cover. Dry heaths occur in rocky or sandy areas. Shrubs >2 m high. Typical of coastal areas and tall heaths up to 6 m in height. May be dominated by Banksia, Melaleuca or Leptospermum with heights of up to 6 metres						
Observation/Justification for classification			PHOTO ID: 3.3		PHOTO ID: 3.4	
Fuel Hazard	Surface	Near surface	Elevated	Bark		
Low	✓			✓		
Moderate			✓			
High		✓				
Very High						
Extreme						
Post development						
To be displaced - Excluded						
Comment: Predominantly Scrub, Shrubs up to 6 m with trees taller than 6m <10%						

PLOT: 4					
Vegetation Classification		PHOTO ID: 4.1		PHOTO ID: 4.2	
Class A Forest - Low open forest A-04					
Slope					
Downslope 0-5					
Description (AS3959)					
Trees over 30 m high; 30%-70% foliage cover (may include understorey ranging from rainforest species and tree ferns to low trees and tall shrubs). Found in areas of high reliable rainfall. Typically dominated by eucalypts with a sub-dominant tree layer.					
Observation/Justification for classification					
Fuel Hazard	Surface	Near surface	Elevated	Bark	
Low	✓				
Moderate		✓			
High				✓	
Very High			✓		
Extreme					
Post development					
Retained.					
Comment: Trees with understorey and canopy cover > 30%					

PLOT: 5					
Vegetation Classification		PHOTO ID: 5.1		PHOTO ID: 5.2	
Class G Grassland – Open herbfield G-27					
Slope					
Flat					
Description (AS3959)					
All forms (except tussock moorlands) including situations with shrubs and trees if the overstorey foliage cover is less than 10%. Includes pasture and cropland.					
Observation/Justification for classification		PHOTO ID: 5.3		PHOTO ID: 5.4	
Fuel Hazard	Surface	Near surface	Elevated	Bark	
Low		✓	✓	✓	
Moderate					
High	✓				
Very High					
Extreme					
Post development					
Retained					
Comment: Grass in foreground photos 5.3 and 5.4.					

PLOT: 5					
Vegetation Classification		PHOTO ID: 5.5		PHOTO ID: 5.6	
Class G Grassland – Open herbfield G-27					
Slope					
Flat					
Description (AS3959)					
All forms (except tussock moorlands) including situations with shrubs and trees if the overstorey foliage cover is less than 10%. Includes pasture and cropland.					
Observation/Justification for classification					
Fuel Hazard	Surface	Near surface	Elevated	Bark	
Low		✓	✓	✓	
Moderate					
High	✓				
Very High					
Extreme					
Post development					
Retained					
Comment: Trees < 10% over grass.					

PLOT: 6					
Vegetation Classification		PHOTO ID: 6.1		PHOTO ID: 6.2	
Class A Forest - Low open forest A-04					
Slope					
Flat					
Description (AS3959)					
Trees over 30 m high; 30%-70% foliage cover (may include understorey ranging from rainforest species and tree ferns to low trees and tall shrubs). Found in areas of high reliable rainfall. Typically dominated by eucalypts with a sub-dominant tree layer.					
Observation/Justification for classification					
Fuel Hazard	Surface	Near surface	Elevated	Bark	
Low					
Moderate	✓			✓	
High		✓			
Very High			✓		
Extreme					
Post development					
Retained					
Comment: Trees < 10% over grass.					

POTENTIAL BUSHFIRE IMPACT - Outputs

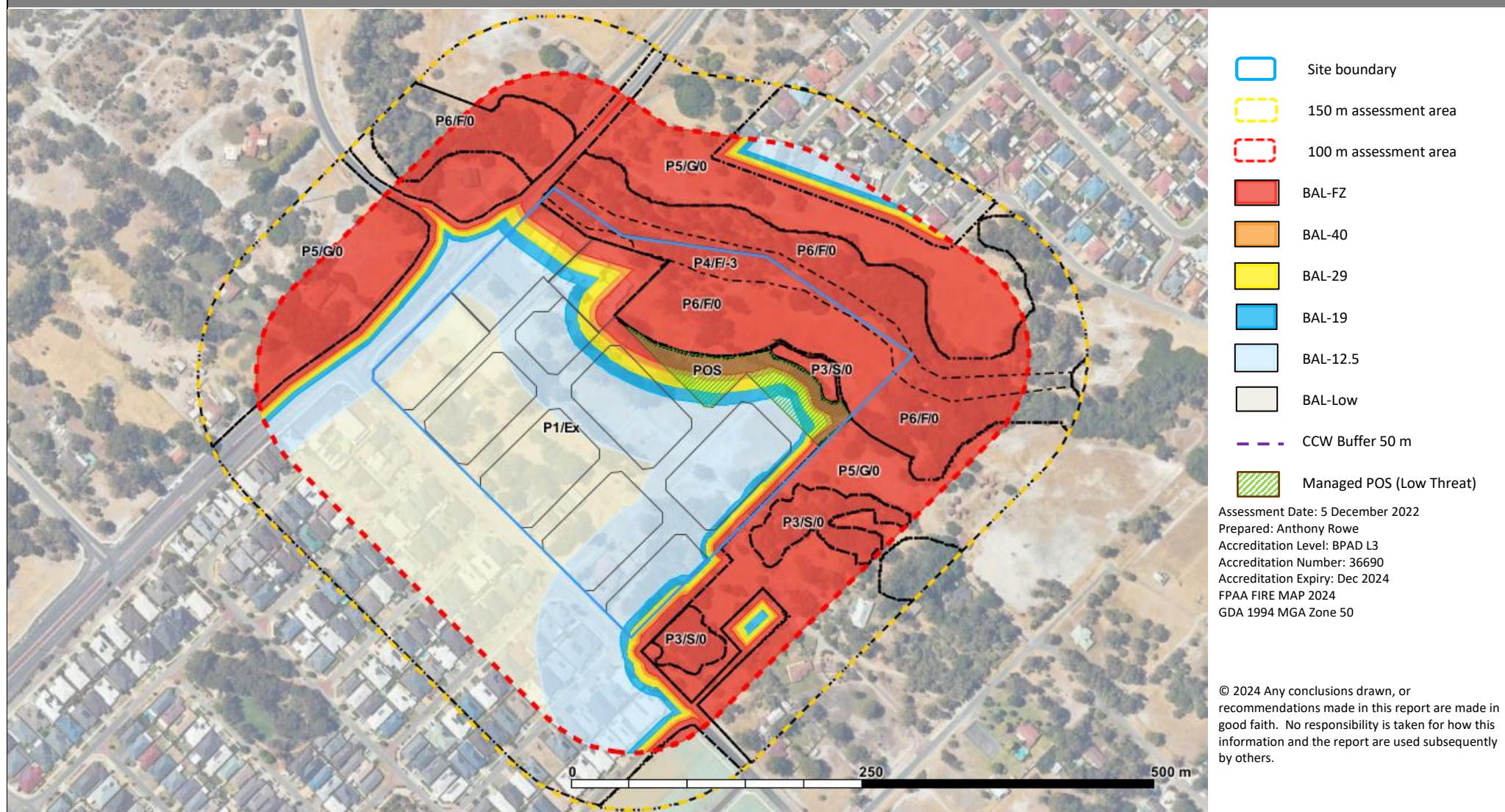
In accordance with SPP 3.7, a BAL Contour Map has been prepared to illustrate the potential radiant heat impacts and associated BAL ratings for the assessment area after the development is completed (Figure 6).

Plot	Vegetation classification	Effective slope (degrees)	Separation Distance (AS 3959:2018 Table 2.5)	BAL
4	Forest	0-5	< 20 m	BAL-FZ
			20 - < 27 m	BAL-40
			27 - < 37 m	BAL-29
			37 - < 50 m	BAL-19
			50 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
3	Scrub	Flat/upslope	< 10 m	BAL-FZ
			10- < 13 m	BAL-40
			13 - < 19 m	BAL-29
			19 - < 27 m	BAL-19
			27 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
2 and 5	Grassland	Flat	< 6 m	BAL-FZ
			6- < 8 m	BAL-40
			8 - < 12 m	BAL-29
			12 - < 17 m	BAL-19
			17 - < 50 m	BAL-12.5
			> 50 m	BAL-LOW

Figure 5: Vegetation Classification – Post Development



Figure 6: Southern River foreshore forest established



3.2 Indicative Bushfire Attack Level (Outputs) Method 1

The Indicative Bushfire Attack Level (highest BAL) for the site / proposed development is based upon the conditions and classified vegetation expected at the time of completion.

The separation of the residential areas by the perimeter road will result in each residential cell achieving BAL-29 at 6 m from the boundary with a road separating it from the classified vegetation (Southern River foreshore).

The indicative BAL is illustrated in Figure 6.

4. IDENTIFICATION OF BUSHFIRE HAZARD ISSUES

Risk

Sustainable fire combustion depends upon the availability of fuel, oxygen, and heat. Removal of any one of the three aspects will extinguish or not sustain a fire. Fuel management, the management of vegetation, is the most practical means of control.

Bushfire behaviour, as it increases in intensity and speed of travel, can exceed human control measures and when this occurs the risk to humans and property increases. Bushfire behaviour is a result of climate, topography, and the availability of bushfire fuel (vegetation).

- Climate (drought and season) & weather (temperature, humidity, wind, atmospheric instability).

Wind

Bushfires are influenced by the wind direction and the speed. The wind direction generally determines the direction of the fire and wind speed, along with ground slope, generally determines the speed a fire will travel over ground. As wind strength increases it increases the availability of oxygen allowing the fire intensity to increase.

Atmospheric conditions determine the potential for the uplift of embers and particles that can be distributed by the prevailing wind direction well ahead of the fire, up to 9 km, to create spot fires that can advance the location of the fire front.

Fire Danger Index FDI

FDI is an indicator of potential fire intensity and behaviour based upon weather conditions; temperature, humidity, and wind speed, together with climate measures, drought factor representing the dryness of the ground fuels.

The FDI is an indicator of the potential for house loss and fatalities.

The FDI is used as a basis for determining the required design performance of a building.

- Topography (slope of the ground, aspect) – fire travels faster uphill, and in some conditions may determine the direction of the fire. The landform can also channel and increase the windspeed at a locality and create turbulence. It is measured as 0.0° or in downslope increments of 5.0°.
- Vegetation (horizontal and vertical structure, flammability, mass, and availability). Measured as a vegetation classification, or an exclusion, in AS 3959 (Method 1). The arrangement of fuel has a greater effect upon the **intensity** of a fire than just its mass; its exposure to oxygen is referred to as its availability in a bushfire. The available fuel represents a potential fire intensity measured in tonnes per ha. For this reason the predominant vegetation as an expectation of fire intensity is used, rather than a determination based upon a minor proportion of exceptional vegetation; that may either under or overestimate the bushfire intensity. The potential for revegetation is also to be considered in context to the likely future use of the land, where there is potential to introduce an extreme bushfire hazard level.

Risk Evaluation

It is assumed that a bushfire will achieve a steady-state and be fully developed to maximum intensity over a 100 m (minimum) fire run. Grass fires travel faster (GFDI) than a forest canopy fire, but a forest canopy fire can eject a higher level of embers and also eject them over a greater distance. Crown fires occur when the ground fire is intense, and conversely, when ground fuels are managed, the resultant fire intensity may not be sufficient to involve the crown or sustain a fire.

Fuel reduction initiatives such as slashing and controlled burns are intended to reduce the fuel availability to a level where the intensity of the fire remains controllable.

The most relevant weather station to the site is at Gosnells, 6.6 km from the site. The site is within an area described as having a Mediterranean climate of dry summers and mild, wet winters. The majority of rainfall is between May and September. The prohibited burning period is from mid-December to mid-March.

The Bushfire Danger Season has traditionally been between November and April each year, but recent climatic conditions have caused fire danger conditions to be present either side of this period.

Severe bushfire conditions FDI 50+, occur mostly between January and March. Extreme and Catastrophic conditions occur mostly in the afternoon and typically with easterly or south westerly winds (see Plate 5 and 6). Fire from the east is predominant due to declining humidity compared to the south west. A bushfire can however come from any direction.

Bushfires generally travel in the direction of the prevailing wind. The direction of the prevailing wind conditions can affect the options for evacuation and anticipated fire intensity depending upon the slope and fuel

9 am Feb
787 Total Observations
Calm 1%

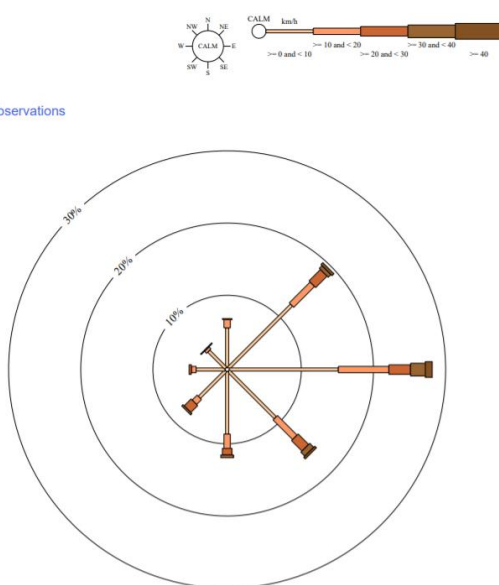


Plate 5: wind directions as at 9 am

3 pm Feb
517 Total Observations
Calm 1%

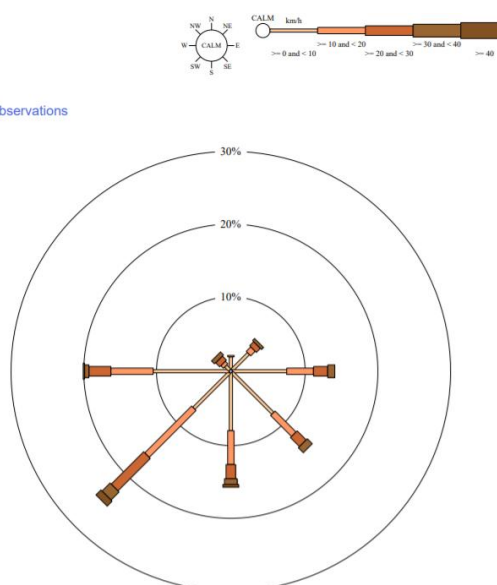


Plate 6: wind directions as at 3 pm

Risk assessment

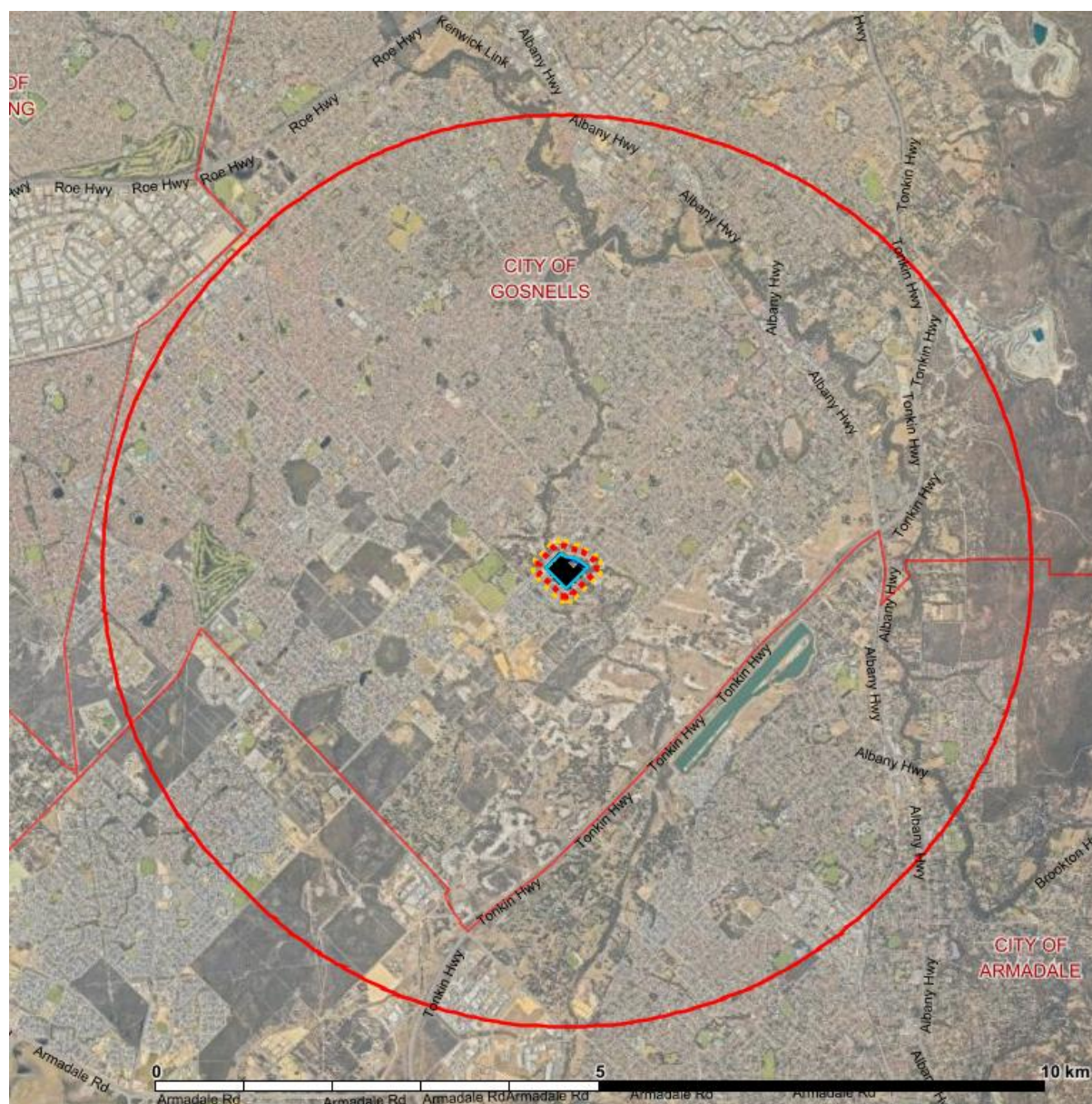


Plate 7: Illustrates the surrounding area within 5 km is predominantly urban development and the Darling Scarp Forest to the east.

Plate 7 when combined with Plates 5 and 6, indicates the site has a proximity that could be subject to a dispersed ember attack (along with the general residential area) from a fire within the Darling Scarp/Perth Hills. These fires typically travel east to west pushed by strong easterly winds. Embers can travel up to 5 km.

The retained hazard affecting the development site in the long term is within the Southern River CCW, to be revegetated to forest. The balance of the public open space will be managed grassland. It is possible a fire within the Darling Scarp/Perth Hills could cause a spot fire to ignite in the public open space along the Southern River. The required setbacks are shown on Figure 6.

A perimeter road along the north of the development site will provide a separation between the forest and future residential development. A road reserve and a 6 m street setback will provide a separation of 21 m which is commensurate with BAL 29, at 21m from forest. The Public Open Space is a linear reserve along the Southern River which runs from east to west. Forest can generate embers. Whilst the habitable building can be separated and distanced outside of direct flame contact (BAL 29), ember attack can ignite flammable materials near buildings, accumulate against walls, or find gaps in the exterior to access flammable materials

inside. BAL 29 is designed to resist ember attack, but ongoing maintenance is required to ensure flammable materials are not stored near buildings and the external surfaces do not present gaps greater than 2 mm.

The land to the east of the site is identified as Urban in the Metropolitan Regional Scheme. The land presently contains isolated scrub (not restricted) at the east boundary and extended grassland east of the site. A section of the structure plan south east, abuts the east boundary, instead of having a separation provided by a road on the site boundary.

This section will be affected by a BAL rating greater than BAL 29 extending 13m into the site from the east boundary. Habitable buildings will be restricted within this area, until the adjoining land is developed and the bushfire threat removed.

The adjoining road network enables the site to be approached from the west, east and south. The site is connected to a reticulated water supply and hydrants within the public roads enable emergency services to undertake fire suppression. The nearest brigade is located 7.5 km from the site to provide a rapid response, to the site in a bushfire event, within 15 minutes.

The AS3959 construction standard, aims to increase the passive resistance of a building, reducing the dependency upon fire services to provide suppression to prevent building loss.

5. BUSHFIRE PROTECTION MEASURES

5.1 Guidelines for Planning in Bushfire Prone Areas Version 1.4 (the Guidelines)

The Guidelines apply to development applications located within designated bushfire prone areas. The Guidelines provide supporting information for implementation of SPP 3.7. Specifically, they provide the Bushfire Protection Criteria to be addressed for all applications.

The bushfire risk mitigation strategies detailed in (Table 2 below) are designed to comply with the Bushfire Protection Criteria detailed in Guidelines for Planning in Bushfire Prone Areas Version 1.4 (the Guidelines) Appendix 4 (WAPC, 2021).

Where discrepancy occurs between State and local bushfire planning provisions the higher standard of mitigation has been selected.

BUSHFIRE PROTECTION CRITERIA ASSESSMENT

5.1 Bushfire Protection Criteria (Appendix 4 of the Guidelines v1.4)

For each of the elements listed within Appendix 4 of the Guidelines for Planning in bushfire-prone areas, the 'intent' must be achieved either by the proposal meeting the acceptable solutions; or where these acceptable solutions cannot be fully met, then by a performance-based solution that can achieve the 'intent.'

Table 2: Bushfire Protection Criteria assessment.

✓	Acceptable solution provided	C	An Acceptable Solution to be conditioned
N/A	Not Applicable	P	Performance Principle solution see 5.2

Bushfire Protection Criteria	Method of Compliance	AS	PP	Proposed Bushfire Management Strategies
Element 1: location To ensure that strategic planning proposals, subdivision, and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property, and infrastructure	A1.1 Development location The strategic planning proposal, subdivision, and development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL-29 or below.	✓		The site is within an Urban area identified by the MRS area that is considered a moderate bushfire hazard level. Each residential area within the site is able to achieve a developable area (not exceeding BAL 29) in accordance with the WAPC Position Statement Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design – November 2019. Development at the south east residential cell is deferred until able to achieve BAL 29.

Bushfire Protection Criteria	Method of Compliance	AS	PP	Proposed Bushfire Management Strategies
Element 2: Siting and Design To ensure that the siting and design of development minimises the level of bushfire impact	A2.1 Asset Protection Zone Every habitable building is surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements: - Width: Measured from any external wall or supporting post or column of the proposed building, and of sufficient size to ensure the potential radiant heat impact of a bushfire does not exceed 29kW/m² (BAL-29) in all circumstances. - Location: the APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity (see explanatory notes). - Management: the APZ is managed in accordance with the requirements of 'Standards for Asset Protection Zones.' (see Schedule 1).	✓		Figure 6 illustrates the extent of the BAL extending into the site from the north boundary with Southern River. A proposed Landscape Management Plan (Plate 3b) has assumed CCW buffer of 50m will be revegetated as forest POS (conservation) and the balance of the foreshore POS (recreation), as managed will be excluded. The POS (recreation) contains classified vegetation Scrub in a proposed stormwater retention basin. It has been followed in Figure 6 BAL contour map. The facing residential area is separated from the POS by a road, and the residential areas provide developable areas not exceeding BAL 29 (Figure 6). The south eastern residential area that adjoins the east boundary, faces adjoining Scrub. It is assumed this area will adjoin low threat when the land east is developed for residential low threat. In the interim along the south east boundary should be withheld until it can achieve BAL 29, when works commence adjacent the east boundary.
Element 3: Vehicular Access To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event	A3.1 Public roads The minimum requirements under this acceptable solution are applicable to all proposed and existing public roads. Public roads are to meet the minimum technical requirements in Table 6, Column 1. The trafficable (carriageway/pavement) width is to be in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development (IPWEA Subdivision Guidelines), Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government area	✓		Leslie Street is a sealed public road compliant with the IPWEA subdivision guidelines. All roads within the site are public roads, with a proposed road reserve of 15 m, capable of complying with the technical requirements in Table 6 column 1 (compliant with the IPWEA subdivision guidelines).

Bushfire Protection Criteria	Method of Compliance	AS	PP	Proposed Bushfire Management Strategies
	A3.2a Multiple access routes Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access).	✓		The site is located on Southern River Road and Leslie Street. Leslie Street is a through Road running from west to east, connecting from Southern River Road through to Madison Road. Both Southern River and Madison Road are north south running roads with multiple connections to the urban Perth road network.
	A3.2b Emergency access way Where it is demonstrated that A3.2a cannot be achieved due to site constraints, or where an alternative design option does not exist, an emergency access way can be considered as an acceptable solution. An emergency access way is to meet all the following requirements: • requirements in Table 6, Column 2; • provides a through connection to a public road; be no more than 500 metres in length; and • must be signposted and if gated, gates must open the whole trafficable width and remain unlocked.³²	N/A		
	A3.3 Through-roads All public roads should be through-roads. No-through roads should be avoided and should only be considered as an acceptable solution where: • it is demonstrated that no alternative road layout exists due to site constraints; and • the no-through road is a maximum length of 200 metres to an intersection providing two-way access, unless it satisfies the exemption provisions in A3.2a of this table. A no-through road is to meet all the following requirements: • requirements of a public road (Table 6, Column 1); and • turn-around area as shown in Figure 24	✓		The roads are arranged as through roads connecting to Leslie Street. The arrangement provides for perimeter roads located to separate the residential area from the Southern River foreshore.

Bushfire Protection Criteria	Method of Compliance	AS	PP	Proposed Bushfire Management Strategies
	A3.4a Perimeter roads A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more lots are being proposed (including as part of a staged subdivision) with the aim of: - separating areas of classified vegetation under AS 3959, which adjoin the subject site, from the proposed lot(s); and - removing the need for battle-axe lots that back onto areas of classified vegetation. A perimeter road is to meet the requirements contained in Table 6, Column 1. A perimeter road may not be required where: the adjoining classified vegetation is Class G Grassland; - lots are zoned for rural living or equivalent; - it is demonstrated that it cannot be provided due to site constraints; or - all lots have frontage to an existing public road	✓		A perimeter road reserve 15 m wide will separate the residential area from the Southern River foreshore reserve (forest). A perimeter road is also provided at the east boundary separating the north residential area from the grassland on the adjacent lot..

Bushfire Protection Criteria	Method of Compliance	AS	PP	Proposed Bushfire Management Strategies
	A3.4b Fire service access route Where proposed lots adjoin classified vegetation under AS 3959, and a perimeter road is not required in accordance with A3.4a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation. A fire service access route is to meet all the following requirements: requirements in Table 6, Column 3; • be through-routes with no dead-ends; • linked to the internal road system at regular intervals, every 500 metres; • must be signposted; no further than 500 metres from a public road; • if gated, gates must open the required horizontal clearance and can be locked by the local government and/or emergency services, if keys are provided for each gate; and • turn-around areas designed to accommodate type 3.4 fire appliances and to enable them to turn around safely every 500 metres.	✓		Not applicable, a Perimeter Road has been provided in the indicative layout. The south east residential cell will adjoin an isolated area of scrub (> 2500 m²). This residential cell will not be developed until BAL 29 can be achieved at the boundary. This residential cell is separated from the other residential cells by a road, which provides an accessible separation until the residential cell can be developed, at which time the FSAR will not be required; because the effect of the Scrub has been removed.
Element 4: Water To ensure that water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire	A4.2 Provision of water for firefighting purposes Where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, then the following applies: • The provision of a water tank(s), in accordance with the requirements of Schedule 2; and	✓		Access to a reticulated water supply is available. Fire Hydrants are provided within Leslie Street. The proposed road network within the site is to be developed as a public road and ceded to the City. The requirement for a public road is the provision of hydrants in accordance with the Water Corporation standard No. 63

Bushfire Protection Criteria	Method of Compliance	AS	PP	Proposed Bushfire Management Strategies
	- Where the provision of a strategic water tank(s) is applicable, then the following requirements apply: - land to be ceded free of cost to the local government for the placement of the tank(s); - the lot or road reserve where the tank is to be located is identified on the plan of subdivision; - tank capacity, construction, and fittings, provided in accordance with the requirements of Schedule 2; and - a strategic water tank is to be located no more than 10 minutes from the subject site (at legal road speeds). Where a subdivision includes an existing habitable building(s) that is to be retained, a water supply should be provided to this existing habitable building(s), in accordance with the requirements listed above.			

5.2 Conclusion - Compliance with SPP 3.7 Objectives

Objective 1: Avoid any increase in the threat of bushfire to people, property, and infrastructure. The preservation of life and management of bushfire impact is paramount.

The proposal is to facilitate residential development over land that is predominantly grassland. The expanded Southern River foreshore will increase the extent of localised bushfire fuels, but it will not increase the bushfire threat to existing development.

Objective 2: Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.

The proposed residential development will be designed to respond to the anticipated bushfire threat by a perimeter road, a building location within BAL-29 and construction standards commensurate to the BAL Level.

Objective 3: Ensure that higher order strategic planning documents, strategic planning proposals, subdivision and development applications take into account bushfire protection requirements and include specified bushfire protection measures.

The assessment has identified the site is suitable for the intended residential land use and demonstrated compliance with the acceptable solutions in the Bushfire protection Criteria, addressed in Section 5.1, can be achieved.

Objective 4: Achieve an appropriate balance between bushfire risk management measures and, biodiversity conservation values, environmental protection and biodiversity management and landscape amenity, with consideration of the potential impacts of climate change.

The structure plan will facilitate development displacing unregulated vegetation but will augment the revegetation of the foreshore in the CCW 50 m buffer. The proposal will provide a positive enhancement of the biodiversity conservation value of the Southern River.

5.3 Additional Bushfire Risk Management Strategies

No measures additional to the matters addressed in the Bushfire Protection Criteria have been identified.

The site is located within the urban area of the City of Perth, at the suburb of Southern River, and is supplied with urban utilities including, power, water, and telecommunications. The roads are maintained in good condition.

The nearest fire brigade is located within 7.5 km by road to the site. These are attributes conducive to a quick response from emergency services with adequate resources to undertake fire suppression to minimise the potential for damage by bushfire.

6. RESPONSIBILITIES FOR IMPLEMENTATION AND MANAGEMENT OF THE BUSHFIRE MEASURES AT SUBDIVISION

The structure plan guides the subsequent subdivision. The following instructions (Subdivision Requirements) are provided for guidance of the subdivision.

The following acknowledgements, acceptance and directions (conditions) are to be provided on the Structure Plan under the heading of Subdivision Requirements.

Bushfire Protection Measures.

1. Acknowledgments

1.1 Location

The site is accepted as a moderate Bushfire Hazard Level where the bushfire impacts can be ameliorated to an acceptable level in compliance with Element 1 (Guidelines v1.4 SPP 3.7)

1.2 Access

The existing public road arrangement satisfies the intent of the two access routes and public road arrangement to provide an arrangement of access serving the community and subdivision that is available and safe during a bushfire event.

The proposed (internal) roads are to be constructed as public roads and ceded to the City and provided with hydrants in compliance with the Water Corporation standard No. 63.

2. Lot Requirements

2.1 Notification

- a) A notification, pursuant to Section 165 of the Planning and Development Act 2005, is to be placed on the certificate(s) of title of the proposed lot(s)

The notification is to state as follows:

“This land is within a bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner and is subject to a Bushfire Management Plan. Additional planning and building requirements may apply to development on this land” (WAPC F2)

Figure Ex1: Spatial representation of the proposed risk management strategies – Precinct 3B1 Leslie Street Southern River



Bushfire Protection Measures.

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-  Site Boundary
- R25-R30** Residential development
-  CCW Buffer

Property Assessment Details
Prepared: Anthony Rowe
Accreditation Number: 36690
Accreditation Level: Level 3
Date: 5 March 2026

References

GENERAL REFERENCES

Hines. F. *Overall fuel hazard assessment guide 4th edition July 2010*, Victoria Department of Sustainability and the Environment.

Standards Australia, *AS 3959:2018 Construction of buildings in bushfire-prone areas*, Sydney

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Western Australian Planning Commission (WAPC) *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design* November 2019

WA Department of Planning Land and Heritage 2016, *Visual Guide for bushfire risk assessment in Western Australia*

Western Australian Planning Commission (WAPC) 2015, *State Planning Policy 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth, Perth

Western Australian Planning Commission and Department of Fire and Emergency Services (WAPC and DFES) 2017, *Guidelines for Planning in Bushfire Prone Areas Version 1.4*, Western Australia

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Office of Bushfire Risk management (OBRM), Map of Bush Fire Prone Areas, viewed August 2022, <
<https://maps.slip.wa.gov.au/landgate/bushfireprone/>>

APPENDIX D | LOCAL WATER MANAGEMENT STRATEGY

Southern River Precinct 3B - 1

LOCAL WATER MANAGEMENT STRATEGY



DOCUMENT QUALITY CONTROL

Project Reference		B24031
Ver No.	Purpose	Date
Draft	Client Review	November 2024
V1	Client Review	November 2024
V1	Submission for approval	Decemberr 2024

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1 EXECUTIVE SUMMARY

This Local Water Management Strategy (LWMS) has been developed to accompany the Structure Plan for the subject land.

The subject land is composed of Lots 1, & 1522-1526 Leslie Street, Southern River in the City of Gosnells. The area is known as Precinct 3B (1) and is the northern portion of Precinct 3B. It is approximately 9.4ha in area. The subject land is bounded by the Southern River along the northern boundary, Leslie Street and Southern River Road to the west and south respectively, and the eastern boundary of Lot 1522 (rural residential lot). The subject area can be seen in Figure 1 and 2, with the location shown in Figure 1.

The site is currently composed of rural residential lots in the southern portion with associated houses and outbuildings. Along Southern River Road there is a current mosque and an area approved for a childcare centre. There is also a new R25 Residential lot being developed in the north adjoining the Southern River foreshore. The subject land is relatively flat for the majority of the site, with an increasing gradient in the north east as it nears the reserve along the Sothern River. The surface is generally sand.

The site is mostly cleared of native vegetation with some native trees along the Southern River. The rest of the site is composed of planted trees, pasture species and gardens. The existing site features are shown on Figures 3 to 16.

The objective of this LWMS is to detail the best management practices approach to water management that will be undertaken for the development. This will include managing, protecting and conserving the total water cycle of the local environment and the greater catchment. The practices will involve:

- Stormwater management that incorporates the water sensitive urban design practices;
- Flood protection from localised stormwater and the Southern River;
- Groundwater resource management;
- Protection of ecosystems dependent on water resources from the subject land; and
- Sustainable water servicing

The effectiveness, efficiency and benefits provided by the best management practices require a collaborative effort between local governments, developers and relevant regulatory authorities. The developers are committed to the concepts and outcomes outlined within the approved LWMS for the subject land. This includes the implementation, monitoring and maintenance of the best management practices for stormwater designed specifically for this site.

1.1 PLANNING SUMMARY

This LWMS has been produced to accompany the Southern River Precinct 3B(1) Local Structure Plan (LSP) by Harley Dykstra Land Use Planners on behalf of Auswide Investments Southern River Pty Ltd. It is submitted in line with the City of Gosnells (CoG) Town Planning Scheme No.6 (TPS6) and CoG's Local Planning Policy No. 6.3.3.1 Southern River Precinct 3 Planning Framework. The LSP has been prepared in accordance with the requirements of Clause 7.3 of TPS6 and refines the land use elements stipulated within the Southern River/ Forrestdale/ Brookdale/ Wungong District Structure Plan 2001 and the Southern River Precinct 3 Outline Development Plan 2008.

The site is proposed to be transfered from Urban Deferred to Urban under the MRS and from General Rural to Urban Development under Local Planning Scheme no.24.

The LWMS follows on from the Integrated Land and Water Management Plan (ILWMP) that gazetted by the DoW (now DWER) in January 2009. This superseded the UWMS that was undertaken in 2002. Both of these documents recognised water and drainage as one of the key issues for development in the Southern River area.

This LWMS, to support the LSP, will guide future subdivision to ensure that the land is developed in a sustainable manner, fulfils the objectives of the WAPC as described in Liveable Neighbourhoods (WAPC, 2009) and in accordance with the objectives of the Department of Water and Environmental Regulation (DWER) and the CoG and as such provides the necessary water management strategies to guide the subsequent UWMP required for subdivision.

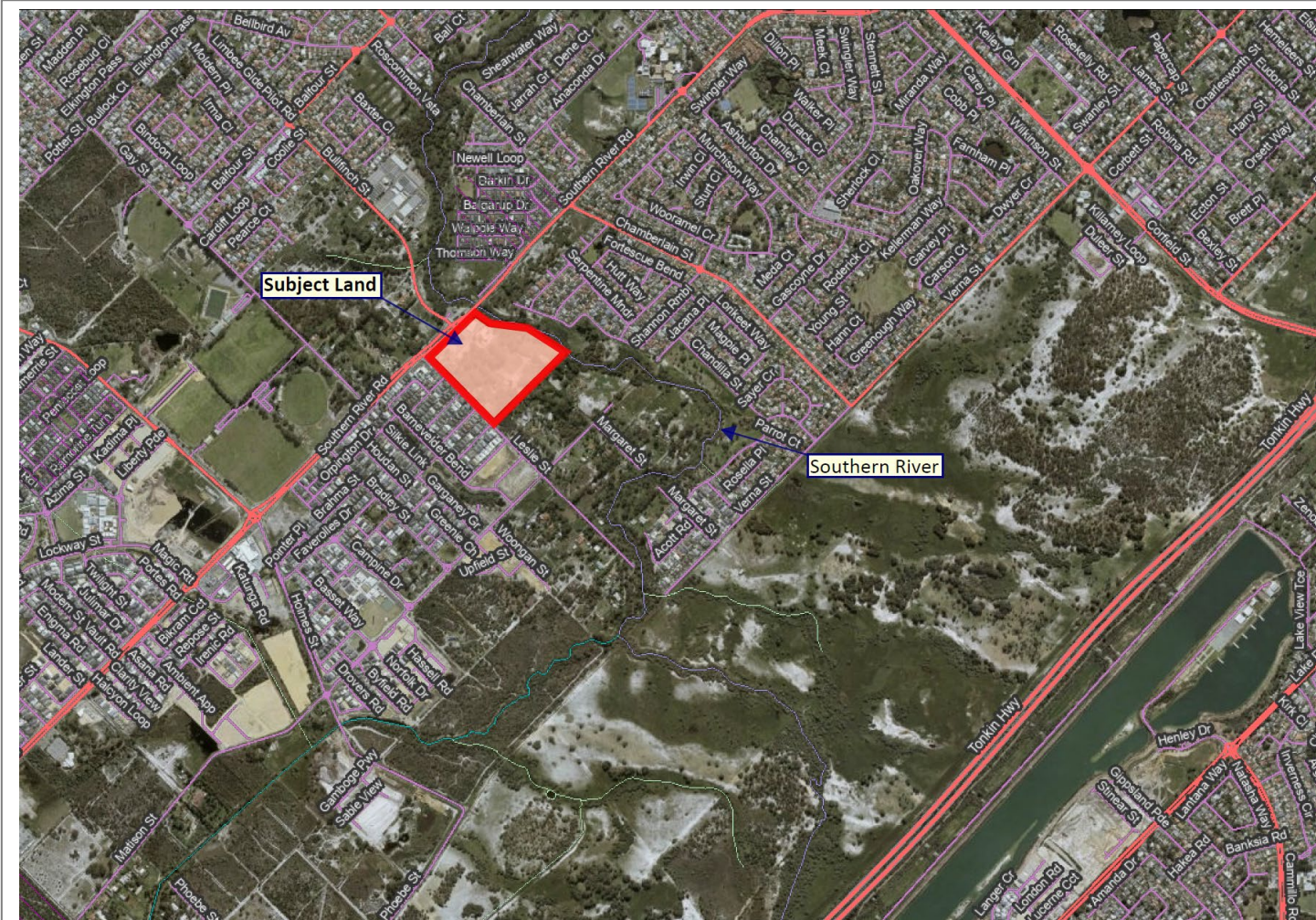


Figure 1 Location Plan

1.2 SUPPORTING DOCUMENTATION

This LWMS has been compiled using information contained within the detailed assessments and reports undertaken for the subject land and surrounds. For further information relating to the water management on the subject land please refer to these supporting documents:

- Southern River / Forrestdale / Brookdale / Wungong District Structure Plan Urban Water Management Strategy (WRC, 2002)
- Southern River Area: Groundwater modelling to assess effects of climate variation, and proposed development (Rockwater, 2005)
- Precinct 3 Environmental Review undertaken by ENV for City of Gosnells (ENV, 2006)
- Southern River Integrated Land and Water Management Plan (DoW, Jan 2009)
- Information system for hydrologic investigation of the Southern River catchment (CSIRO, 2009)
- Geotechnical Report Southern River 3B, (Bioscience 2015)
- Geotechnical Report Southern River 3B, Lot 1525 Leslie Street (Bioscience 2012)

2 KEY ELEMENTS PLAN

Water management strategies for the subject land are based on best practice water sensitive urban designs that integrate sustainability and the provision of attractive communities. The strategies will be achieved through the synthesis of planning and designs to manage, protect and conserve the total water cycle. The plans and designs for the development are appropriate for the subject land's residential development, surrounding environment, former and future stages and local drainage characteristics.

A summary of the WSUD elements that will be implemented within the development to achieve best management practices are outlined below. The general strategies can also be seen in Figure 2.

Water Conservation and Servicing

- The site is to be serviced with potable water from the Water Corporation's network.
- Sewer is to be gravity fed to the Water Corporation sewer main.
- Future landscaping is designed to be waterwise to reduce irrigation requirements from licenced groundwater allocation.

Stormwater Management

- On lot detention systems are to be installed in line with the City of Gosnells guidelines for lot storage.
- Road runoff is to be collected in a pit and pipe network and transferred to the bioretention and detention basin system.
- Flows off site in events up to and including the 1%AEP will be at or below pre development rates.
- Road runoff 1EY treatment is achieved through on lot detention and infiltration of road runoff through the bioretention basin.
- Larger events flow through a controlled pipe outlet and weir for infiltration and release into the Southern River foreshore at or below pre development flow rates

Flood Protection

- All finished floor levels will be designed to be a minimum 300mm above the adjoining road gutter flows.
- All lots are out of the Southern River floodway and finished floor levels are more than 500mm above the 1% AEP adjoining flood level.
- The basin system is sized to manage the 1%AEP generated on site, with overtopping through the POS to the foreshore reserve.

Ecosystem Protection

- New ephemeral wetland habitat will be created within the basin as a result of using native riparian species plantings.
- Future landscaping within the POS will utilise native species that complement the nearby bushland.
- The WSUD elements used on site will treat stormwater and groundwater, improving the water quality prior to it entering the Southern River and other downstream ecosystems via groundwater flows, and controlled surface flow.
- The landscaping will utilise nutrient and waterwise practices to minimise contamination of the groundwater and surface runoff to the Southern River.
- The Foreshore area is to be protected in a reserve and enhanced through weed control and revegetation.

Groundwater Management

- Groundwater quality is managed via infiltration of stormwater through the POS bioretention basin.
- Clean free draining fill and a subsoil network will be used as required to manage potential ground water rise under the developed portion of the site.

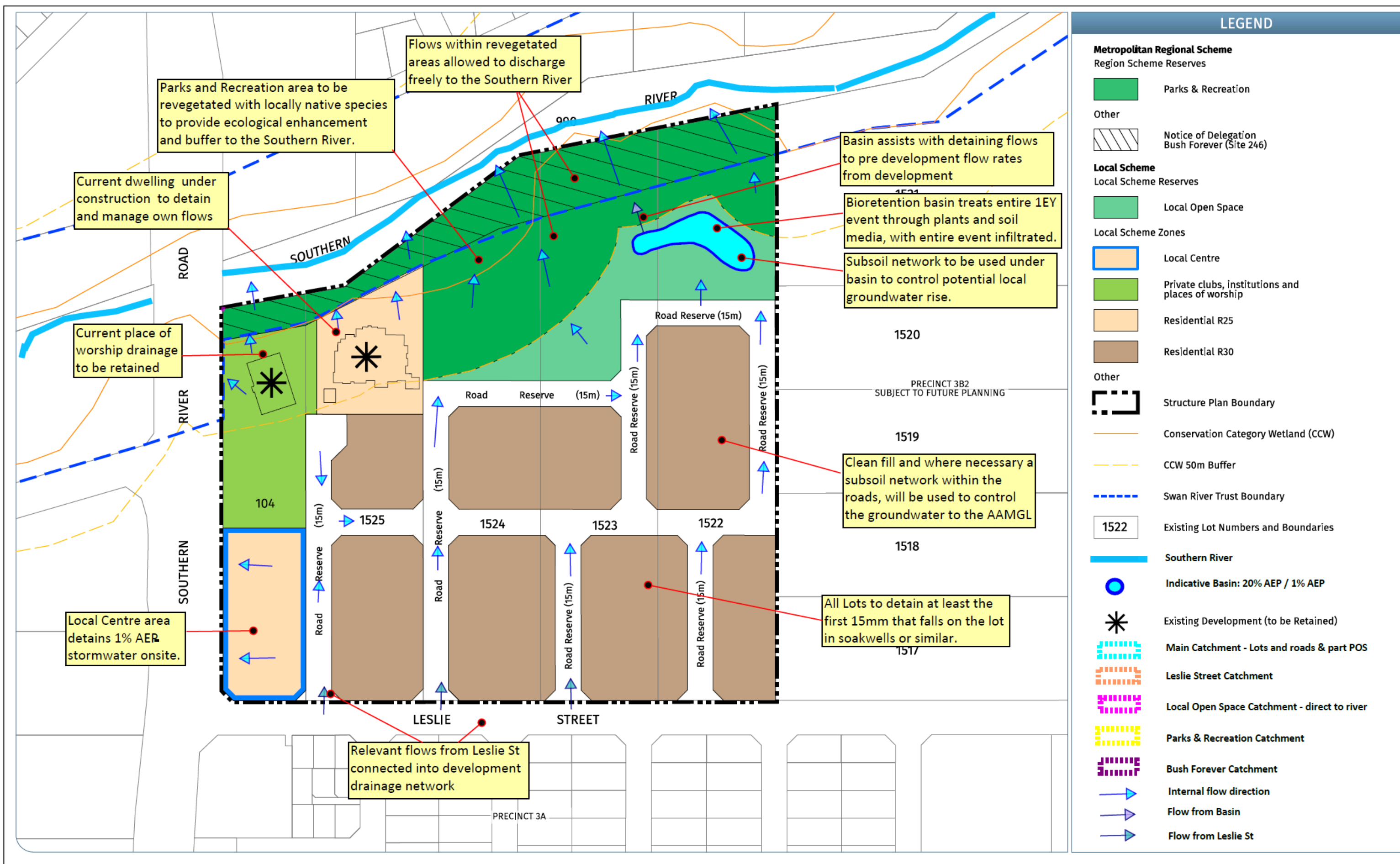


Figure 2 Key Elements Plan

3 GEOTECHNICAL

3.1 GENERAL GEOLOGY AND GEOMORPHOLOGY

The site is located on the Swan Coastal Plain within the Bassendean dune system, an area characterised by low dunes of siliceous sand interspersed with poorly drained areas or wetlands. Soils tend to be a deep bleached grey colour sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2m.

Underlying the Bassendean formation is the Guildford formation. The soils of the Guildford formation are complex, and comprise a successive layering of soils formed from erosion of material from the scarp to the east. Rivers and streams have mostly carried the eroded material, which is deposited from the water as fans of alluvium. The Guildford formation is characterised by poor drainage due to the low permeability of sub-soil clays which prevent the downward infiltration of rainfall, consequently, water logging and surface inundation can occur during the winter months. In addition, the clay fraction of the Guildford formation is known to have highly variable plasticity indices.

The geology at the site as per the Geological Survey of Western Australia 1:50000 Environmental Geological Series Armadale Map part of sheet 2033 I and part of sheet 2133 IV is mapped as follows:

- S8 – SAND – Very light grey at surface, yellow at depth, fine to medium grained, sub- rounded quartz, moderately well sorted of eolian origin
- S10 – SAND – As S8 over sandy clay to clayey sand of the Guilford formation
- SP1 – PEATY SAND – Grey to black, fine to medium grained, moderately sorted quartz sand, slightly peaty of lacustrine origin
- Ms4 - SANDY SILT - cream to pale brown alluvium, clayey in part, fine to medium grained sand, of alluvial origin

3.2 GEOTECHNICAL SITE INVESTIGATION

A preliminary geotechnical investigation was carried out in May 2011 (report amended in 2015) during the installation of 5 piezometers (B1-B5) across Precinct 3B. Further investigations were undertaken in Lots 1525 and 1526 (Bioscience, 2012) Leslie Street in conjunction with previous developments.

Soil profile was typically sand over sandy clay and clayey sand as per the Geological Survey of Western Australia (Figure 4). Depth of sand ranged from 1m in B3 to 3.1m in B2. The test pits on Lots 1525 & 1526 Leslie Street identified sand of depth 0.7-1.2m over sandy clays.

The site is currently classified as Class A and Class S based on the depth of sand cover over the clayey soils. Class A soils have greater than 1.5m of sand over clays. Class S soils typically have less than 1.5m coverage of sand over clays. The requirement for the importation of suitable fill is likely to improve Class S areas to Class A.

Additional, more detailed, geotechnical investigations will be required at future planning stages to confirm site classifications, with results to be included within subsequent UWMP(s).

3.3 PERMEABILITY

In-situ permeability tests have not been undertaken for the site. The Bassendean sands are likely to have a moderate to high permeability. Permeability testing is to be undertaken as part of detailed design to inform final stormwater design. This is to include near surface permeability and the permeability at the likely basin floor level.

3.4 ACID SULPHATE SOILS

A search of the Swan Coastal Plain ASS risk map (Landgate 2016) indicates that much of the subject land has a moderate to low risk of ASS occurring within 3m of soil. An area of moderate to high risk ASS occurs along a portion of the Southern River and adjoining lower areas with potential to become inundated.

Selected soil samples collected during the geotechnical investigation were analysed using the DEC field test procedure as well as LECO carbon sulphur analyser and redox potential. Overall, these give an indication of whether or not soils are actual (AASS), potential (PASS) or non-acid sulfate soils (NASS). Ten samples from the 5 mechanically excavated monitoring bores were analysed and all samples came back as NASS.

It should be noted that based on the regional mapping, preliminary ASS investigations, and the required fill it is not envisaged that ASS management will be required for the overall development. Any potential excavation work related to the foreshore reserve of Southern River or excavation for deep sewer will require additional analysis and possibly ASS management plans. ASS assessment should be conducted for subsequent UWMP(s) to confirm ASS is not an issue for areas where there is a higher risk.

3.5 PHOSPHORUS RETENTION INDEX

Testing for Phosphorous Retention Index (PRI) has not been undertaken. The in situ Bassendean sands means that it is likely that the PRI at the surface is low. The deeper clay soils may have higher PRI values.

3.6 CONTAMINATED SITES

The Department of Water and Environmental Regulation (DWER) contaminated sites database was searched for known contaminated sites (sites classified as Contaminated-restricted use, remediated for restricted use or Contaminated-remediation required) in proximity to the site. To date, the site has not been reported to DWER as a known or suspected contaminated site either prior to or after the commencement of the *Contaminated Sites Act* 2003. There is also no contaminated site within 100m of the subject land.

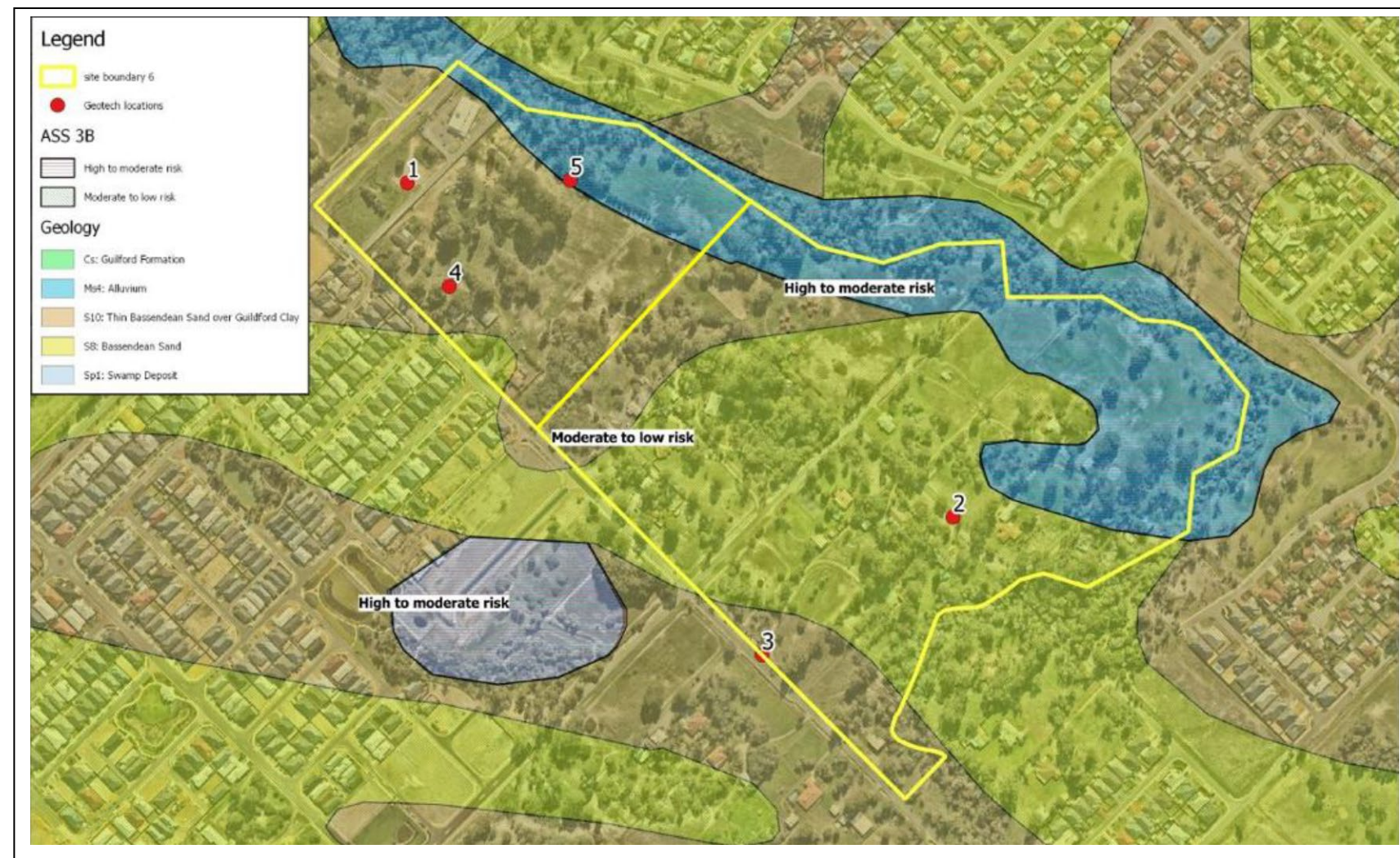


Figure 3 Geology and test pit locations

4 LANDFORM, ENVIRONMENTAL CONDITIONS AND HERITAGE

4.1 LANDFORM

The subject land is located on the Swan Coastal Plain. The majority of the Site is located on a flat lying plateau with an elevation of approximately 17-19m Australian Height Datum (mAHD) with minor undulations across the site. There is a very gradual fall toward the foreshore of the Southern River. Within the foreshore area there is a drop down to approximately 16mAHD. The river itself is within an incised channel of approximately 1 – 2.5m deep. This fall towards the river means that surface water generally heads towards the river.

There has been historical areas of earth work associated with the development of the Mosque and new R25 residence. This places these areas below the level of the areas where they adjoin the rest of the site. These 2 areas also generally fall towards the river. The approved childcare center generally falls towards Southern River Road, with isolated areas of fill. Figure 5 shows site landform including topographic contours, and flow paths. A survey of the site can be seen in Appendix B.

4.2 ENVIRONMENTAL

The following is a summary of the environmental characteristics of the subject land, with relevant references to the surround areas.

4.2.1 VEGETATION

The site has been largely cleared for pasture and rural residential lifestyle uses. No DRF or Priority flora was identified during site walkthroughs and preliminary flora assessments by Bioscience. An EPA guidance 51 flora survey was not undertaken due to the degraded state of the site and not considered appropriate. The predominant native vegetation remaining consists of tree species such as *Corymbia calophylla*, *Allocasuarina fraseriana*, *Acacia longifolia*, *Melaleuca preissiana*, and *Kunzea glabrescens* some remnant *Xanthorrhoea preissii* and *Macrozamia riedlei* are also scattered across the site. The area is highly impacted by aggressive weeds such as *Ehrharta calycina*, *Cenchrus clandestinus*, *Avena barbata* and *Zantedeschia aethiopica*.

The area is highly impacted by clearing and invasive weeds. As a result, vegetation condition rating is 'completely degraded' with one small area classified as 'degraded' to 'Good'. The small area of degraded to good condition contains open woodland of *Corymbia calophylla*, *Melaleuca preissiana* and *M.raphiophilla*, *Allocasuarina fraseriana* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Astartea affinis*, *Dasypogon bromeliifolius*, and *Lepidosperma longitudinale*. The vegetation condition mapping can be seen in Figure 4.

Three Bush Forever sites are located within close proximity of the subject site; 246, 464 and 125. These depict the likely vegetation complexes that once resided within the property. According to the *Bush Forever* site description (from *Bush Forever* Volume 2 Government of WA 2000) four complexes exist within sites 125, 246, and 464; the Forrestfield complex (Ridge Hill Shelf, Darling Plateau), Guilford complex, Swan complex, and the Southern River complex.

4.2.2 FAUNA

A desktop study of potential rare and endangered fauna listed under the Wildlife and Conservation Act 1950 and EPBC Act 1999 was undertaken by analysis of NatureMap: Western Australia's biodiversity online mapping (DBCA). A site investigation was conducted by Bioscience for the presence of rare and endangered fauna and fauna habitat. Fauna surveying of the subject land involved a careful walk-through of the subject area documenting all fauna species present as well as presence of habitat.

The site is largely degraded due to clearing and grazing of horses and sheep. As a result, the site lacks any significant habitat for native fauna, with the exception of large trees available to birds, including Carnaby's Cockatoo. Evidence of introduced species such as Foxes and Rabbits is present. Tiger Snakes (*Notechis scutatus* ssp. *occidentalis*) and Quendas (*Isoodon obesulus* ssp. *fusciventer*) were observed inhabiting the area. Bioscience installed a motion camera trap along the edge of the Southern River on 06/12/2022, adjacent to the wetland area. The aim being to identify any native or introduced species inhabiting the site, with an emphasis on *Hydromys chrysogaster* (Rakali or Water Rat), *Isoodon obesulus fusciventer* (Southern Brown Bandicoot or Quenda). *Vulpes vulpes* (European Red Fox) and *Felis catus* (Feral Domestic Cat) were also suspected as being possibly present.

Camera traps were installed on the 06/12/2021 for a 48-hour period. The camera did not capture any evidence of *Hydromys chrysogaster* (Rakali or Water Rat), *Isoodon obesulus fusciventer* (Southern Brown Bandicoot or Quenda). No evidence of mammals inhabiting the area was found, the camera was set off only 3 times, by interference.

4.2.3 WETLANDS

According to the Geomorphic Wetland Mapping, the majority of the site is classified as a Multiple Use Wetland (MUW). It contains the MUW's UFI 16154 and 16152.

There is a Conservation Category Wetland (CCW) (16151 Dampland) associated with Southern River which is now classified as a CCW (16153). The wetlands can be seen in Figure 6.

4.3 HERITAGE SITES

A search on the Aboriginal Heritage Inquiry System on the Department of Indigenous Affairs (DIA) website, indicated that Precinct 3B(1) lies within Aboriginal Heritage site 3511. Aboriginal Heritage site 3511 is a registered, unrestricted, closed access site related to Southern River. The DIA recommends that an Aboriginal Heritage Management Plan be established to avoid disturbance to heritage sites. Guidelines for Aboriginal heritage management can be obtained from the DIA. This should be considered in conjunction with a Foreshore Management Plan.

A search on the Heritage Council of Western Australia (2011) database reveals no European heritage exists within the subject area.



Figure 4 Vegetation condition

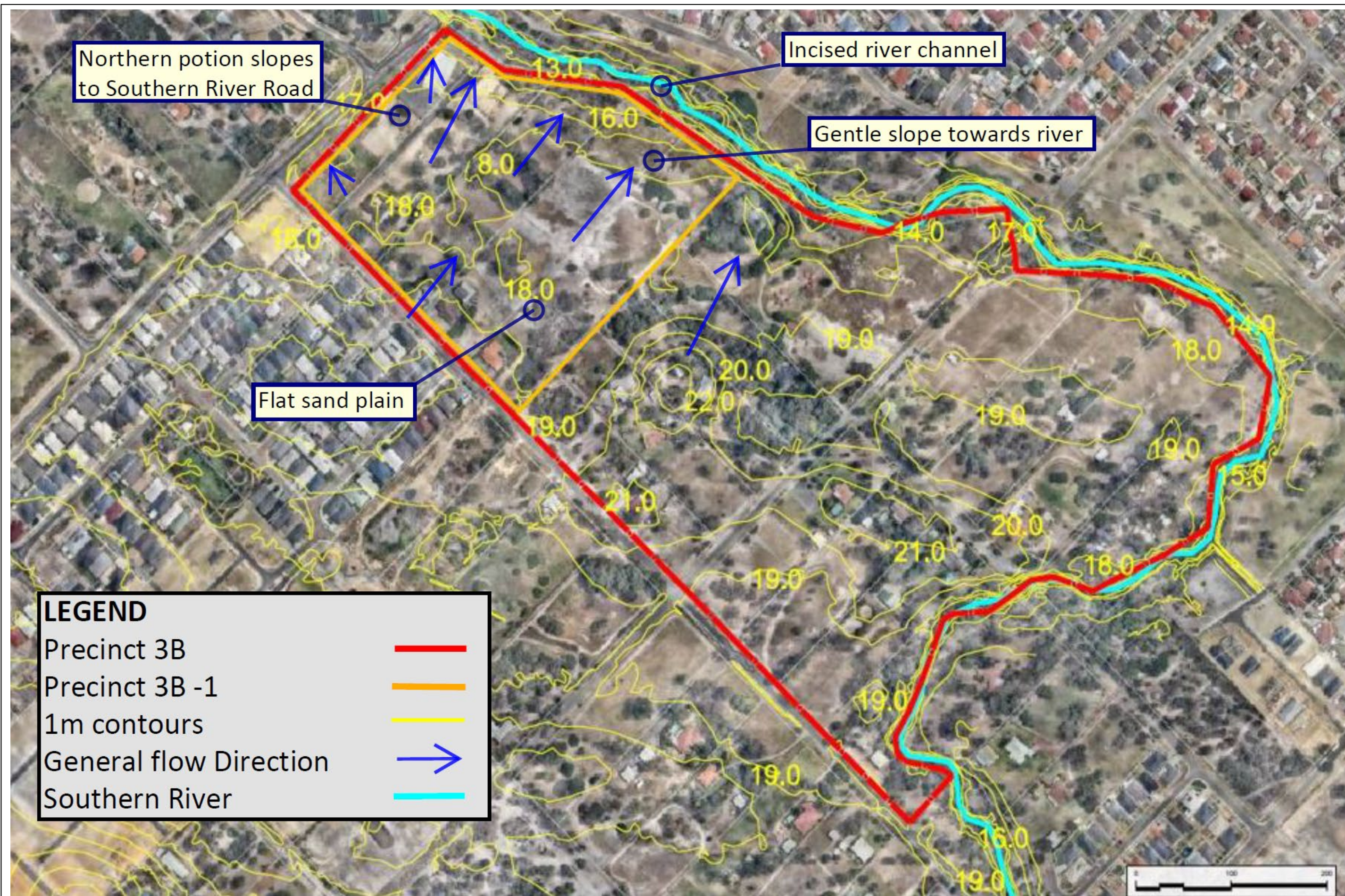


Figure 5 Landform Characteristics



Figure 6 Wetlands

5 PRE DEVELOPMENT SURFACE WATER SITUATION

5.1 REGIONAL HYDROLOGY

Southern River Precinct 3B drains surface water towards the Southern River which abuts the development. Southern River is a major tributary to the Canning River. DWER have a surface gauging station (SWS7, 616092) at Anaconda Drive, approximately 1.8km downstream from Precinct 3B(1). The gauging station has been operational since 1/1/1990, with a float well installed 27/3/1997. Figure 8 and 9 below identify the historical water levels (mAHD) and flow rate – daily maximum (m³/s).

The Department of Water mapping indicates that the 1% AEP flood levels of Southern River range from 14.49mAHD at the bridge overpass at Southern River Road (downstream) to approximately 15.5mAHD at the upstream boundary of the development, the eastern most region of the development. Figure 10 identifies flood levels as well as floodway and flood fringe mapping associated with Precinct 3B(1).

5.2 SURFACE WATER CHARACTERISTICS AND CATCHMENTS

There are no waterways within the actual subject land. The Southern River runs adjacent to the eastern boundary of the project area. Southern River is a seasonal waterway that typically flows between May and December.

The relatively flat sandy soil surface of the majority of the site means that there is little surface runoff except during extreme events. The developed mosque site has its own drainage network of detention pits with discharge to the Southern River Road pipe system. The approved childcare centre has a designed stormwater system for detaining the 1% AEP event on site. When the systems capacity is exceeded, the water will enter the Southern River Road network. The new residence also has its own internal stormwater management system, which when exceeded, will discharge to the Southern River foreshore.

The subject land does receive flows from the un kerbed portion of Leslie Street that adjoins the western boundary. This enters as sheet flow, when the capacity of the verge to absorb the water is exceeded. This catchment has been measured as being the eastern side of Leslie St. A picture of this portion can be seen in the Photos 1. The other portions of Leslie St that adjoin the subject land do not contribute flows to the subject land. The northern portion slopes towards the Southern River Road and discharging water is collected in a pit as it enters Southern River Road. The southern portion is kerbed with stormwater directed towards and existing pit and pipe network that discharges into a roadside bioretention garden.

A summary of the catchments can be seen in Table 1. Figure 7 shows the predevelopment characteristics and general surface water characteristics.

5.3 PRE DEVELOPMENT DRAINAGE MODELLING

A predevelopment model was constructed in DRAINS With a focus on flows that will contribute to the proposed POS basin and flows to the Southern River. The other areas were not modelled as their drainage has already been designed as part of their approval and subsequent construction (where relevant). These areas (mosque, childcare centre and R25 new residence) are below the finished levels of surrounding areas and won't contribute flows into the POS basin.

The key modelling assumptions included:

- Horton/ ILSAX drainage modelling method used.
- ARR 2019 methodology and rainfall figures used.
- To reflect the Bassendean sandy soils with water repellence characteristics, a soil factor of 2 was applied (moderate infiltration).
- A retardance coefficient of 0.2 was used to reflect the rough grass and tree vegetated surface outside the foreshore, while inside the heavier vegetated foreshore, the coefficient was 0.25.
- A retardance coefficient of 0.01 was used to reflect the impervious surfaces of the sheds and houses, while the gravel drive was assumed to have a retardance coefficient of 0.013.
- Leslie St road surface had a retardance coefficient of 0.01

- The contributing catchment 1800m² of Leslie St is assumed to enter as sheet flow.

The storms modelled were the 5min,10min,15min, 20min, 25min, 30min, 45, 1 hr, 1.5hr, 2hr, 3hr, 4.5hr, 6 h, 9hr and 12hr. Longer events were not modelled as the larger events were generally less than 30 min with a steady fall for events greater than 2 hours. These were modelled for the 20% AEP and 1%AEP.

The results are outlined in Table 2.



Photo 1: Leslie Street showing unkerbed edge with very shallow swale for road runoff infiltration

Table 1 Pre development catchment summary

Catchment name	Area (m²)	Characteristics	Discharge location/Comments
Mosque	5829	• 90% impervious. • Onsite pit and pipe system	Southern River Road
Childcare center	4817	• 90% impervious. • Onsite pit and pipe system	1% on site infiltration then overflow to Southern River Road.
R25 lot/new residence	4376	• 60% impervious. • Onsite pit and pipe system with basin for 1% AEP	1% AEP infiltration on site, then overflow to Foreshore of Southern River
Main subject land	70,665	10% unconnected impervious	Foreshore of Southern River
Leslie St - Contributing area	1800	80% impervious.	Sheet flow into Lots 1523 – 1525.
Foreshore/ Bush Forever	8600	• 99% pervious. • Slope 3%	Southern River

Table 2 Pre development drainage modelling results

Catchment	1EY		20% AEP		1%AEP		Comments
	Peak flow (m³/sec)	Critical Storm	Peak flow (m³/sec)	Critical Storm	Peak flow (m³/sec)	Critical Storm	
Leslie St – Contributing area	0.17	10min	0.037	5 min	0.078	5 min	Travels as channel sheet flow across subject land.
Main subject land	0	NA	0.001	30 min	0.661	20 min	20% flows averaged to 0.001m³/s. Isolated peak flows in some storms to 0.07m³/s
Bush Forever Foreshore	0	NA	0.001	1hour	0.160	10 min	20% flows averaged to 0.001m³/s. Isolated peak flows in some storms
Total to River	0.04	1hour	0.010	1.5	0.685	30 min	Discharge as sheet flow. Flows modelled with each catchment flowing into relevant downstream system to produce final peak at River.

5.4 SURFACE WATER QUALITY

No predevelopment surface water quality samples have been taken within Southern River. Long term monitoring of water quality has however been conducted by the DWER at SWS7, Anaconda Drive gauging station (616092). Figure 11 and 12 show the total nitrogen and total phosphorus concentrations, respectively. These have been compared to the short and long term targets for the Swan Canning system set by SRT. While winter peak concentration generally exceeded these targets, there is a clear decline especially when comparing data since 2009 to historical records. The raw data is available from DWER, as well as annual monitoring reports providing a summary of the data from SRT.

Sampling was also taken at Southern River Road, just downstream from Precinct 3B(1), between 18 October 2006 and 14 November 2012 as part of the Swan Canning River Health Assessment Scheme. This data generally follows the results obtained at SWS7, especially when compared to the moving averages. A comparison of data from samples taken at the same time at both SWS7 (616092) and 6162290 can be seen in Table 3, shows water quality diminishes slightly going downstream.

Due to the limited number of pre-development surface water quality samples available, additional water quality monitoring near 6162260 will be completed and included within subsequent UWMP(s) as required.

Table 3 Comparison of SWS7 & 6162260 concentrations for TN & TP

Date	TN (ppm)		TP (ppm)	
	616092	6162260	616092	6162260
17/10/2006	0.91		0.097	
18/10/2006		0.85		0.09
2/10/2007	1.5		0.18	
3/10/2007		0.54		0.005
13/11/2007	1.3		0.14	
13/11/2007		1.1		0.15
14/10/2008	1.3		0.17	
22/10/2008		1.3		0.15
27/10/2009	1.3		0.14	
28/10/2009		1.1		0.15
27/10/2010		1.5		0.15
28/10/2010	1.7		0.15	
14/11/2012		0.92		0.11
20/11/2012	1.3		0.14	

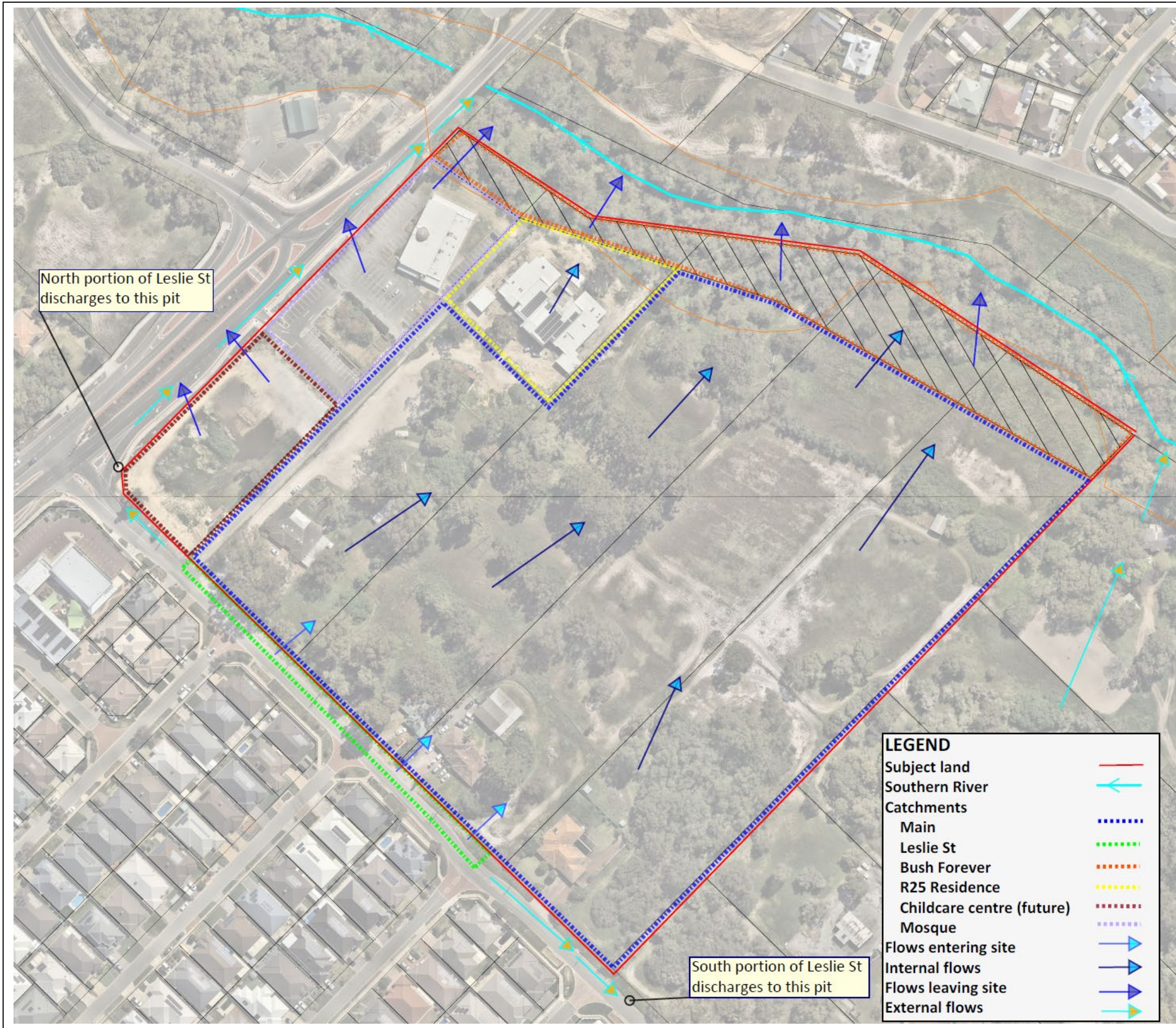


Figure 7 Pre development surface water characteristics and catchments

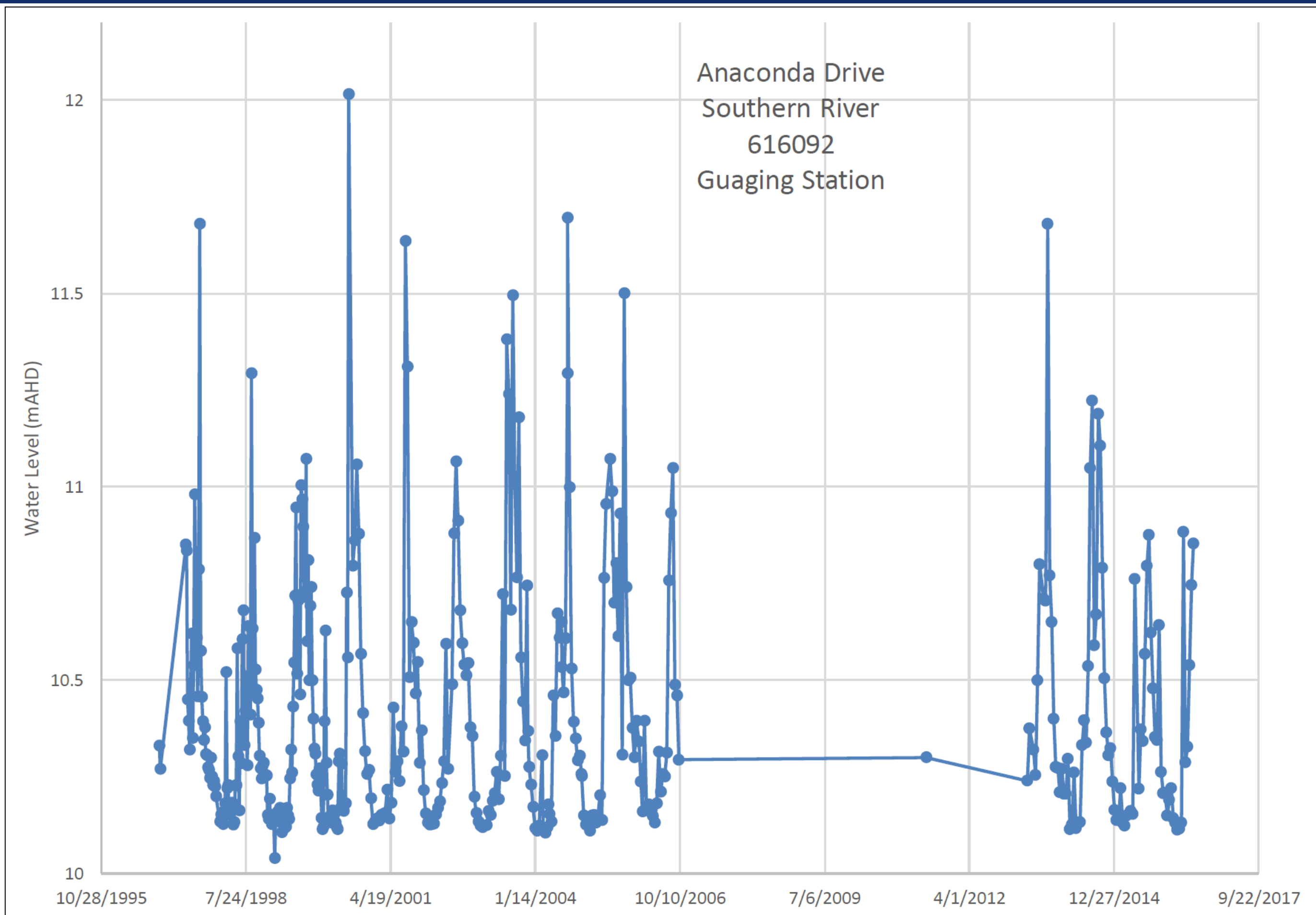


Figure 8 SWS7 Gauging station water levels (mAHD) (DWER 2016)

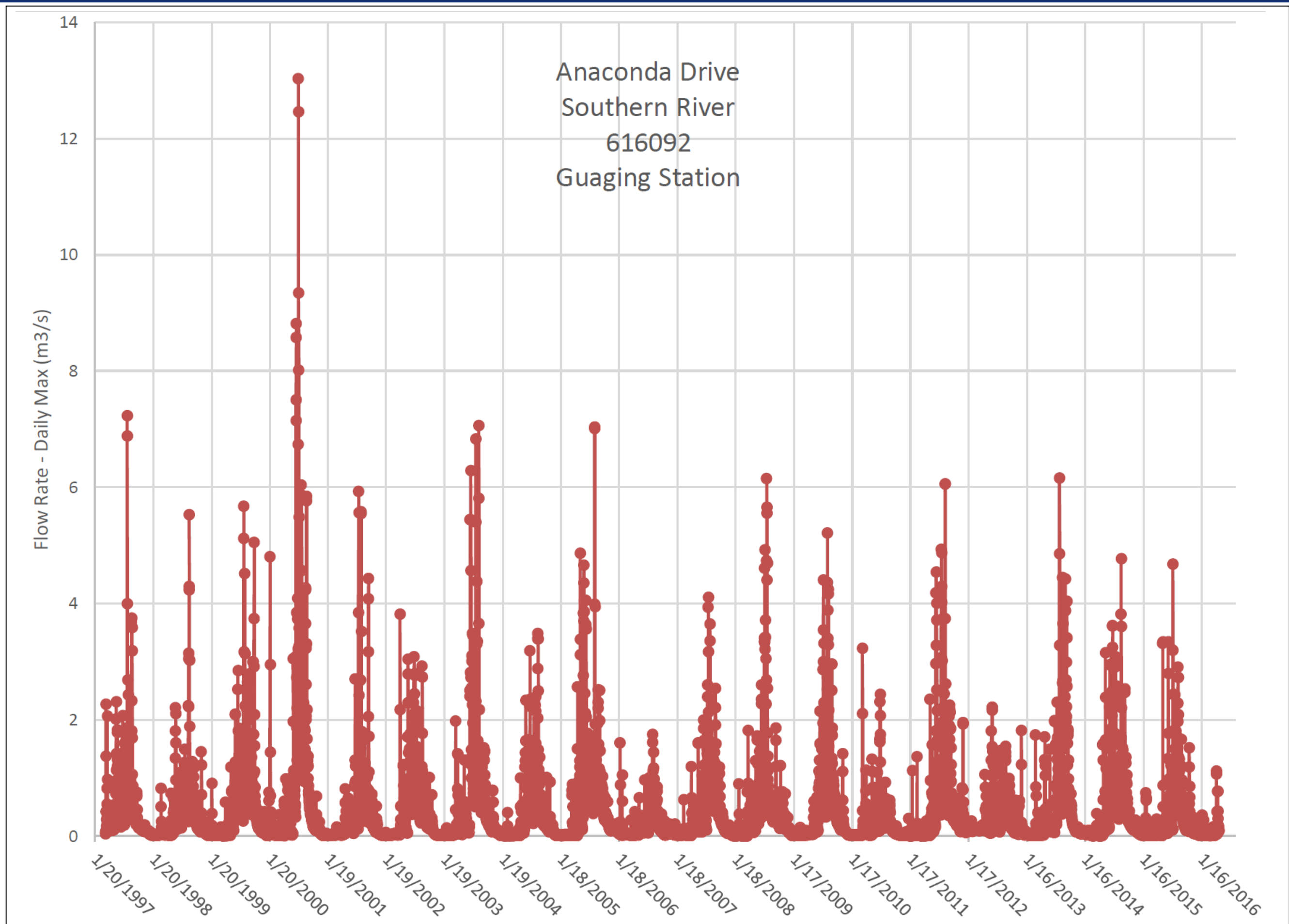


Figure 9 SWS7 Gauging station flow rate – Daily max (m³/s) (DWER 2016)

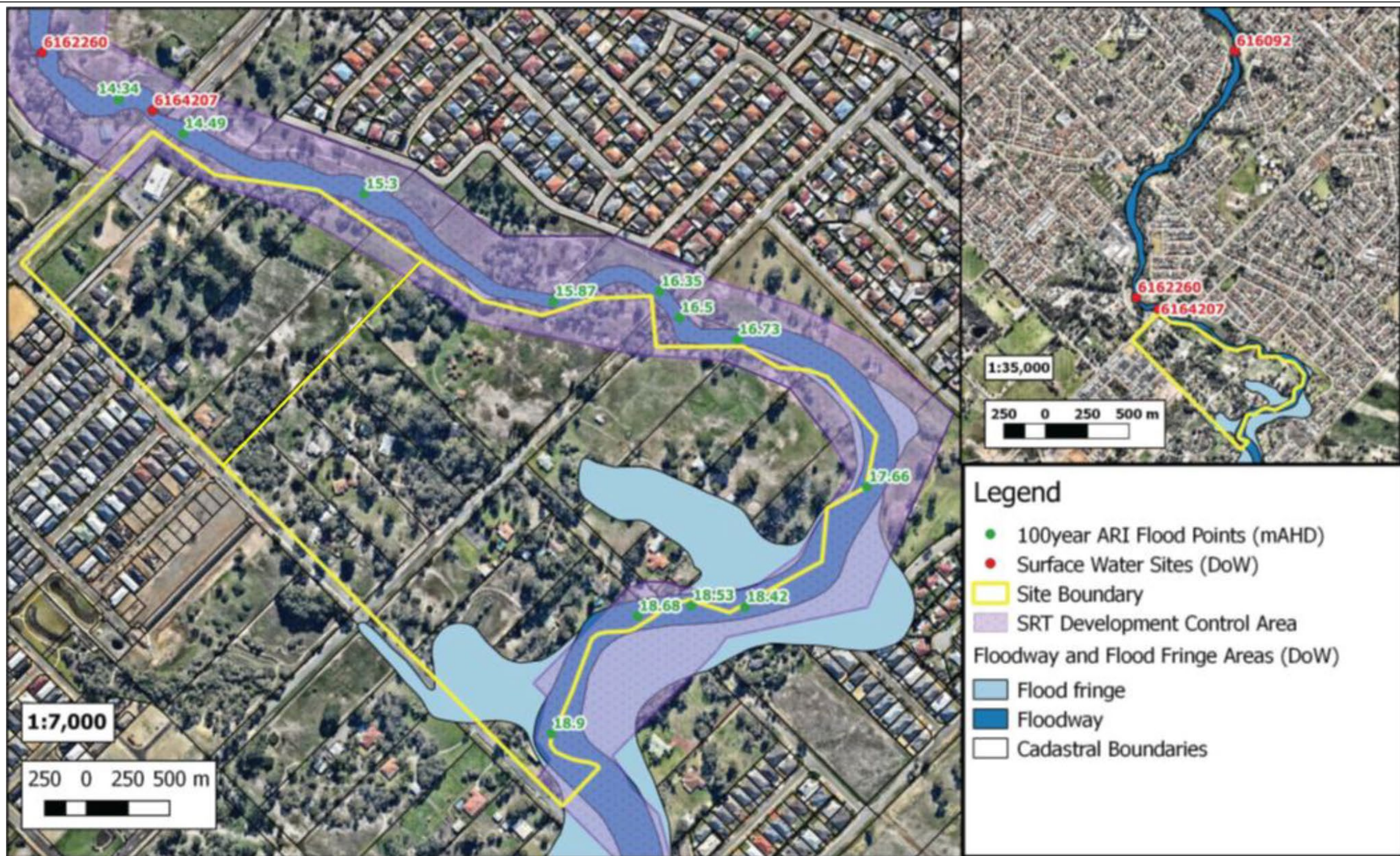


Figure 10 Southern River flood mapping and gauging stations

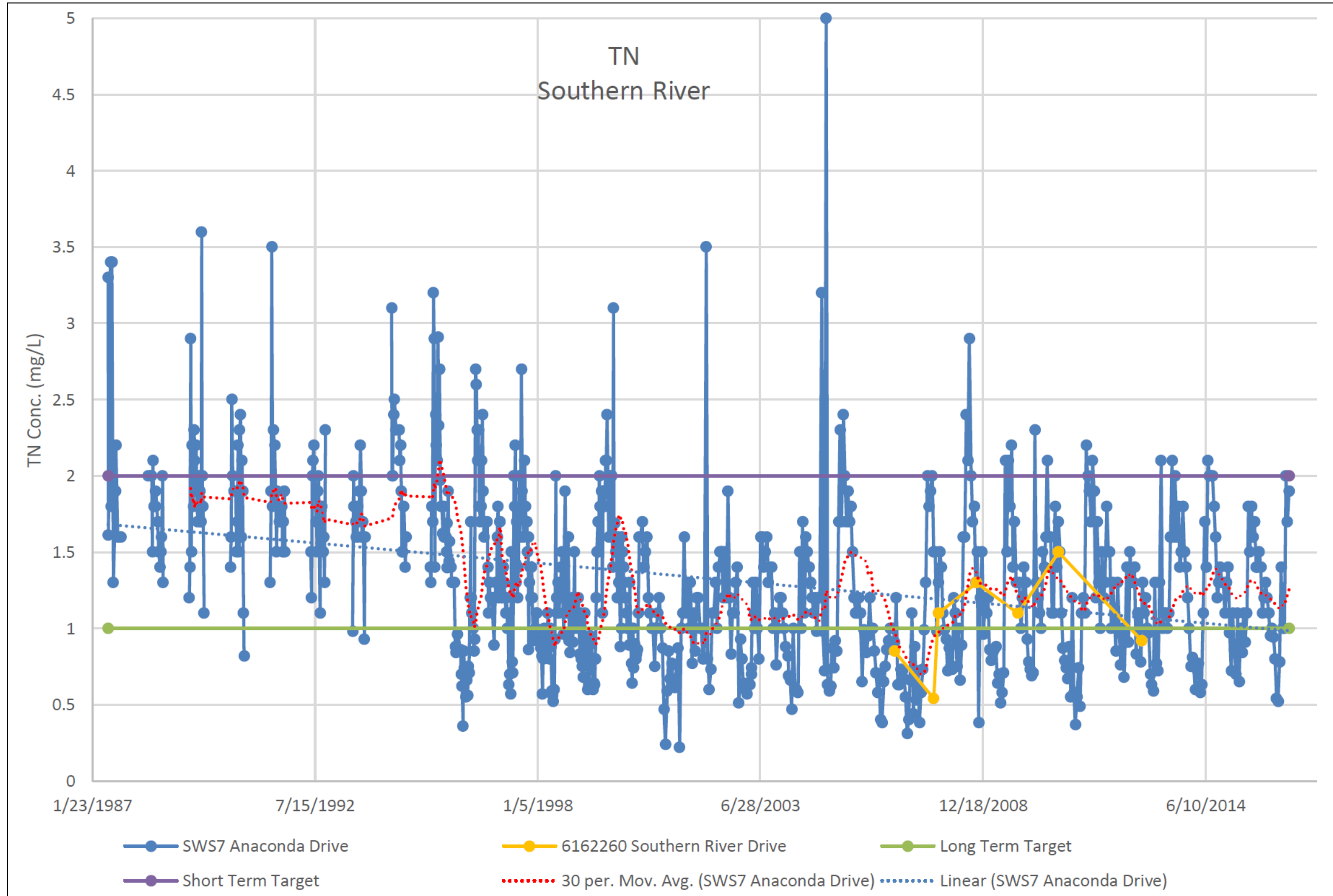


Figure 11 Total Nitrogen Concentration – Southern River

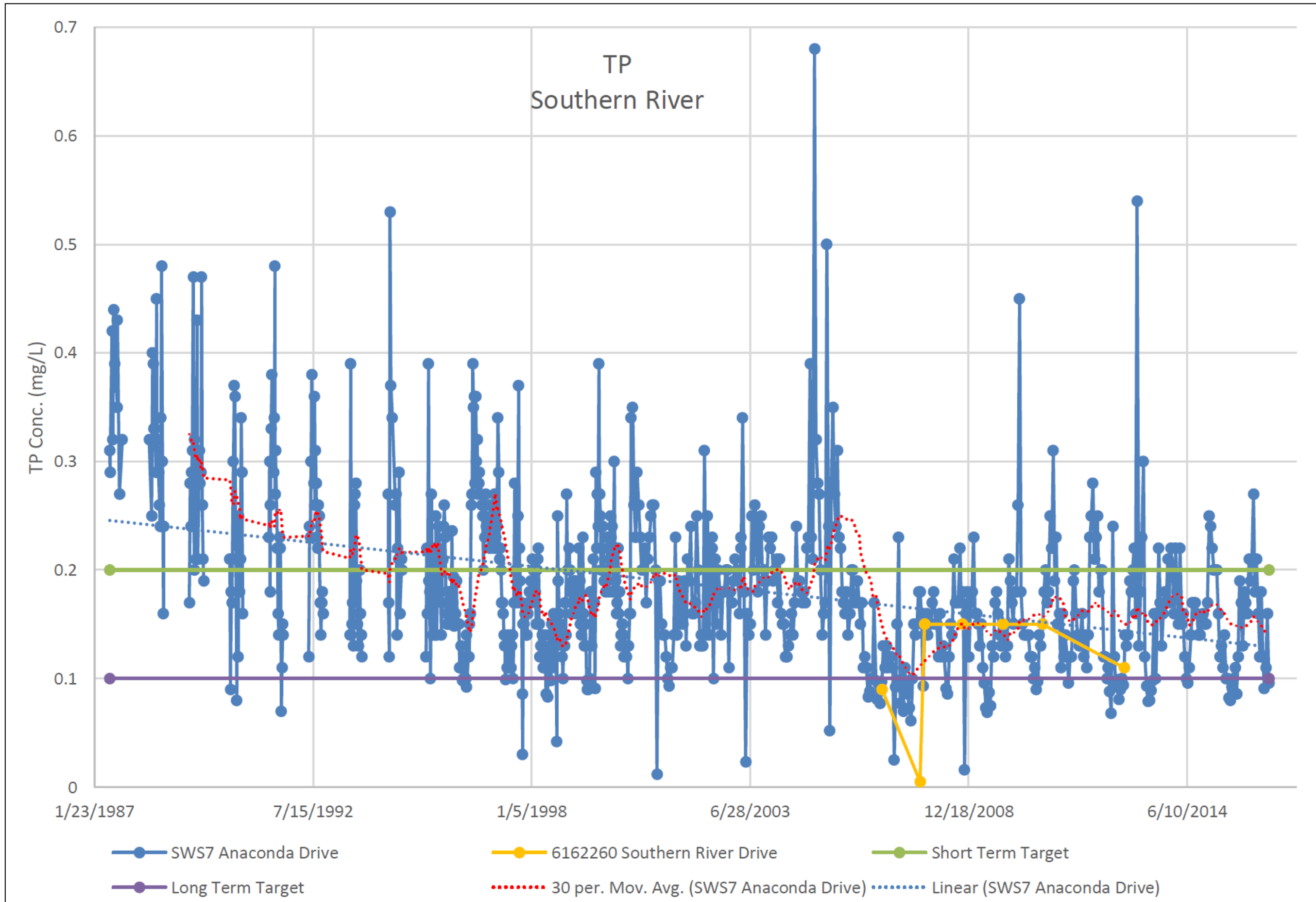


Figure 12 Total Phosphorus Concentration – Southern River

6 GROUNDWATER (PRE DEVELOPMENT)

The following is a summary of the current groundwater characteristics of the site. This information is based on groundwater investigations undertaken as part of the current LSP process.

6.1 REGIONAL HYDROLOGY

The hydrology of the Southern River area is typically characterised by Bassendean sand dunes of low relief hosting a superficial aquifer which is about 30 m thick. The Southern River itself acts as a local discharge point for this superficial aquifer. The Perth Groundwater Atlas (accessed 3 August 2016) shows the historical maximum groundwater contours generally slope north easterly direction and locally towards the Southern River. Groundwater contours parallel to Leslie Street are approximately 18m AHD and decline towards Southern River to 14mAHD (Figure 5).

6.2 GROUNDWATER MONITORING

Bioscience installed 5 monitoring bores across the greater 3B Precinct in May 2011 to define local groundwater levels. Of these 5 bores, B1, B4 and B5 occur in 3B(1). The locations can be seen in Figure 15.

Monitoring was conducted for 3 years between June 2011 and October 2014 on a bimonthly basis. Monitoring was also conducted within Precinct 3A by ENV between August 2005 and November 2007. Bores MW4 and MW5 are located to the south of the boundary of Precinct 3B(1).

6.2.1 GROUNDWATER LEVELS

Figure 7X and 8X, below, provides the hydrographs of localised monitoring related to Precinct 3B. Groundwater ranges from 1.3m below ground level (BGL) to 4.3mBGL at winter peaks with a 2-2.6m variance noticed between peak and troughs in water levels. These results are typical of Bassendean sands within the Swan Coastal Plain and the correlation between all monitoring bores suggest a hydraulic connection between sample sites exist within the superficial aquifer.

To determine the MGL across Precinct 3B(1), the DWER long term data for bore T75 (Lake Thomson, Ref. No. 61610539) was used to calibrate locally recorded monitoring data with long term trends. T75 was installed in 1975 and is located on the corner of Gay and Balfour Street, approximately 1km northwest of the site (Figure 16). The MGL recorded in Bore T75 was in 1994. The peak groundwater level recorded across Precinct 3B was in 2014. Precinct 3B(1) recorded MGLs have been corrected to bore T75 1994 MGL.

MGL for T75 was in 1994 = 19.317mAHD which was 0.330mm above the 2014 MGL. Therefore, the 0.330mm difference is applied as a correction to Precinct 3B monitoring bores to calculate the MGL across the site. The corrected levels for Precinct 3B are mapped in Figure 15.

6.2.2 GROUNDWATER QUALITY

Groundwater quality was monitored between June 2011 and October 2014 to establish the predevelopment groundwater quality conditions. Groundwater was tested for the following parameters on four occasions:

- pH
- electrical conductivity (EC)
- Total Nitrogen (TN)
- Nitrate (NO3)
- Ammonia Nitrate
- Total Phosphorus (TP)
- Filterable Reactive Phosphorus (FRP)
- Chloride (Cl)
- Sulfate (SO4)
- Iron (Fe)

A summary of results (average and standard deviations) are provided in Table 4, with Table 5 providing reference to guideline exceedance targets. Figures 13 and 14 show the Total Nitrogen and Phosphorus values determined for the different bores. Due to the development of Lot 1526 Bore 1 was no longer available for sampling and level monitoring after June 2013.

Table 4 Groundwater quality results

Sample Bore		pH	EC (mS)	Total N (mg/L)	Nitrate NO ₃ (mg/L)	Amm. N (mg/L)	Total P (mg/L)	Filterable Rea. P (mg/L)	Cl (mg/L)	SO ₄ (mg/L)	Fe (mg/L)
B1	AVG	6.72	1.68	0.49	4.50	0.05	0.31	0.38	224.00	N/A	0.11
	STD DEV	0.12	0.21	0.69	2.61	0.06	0.16	0.47	22.63	N/A	0.06
B2	AVG	5.56	0.80	0.44	0.00	0.04	0.04	0.20	149.10	15.83	0.02
	STD DEV	0.87	0.38	0.34	0.01	0.03	0.05	0.25	107.3	N/A	0.02
B3	AVG	6.62	5.01	0.52	0.17	0.32	0.01	0.14	1627.50	251.30	2.08
	STD DEV	0.11	2.26	0.63	0.26	0.25	0.02	0.16	77.07	N/A	3.52
B4	AVG	5.65	1.35	0.70	0.01	0.28	0.16	0.13	90.85	287.00	4.84
	STD DEV	0.32	0.26	0.70	0.01	0.31	0.10	0.06	90.72	N/A	6.33
B5	AVG	6.4	1.46	0.11	0	0.05	0.02	0.02	N/A	N/A	0.05
	STD DEV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5 Water Quality Parameters and Targets

Quality Parameter	Guideline Values (Guideline Reference)	
Electrical Conductivity (mS.cm ⁻¹)	0.3 - 1.5 (2)	ANZECC ARMCANZ (2000) 1. Fresh water ecosystems 2. Wetlands 3. Long term irrigation 4. Short term irrigation Department of Health (2006) 5. Domestic non potable groundwater use Swan River Trust 6. Swan canning clean up targets (long-term)
pH	6.5-8.5 (1) 6.0-8.5 (3)	
Total P (mg/L)	0.2mg/L (1) 0.1mg/L (6)	
PO ₄ -P (mg/L)	0.03 (2)	
Total N (mg/L)	2.0mg/L (1) 1.0mg/L (6)	
NH ₄ -N (mg/L)	0.04mg/L (2)	
NO ₃ -N (mg/L)	0.1mg/L (2)	
Fe (mg/L)	0.3mg/L (1) 0.2mg/L (3) 3mg/L (5) 10mg/L (4)	
SO ₄ (mg/L)	5000mg/L (5)	
Cl (mg/L)	2500mg/L (5)	

pH ranged across the precinct from an average of 5.56 in B2 to 6.72 in B1. pH affects the amount of nutrients that are soluble in soil water i.e. nutrients for plant growth. Many wetlands have near-neutral pH (approximately 7), but considerable variation in either direction occurs naturally and in diurnal cycles. Rainwater is naturally slightly acidic (as low as pH 5.5), due to dissolved atmospheric carbon dioxide, but the pH may be rapidly modified by chemical and biological processes once the water enters the wetland (e.g. carbonate buffering, photosynthesis) (DEC, 2013). Bassendean sands are also naturally acidic and can directly influence the pH of groundwater.

Salinity, or electrical conductivity (EC) (mS/cm) ranged from 0.8mS/cm in B2 to 5.01mS/cm in B3. EC values estimate soluble salt content and can be elevated by fertilisers and sulfate that can flow to low lying areas during rainfall events before percolating into soils and groundwater. Seasonally dry areas increase the concentration of salts in the soil and hence groundwater by evaporative processes and decreasing water volumes.

Nutrients, (phosphorus and nitrogen) were also monitored. These nutrients are often present in different forms and influence the type and abundance of living things contained within the study area.

Total Phosphorus ranged from 0.01mg/L in B3 to 0.31mg/L in B1 which are relatively low and show no major signs of legacy nutrient contamination. High phosphorus levels can be indications of past human or animal activity i.e. surface water runoff from developed areas, application of nutrients in agricultural management systems and animal grazing. Also, the breakdown of organic matter can result in phosphorus leaching.

Total Nitrogen levels are all below the Swan River Trust long term target of 1mg/L. Nitrate occurs naturally in plants but levels can become elevated if the plants are affected by drought before decomposing and leaching with runoff. Often higher levels are generated with application of fertilisers (ammonia based) and animal grazing.

Due to the limited number of pre-development groundwater quality samples available, additional groundwater quality monitoring may be completed and included within subsequent UWMP(s). Figures XX and XX show the Total Nitrogen and Phosphorus values determined for the different bores. Due to the development of Lot 1526, Bore 1 was no longer available for sampling and level monitoring after June 2013.

6.3 GROUNDWATER AVAILABILITY

The Superficial, Leederville and Yarragadee North aquifers occur under the subdivision. The Superficial shows there is allocation available (Nov 2024) The Leederville and Yarragadee North aquifers are all fully allocated. There are currently no groundwater extraction licences within the precinct 3B(1) development area.

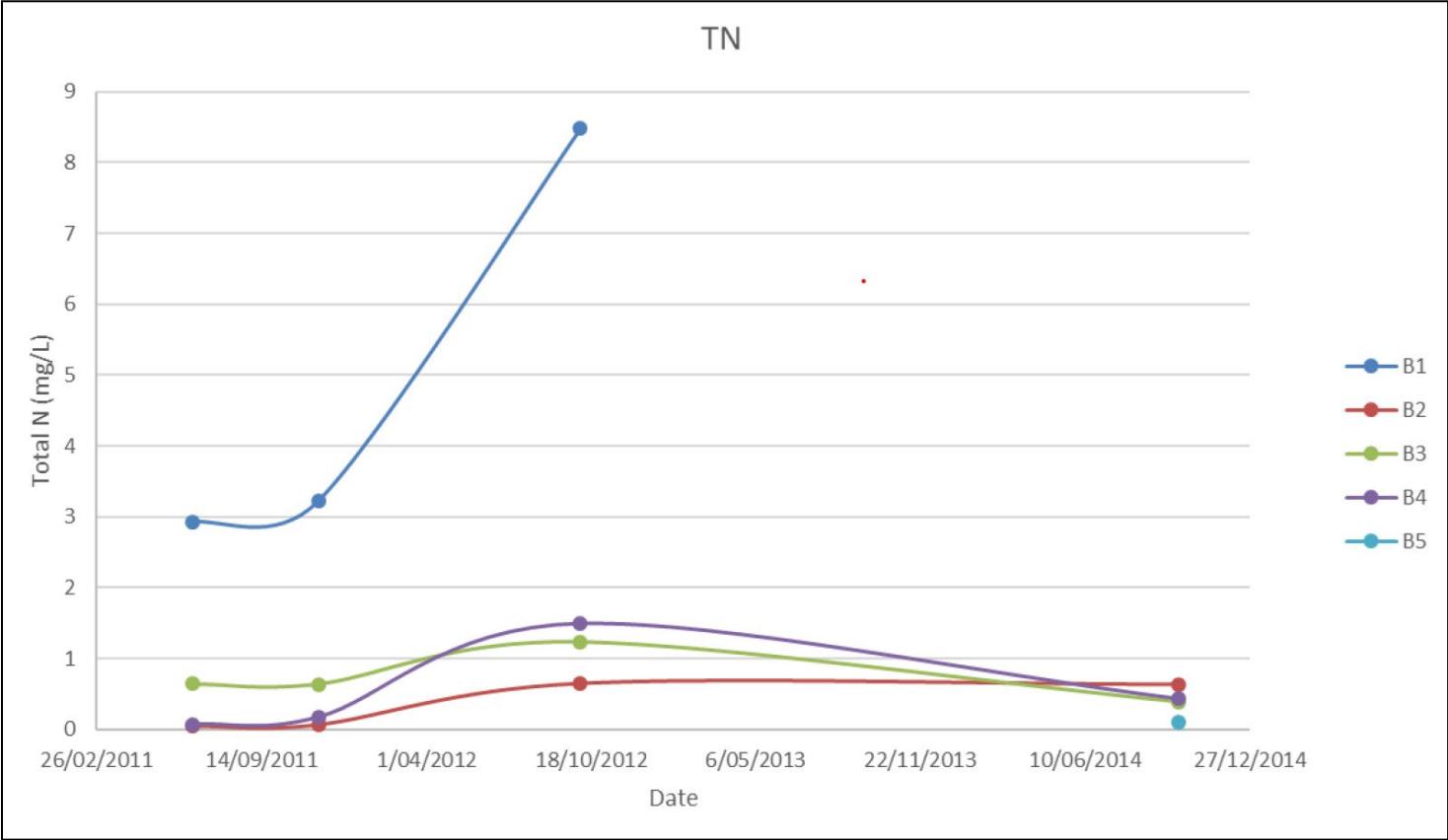


Figure 13 Total Nitrogen concentrations from groundwater bores

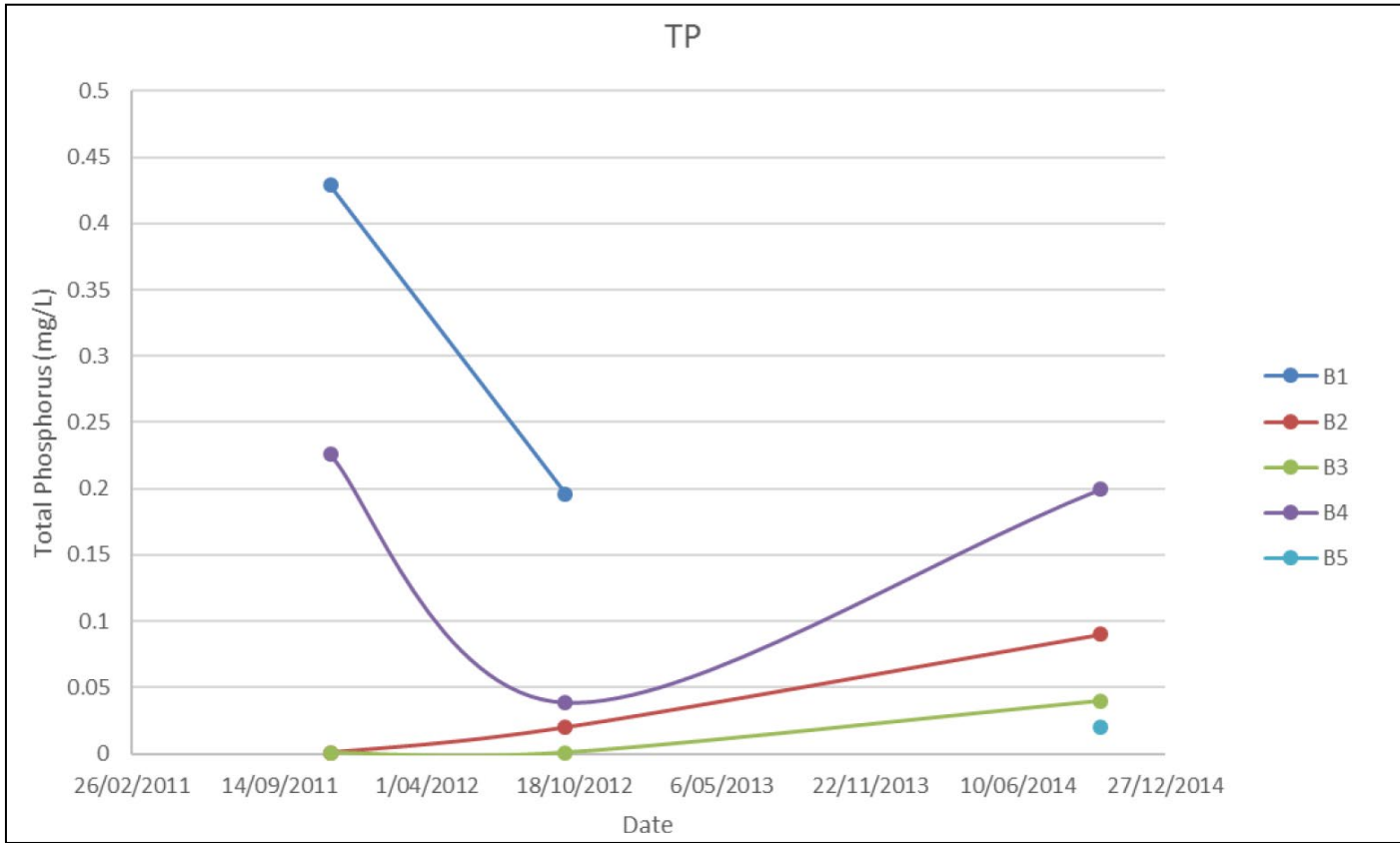


Figure 14 Total Phosphorus concentrations from groundwater bores

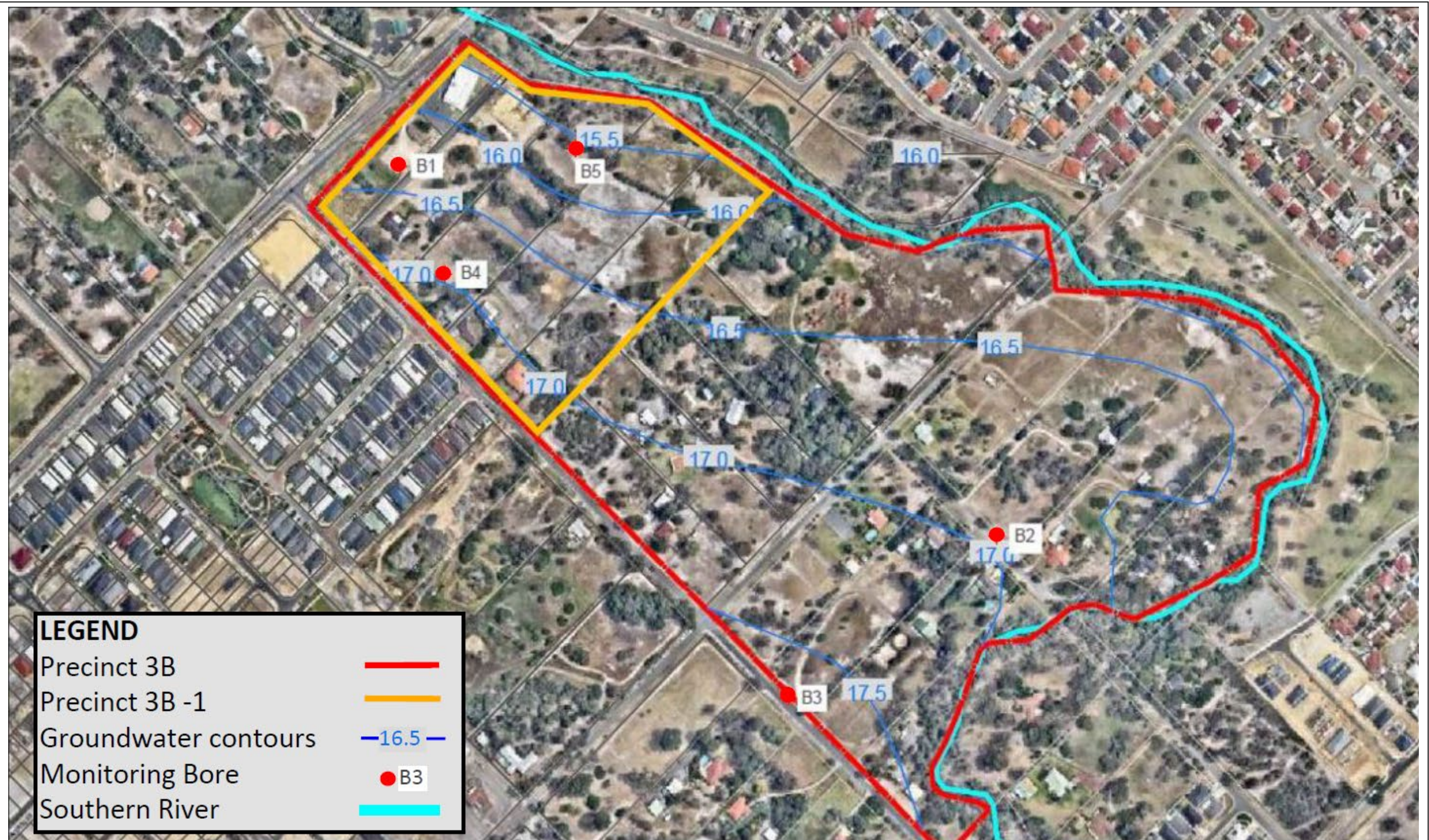


Figure 15 Subject land groundwater contours from on-site measurements

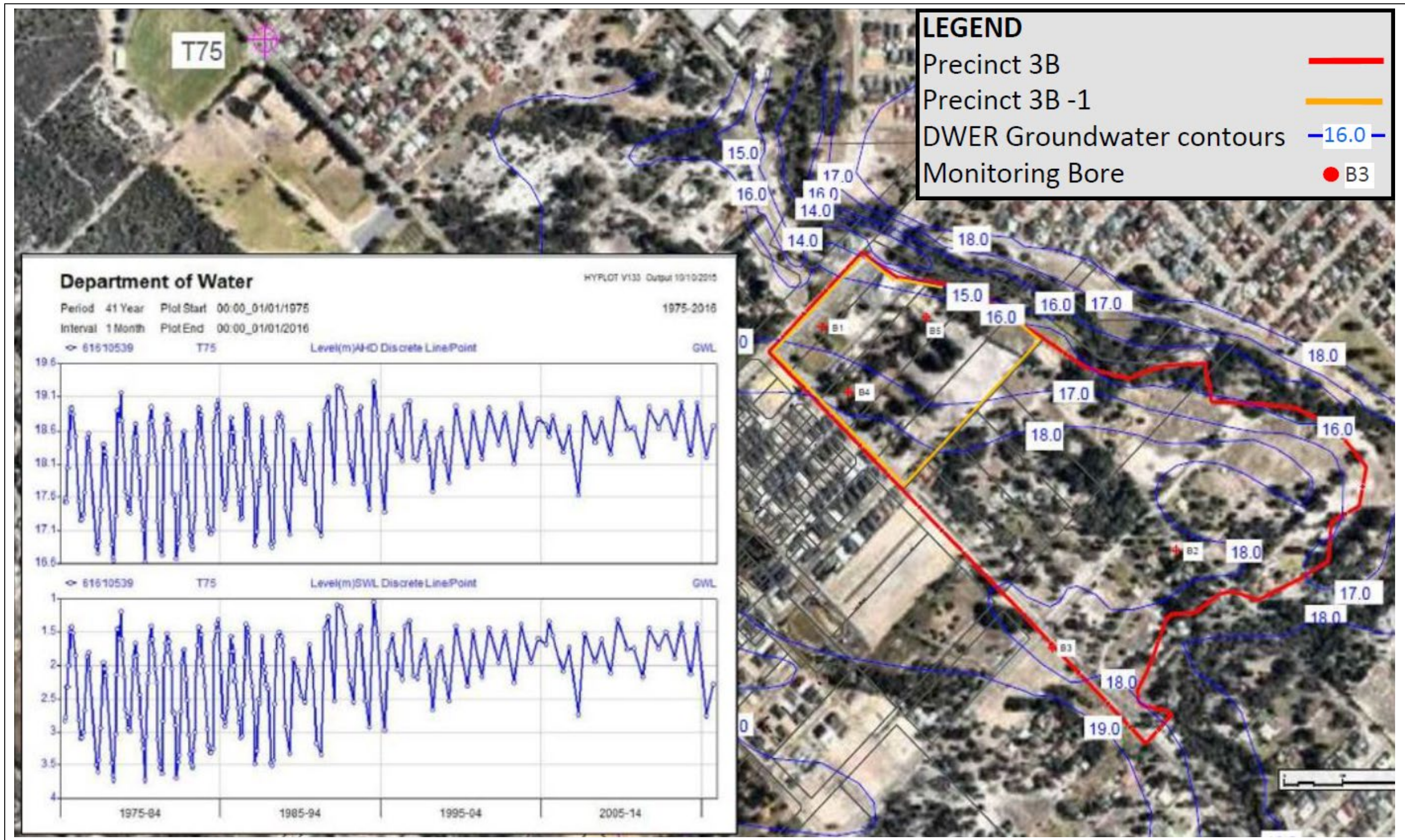


Figure 16 DWER Groundwater contours and Bore T75 level plot

7 DRAINAGE MANAGEMENT STRATEGY OVERVIEW

The aim of Drainage Management for the subject land is to generally manage the water flows so that water treatment is achieved and that the major storms are controlled prior to release.

All flows up to the 1EY are to be treated to reduce nutrients, sediments and other contaminant prior to discharge offsite. Above the 1EY, the main function is to control the flow of drainage water throughout the subject land and its release from the subdivision at agree rates. This water will predominately be captured and infiltrated while protecting lots from internally generated flooding.

The following sections show in more detail how water is treated and conveyed in the different AEP scenarios,

7.4 – 1EY

7.5 – 20%AEP

7.6 – 1%AEP

The full pit and pipe drainage network, including lot connection points can be seen in Appendix A.

7.1 MODELLING

The post development modelling for the development has been split into sub catchments within the 3 main catchments that were modelled to represent the pre development situation. These catchments represent the different landuses and flow paths. The catchments which flow through to the proposed basin are:

- the Leslie Street post development catchment
- the internal roads
- the internal R30 lots
- the Local Open Space (active POS area) that flows to the basin

The catchments that don't discharge to the basin and flow through to the Southern River are:

- the Local Open Space that falls towards Parks and Recreation area within the subject land
- the Parks and Recreation area within the subject land
- the Bush forever reserve area

Details on the catchments can be seen in Table 6. A summary of the peak outflows can be seen in Table 7, with a comparison to predevelopment flows in Table 8.

The key modelling assumptions and characteristics are as follows:

- Horton/ ILSAX drainage modelling method used.
- ARR 2016 methodology and rainfall figures used.
- Catchments were designed to be logical areas of stormwater capture and discharge.
- All roads were assumed to conservatively be 80% impervious, with 150% of this indirectly connected.
- Lots have been modelled with water flowing to on lot storage sized to capture an equivalent value to 15mm of rainfall over the entire lot. The water was assumed to flow to 1.5m wide by 1.2m deep soakwells. The lot storage is as per the agreement with the City of Gosnells. Due to the size of the lots and the coverage of nearby recently developed residential lots, the percentage impervious was assumed to be 70%, with the majority being directly connected impervious.

- Directly connect impervious areas (eg roads, basins during floods and rooves) had an assumed retardance coefficient of 0.01, while supplementary impervious areas eg footpaths and on lot paving had an assumed retardance coefficient of 0.013.
- Pervious surfaces (eg areas of grass or landscaping) were assumed to have a retardance coefficient of 0.1.
- The Bush Forever had a retardance coefficient of 0.3 to represent riparian revegetation.
- The Parks and Recreation area had a retardance coefficient of 0.25 to represent proposed revegetation.
- The Local Open Space (active POS) area had a retardance coefficient of 0.2 to represent lawn and garden bed planting
- The detention basin was assumed to vegetated in accordance with the bushfire requirements.
- The bioretention garden was assumed to have bioretention media and suitable planting throughout.
- The POS Basin infiltration was assumed to be 4.0m/day from the sides into the insitu sand, and 4.8m/day from the base, which represents average bioretention media infiltration rates.
- The basin base has been set at approximately 16.8mAHD, which is more than 0.5m above the modelled groundwater. The sides are sloped at 1:6 to contain the 20% AEP level, plus 0.1m of freeboard, giving a total depth of 0.8m deep. Above this height, the slope is flattened to 1:8, to allow for lawn. The maximum depth of water is to be 1.2m
- An outlet pit is set at 0.7m above the base, with a 2m wide overflow weir at 1.1m above the base. The outlet pipe is a 375mm concrete pipe. Both are assumed to discharge onto a rock spreader surrounded by appropriate native plantings to assist with dissipating the water as sheet flow, prior to it entering the Parks and Recreation reserve.
- To be conservative, the on-lot infiltration was assumed to be 3m/day from the side of soakwells, with 20% of the area available for infiltration and 0.1m/day from the base in case of low permeability soils near the bottom.
- The final storms modelled were the 5min, 10min, 15min, 20min, 25min, 30min, 45, 1 hr, 1.5hr, 2hr, 3hr, 4.5hr, 6 h, 9hr and 12hr. Longer events were not modelled as the peak events were generally between 5 and an 30min for flows leaving the site, with event levels in the infiltration systems generally peaking at between 2 and 4.5 hours. These were modelled for the 1EY, 20%AEP and 1%AEP.

Table 6 Post Development Catchment summary

Catchment	Area (m ²)	Characteristics	Comments
Leslie St Post	1,800	80% impervious (65% directly connected)	Flows into internal road drainage network
Internal Roads	18,536	80% impervious (65% directly connected)	Assumed pit and pipe network with no infiltration. Discharge to POS basin.
Internal lots	35,321	70% impervious (60% directly connected)	Flows to soakwells designed to hold first 15mm for entire lot. Once soakwells exceeded, flows to internal road network
LOS to basin	2,305	30% impervious (20 % directly connected)	Impervious area represents half full basin and pathways. Grades to basin.
LOS to River	5,000	10% impervious	Impervious is pathways/infrastructures. Grades to Parks and Rec.
Parks and Rec	9,503	98% pervious	Impervious is assumed to be minor tracks, rocks etc. Grades to Bush Forever area.
Bush Forever	8,600	99% pervious	Direct discharge to River

7.2 1EY STORM EVENT AND WATER QUALITY

Key points of the minor drainage system strategy are as follows:

- All new lots will use on lot storage to infiltrate the 1 hour duration, 1-year ARI storm event of 15 mm. If the soakwells are exceeded by other 1EY events, they will flow out to the road network.
- Treatment of stormwater is to be in the vegetated bioretention basin located in the POS.
- The basin will be fitted with subsoil drainage to ensure that the basin remains free from localised groundwater mounding. The subsoil is to discharge to a rock spreader within the Local Open Space, that is surrounded by suitable native plants.
- There is no discharge of water from the basin in the 1EY. The water level rises to 0.26m, then infiltrates.
- There is no discharge of water from the LOS and P&R that don't flow to the basin in the 1EY. The rainwater infiltrates into the soil profile.

7.3 DRAINAGE MANAGEMENT PLAN – 20%AEP

The pit and pipe network is designed to transport the flow from the internal and external road network and from lot runoff to the POS basin. Key points for the 20% AEP event are:

- The entire 20% AEP is contained within the basin for the contributing catchment.
- The peak flow rate out has been modelled as 0.001m³/s, which is all discharged via a pit, to the rock spreader.
- Depth to pit level from base is 0.7m (effectively the 20% AEP water level)
- There is no flow from the LOS and P&R areas.
- The total post development flow is slightly below the total predevelopment flow.
- The 20% AEP basin are will be planted with suitable native vegetation.

7.4 DRAINAGE MANAGEMENT PLAN – 1%AEP

The Subject area has been designed to safely manage the 1%AEP flood event so that impacts on the subject land and downstream infrastructure, the environment and people's safety are minimised.

Key points of the major drainage system strategy are as follows:

- The roads are graded to direct flow overland to the basin POS area. The ultimate road low point will be adjacent to POS, with overflow into the POS basin.
- Stormwater will fill both the planted 20% AEP portion of the basin and the surrounding designated flood storage are, with this being lawn and potentially garden beds. The total depth will be 1.2m.
- Outflows will occur through both the 375mm outlet pipe and weir, with the total peak flow being 0.331m³/s. This peaks at 2hours.
- The flow from the LOS and P&R and associated Bush Forever is 0.313m³/s. This peaks at 15min
- The difference in peak flow periods means the peak of both events won't coincide. To be conservative at this point in the design process, the peak values have been combined to determine the total peak outflow in the 1% AEP as 644m³/s. This is below the pre development peak of 0.685m³/s.
- The flow from the basin outlet is to be dispersed by the rock spreader and dense surrounding planting. The water will then travel into and across the P&R area towards the Southern River.

In relation to flood protection the key points are:

- All lot finished levels will have a minimum 0.3 m clearance above the estimated 1% AEP flood level in the road and POS.
- All lot finished levels will have a minimum 0.5 m clearance above the relevant modelled 1% AEP flood level of the Southern River eg Floor levels above 15.5mAHD in the south and 15.0mAHD in the north.

Table 7 Post development catchment flow summary

Catchment	1EY		20% AEP		1%AEP		Comments
	Peak flow (m ³ /sec)	Critical Storm	Peak flow (m ³ /sec)	Critical Storm	Peak flow (m ³ /sec)	Critical Storm	
Leslie St – Contributing area	0.17	10min	0.037	5 min	0.078	5 min	
Internal Roads	0.189	5 min	0.318	5 min	0.833	5 min	
Internal lots	0.027	12 hr	0.112	4.5 hr	0.424	1 hr	Flow shown is after soakwell capacity exceeded
LOS to basin	0.007	5 min	0.011	5 min	0.038	15 min	
LOS to River	0	NA	0	NA	0.062	15 min	
Parks and Rec	0	NA	0	NA	0.147	15 min	
Bush Forever Foreshore	0	NA	0	NA	0.15	15 min	
Total to River - Basin	0	NA	0.001	6hr	0.313	2 hr	Some other minor peaks out to 12hr in 20% AEP
Total to River - other	0	NA	0	NA	0.331	15 min	
Total to River	0	NA	0.001	6hr	0.664	1.5 hr approx	Combined flow from basin and direct flows to River

Table 8 Pre vs Post development flow summary

	1EY flow rate (m ³ /s)		20% AEP flow rate (m ³ /s)		1% AEP flow rate (m ³ /s)	
	Pre	Post	Pre	Post	Pre	Post
Discharge to River	0.004	0	0.01	0.001	0.685	0.664

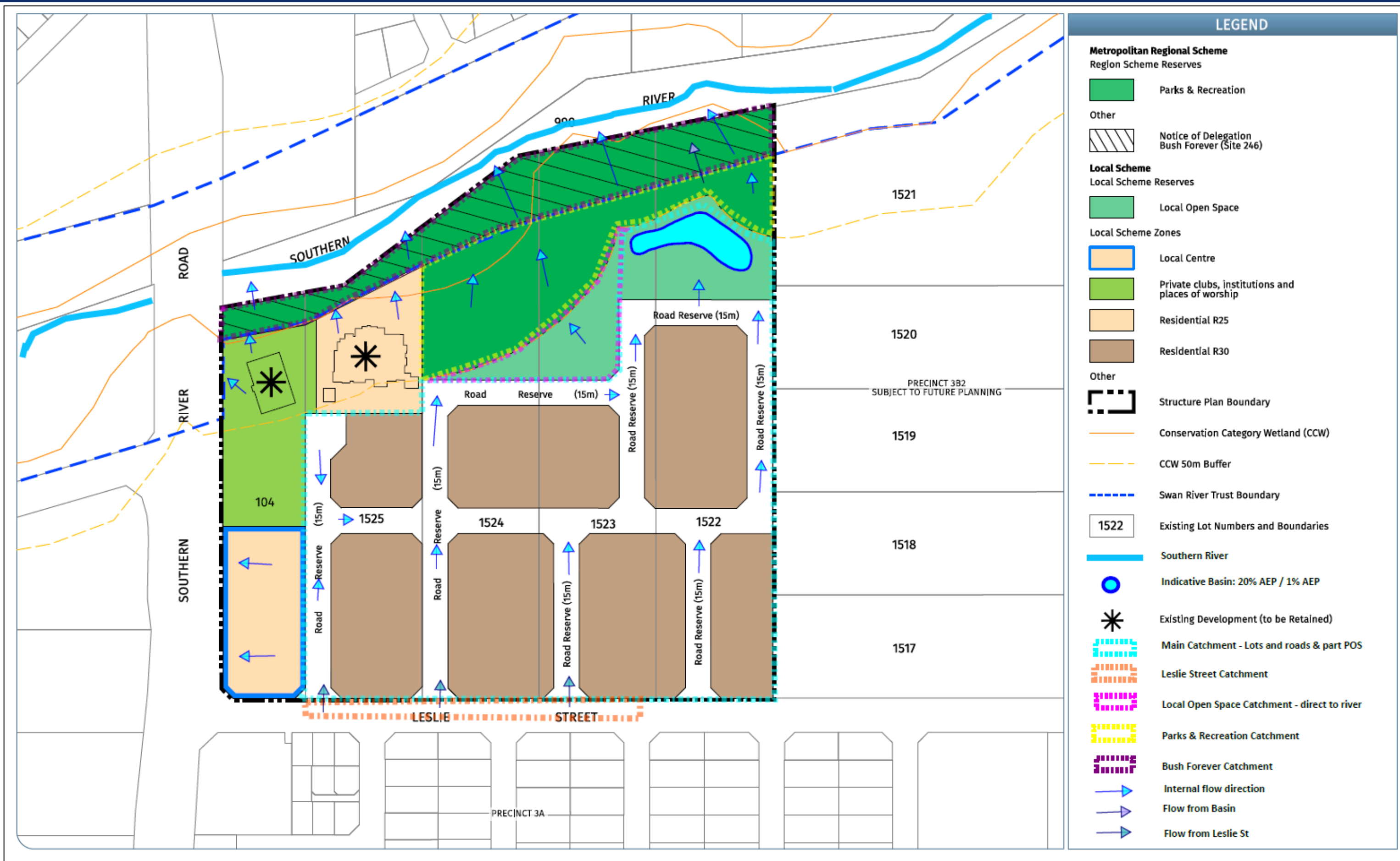


Figure 17 Post Development Catchments

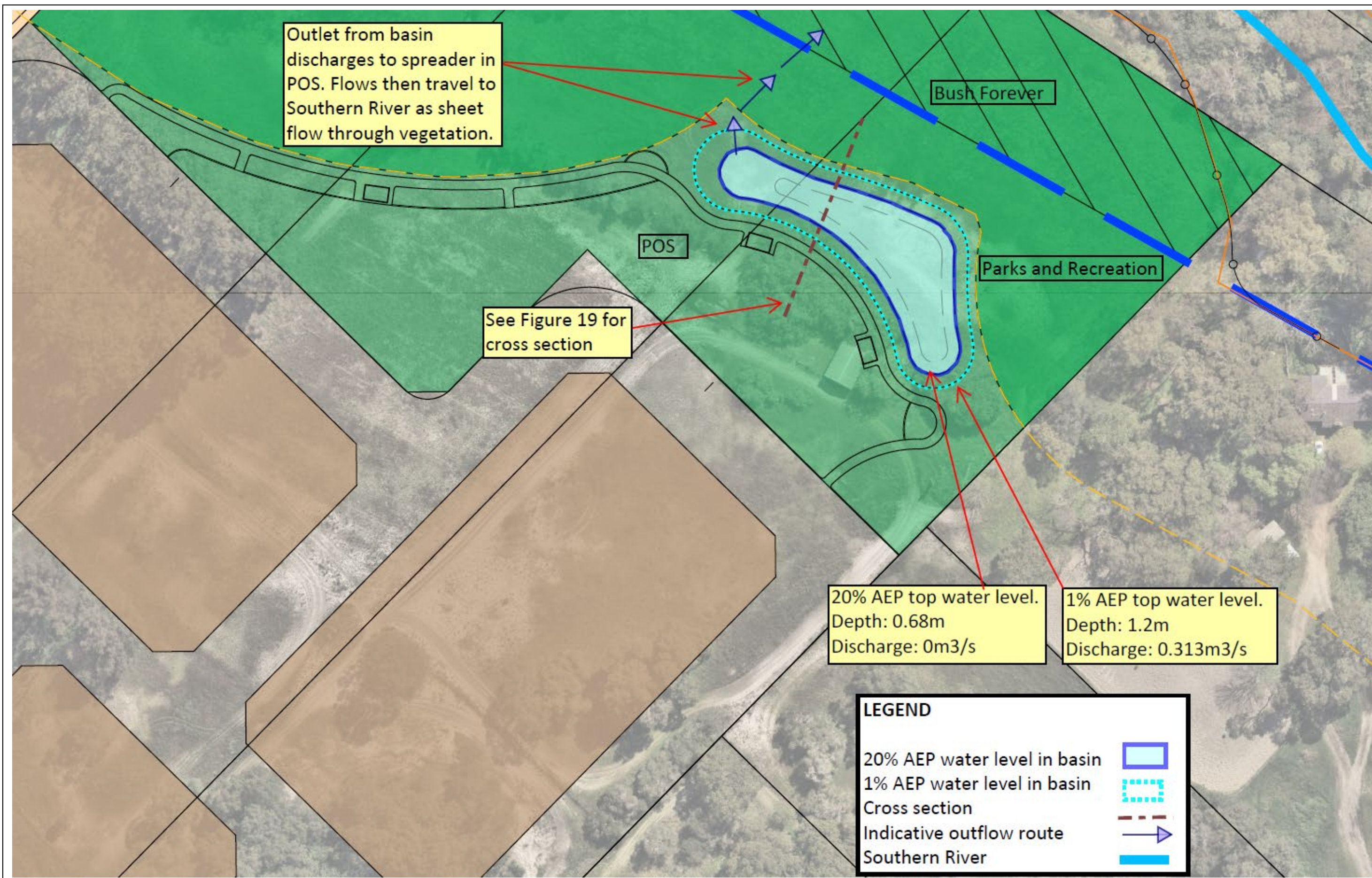


Figure 18 POS basin

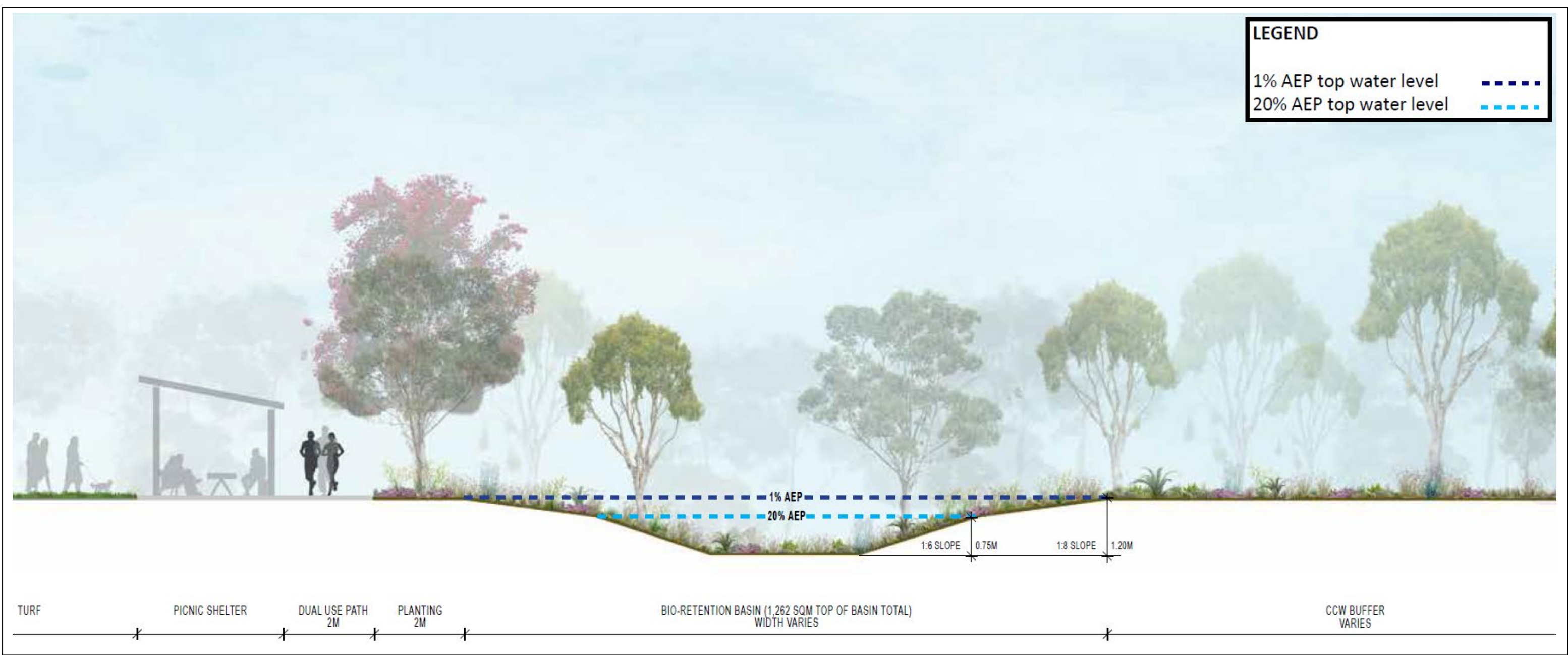


Figure 19 Indicative basin cross section

8 GROUNDWATER MANAGEMENT STRATEGY

The focus of groundwater management for the subject land is to maintain groundwater as close as possible to existing levels, while maintaining adequate separation from infrastructure. Furthermore, groundwater will be managed to improve water quality before it leaves the subject land. By maintaining the groundwater at a level similar to the current level, the development will have minimal impact on the groundwater dependent ecosystems that exist down gradient of the subject land. Groundwater will still be fed from the site, into the Southern River at similar rates to the current situation. There are three primary objectives for groundwater protection and management for the proposed development, these include:

- Protection of infrastructure and assets from flooding and inundation which may be brought about by high groundwater levels.
- Protection of groundwater dependent ecosystems from modified groundwater hydrology following development.
- Maintaining and managing groundwater levels and quality following development.

8.1 INFRASTRUCTURE SEPARATION

A vertical separation between significant infrastructure and the onsite groundwater is to be implemented. This is to be achieved through the current separation to groundwater, importation of clean, free draining sand fill, and where necessary, subsoil network. All lot levels will maintain a minimum 1.2m separation to MGL. All soakwells and basins will have a clear separation of at least 0.5m over the MGL.

Any imported fill is to be free draining with less than 5% fines and a maximum particle size of 10mm and predominately free of any organic matter.

Fill materials, placement and compaction methods and quality control will apply according to standard industry practice and AS 3798 “Guidelines on Earthworks for Commercial and Residential Developments”. The fill will be placed in loose layers not exceeding 300mm thickness and each layer will be compacted with suitable equipment to a minimum of 95% modified maximum density or 70% density index as appropriate.

Further details on the finished levels, cut -to-fill requirements, clay grading and subsoil network are to be determined at detailed design and reported in the UWMP. This is to include the potential for a subsoil system below the bioretention basin to assist with maintaining infiltration and treatment within the basin.

8.2 QUALITY MANAGEMENT

The groundwater quality is managed by road stormwater being treated within the bioretention basin. The infiltrating stormwater will receive treatment as it infiltrates through the bioretention media and plant root zone, prior to entering the groundwater system. This will minimize nutrients and other contaminants from entering the superficial groundwater system.

Fertiliser use for landscaping areas in the POS is recommended to be minimal and utilise slow release products, as necessary. This will reduce the total load of nutrients applied to the development area and minimise the risk for nutrient movement into the groundwater.

8.3 PROTECTION OF GROUNDWATER DEPENDENT ECOSYSTEMS

Potential threats to groundwater dependent ecosystems will be managed by:

- POS to have waterwise landscaping and irrigated through water efficient system
- Infiltrate water close to source to minimise hydrological changes
- Any subsoil system is to connect to the stormwater pipe system and discharged to the POS bioretention basin for treatment.

8.4 DEWATERING

Throughout the construction phase of the development, dewatering may be required according to the Policy Statement No. 50: Planning for dewatering affecting the Swan Canning Development Control Area (DBCA, 2017). Prior to the commencement of any dewatering, a licence to take water will be required through application to DWER. If possible, site preparation should occur during dry periods to reduce or eliminate dewatering requirements. Should dewatering be required, a monitoring and treatment program must be implemented as outlined in Treatment and management of soils and water in acid sulfate soil landscapes (DEC, 2011) after an ASS investigation undertaken according to Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DEC, 2009) to ensure construction and dewatering activities effectively manage disturbances to ASS and treat dewatering effluent appropriately to ensure no adverse impacts to the environment or human health.

Should it be required, a dewatering management plan is to be produced as part of detailed design. It is to cover the treatment and management of groundwater including but is not limited to acidity monitoring and neutralisation, heavy metal monitoring and nutrient monitoring. The management plan is to set the monitoring parameters so that levels are to remain within set guidelines and have contingency plans enacted if guidelines are exceeded. All dewatering effluent is to be infiltrated as close to source as possible to limit groundwater drawdown outside the area required for excavation. An approved.

9 WATER SERVICING AND SUSTAINABLE USAGE STRATEGY

9.1 POTABLE WATER

Preliminary information from Water Corporation indicates that there is a potable water supply network in the area.

A DN100 CI potable water pipe is located immediately outside the subject site along the northern verge of the Leslie Street, a 200P-12 potable water pipe along the southern verge of Leslie Street, and a DN150 CI potable water pipe along the eastern verge of Southern River Road. Water Corporation has confirmed that the current existing water infrastructure is sufficient to accommodate the proposed development without any required upgrades. There are currently five potable water connections to the subject site, one to each of the lots.

The internal water reticulation shall be designed and constructed in accordance with standard Water Corporation requirements. This service is to be managed by Water Corporation.

9.2 WASTEWATER MANAGEMENT

Preliminary information from the WA Water Corporation indicates that there is a reticulated sewer service network in the area. A DN225 sewer main is located immediately outside the southern corner of the subject site in the northern verge of Leslie Street. There is a DN100 sewer main located in the southern verge of Leslie Street that connects to the existing development to the south of the proposed lot and also runs up Southern River Road.

Water Corporation has confirmed that the current existing wastewater infrastructure is sufficient to accommodate the proposed development without any required upgrades. Based on Water Corporation records the site has no existing sewer connections. The current proposed option is for the sewer reticulation to connect to the existing DN225 gravity sewer reticulation to the south of the site on Leslie Street. This service is to be managed by Water Corporation.

Further details are to be found in the civil engineering plans (Appendix A).

9.3 DEVELOPMENT WATER BALANCE

This water balance aims at assessing the impacts of the development on wetlands through groundwater changes and therefore does not consider potable scheme water. It is a simplistic approach for assessment of project feasibility. The calculations will be refined at subdivision stage as detailed design is complete. A summary of the water balance can be seen in Table 9 and 10. The data in Table 9 informs the final water balance in Table 10, with Table 10 taking into account the effects of the infiltration within the basin. Due to the majority of water being infiltrated on site, there is minimal change to the water balance post development. This water balance is based on an average annual rainfall of 829.1mm, which over the entire site produces a total volume of 83.7ML annually. The recharge rate takes into account both the total water that doesn't run off then refines to the amount that soaks into the soil profile by more than100mm vs evaporates off or is held directly on plants. It does not include uptake by the vegetation present. As a general statement, the lack of deep rooted perennials on much of the site means that the majority of water uptake will occur during the winter period , rather than the accessing of the deeper groundwater layers. It is likely that the significant revegetation of the Parks and Recreation reserve and Bush Forever reserve, combined with street tree and lot planting will balance the removal of vegetation and its effect on total infiltration. In a drying climate the small increase in potential infiltrated water is likely to be beneficial in maintaining the native vegetation planted in the reserves.

9.4 LANDSCAPING

The proposed POS area is to utilise a hydrozoned irrigation strategy to minimise overall water usage, while providing public amenity and assisting with plant establishment. Landscaping of the POS will use suitable native species and other waterwise species throughout. The objective of the landscaping is to implement strategies that minimise the quantity of irrigation required including mulching, low use of slow-release fertilisers, direct irrigation from stormwater runoff and utilisation of native plants in garden beds and shade trees.

The POS irrigation is to be supplied from the groundwater. The current developer has a groundwater licence linked to the subject land. Should additional irrigation volumes be required as determined through the landscaping design, then this will be sourced from either the unallocated portions of the superficial or through trading of a groundwater licence from an existing licence holder. The indicative POS irrigation requirement, including garden beds lawn and trees is 2476KL/annum. This is to be confirmed as part of detailed deign and included in the UWMP.

The foreshore reserve area adjacent to the subject land is anticipated to be planted with native vegetation with no areas of irrigated turf. Further information regarding the foreshore can be found in the Riparian Restoration Plan and Wetland Management Plan for Precinct 3B -1. The final works, including any temporary irrigation is to be determined as part of detailed design and incorporated into the UWMP. The Landscaping Plan can be seen in Figure 20.

9.5 FIREFIGHTING WATER SUPPLY

Fire hydrants will be provided throughout, as per the relevant regulations.

Table 9 Water Balance excluding POS basin

Scenario	Landuse	Area (m2)	Recharge coefficient	Total infiltration (ML)	Surface runoff coefficient	Total runoff (ML)
PRE	Rural Residential	94000	0.7	54.6	0.1	7.8
POST	Total R30 Lots	35321	0.6	17.6	0.1	2.9
	Local Centre	4817	0.8	3.2	0.05	0.2
	Mosque	5829	0.8	3.9	0.05	0.2
	R25 lot	4376	0.65	2.4	0.1	0.4
	Local Open Space	7305	0.7	4.2	0.05	0.3
	Parks and Recreation	9503	0.7	5.5	0.05	0.4
	Bush forever delegation	8600	0.7	5.0	0.05	0.4
	Roads	18536	0.1	1.5	0.8	12.3
	Combined infiltration excluding basin	94000		43.3		24.9

Table 10 Total water balance with POS basin infiltration

Flow/infiltration item	Volume (ML)	Comments
Basin inflow from roads	12.3	Taken from Table 9 Total Runoff column
Basin inflow from lot overflow	2.9	Taken from Table 9 Total Runoff column
Basin inflow from POS	0.1	Taken from Table 9 Total Runoff column at 30% of POS
Total inflow to basin	15.3	Combines 30% of POS, lot overflows and road runoff
Total infiltration within Basin (90% infiltration)	13.8	Based on generally no flows out in 1EY
Total infiltration outside of basin	43.3	Taken from Table 9 Total infiltration column
Total infiltration post development	57.1	Includes basin and non-basin infiltration
Difference pre vs post	2.5	Represents approximately 5% increase in infiltration

10 WATER DEPENDENT ECOSYSTEMS MANAGEMENT STRATEGY

10.1 EXISTING ECOSYSTEM ENHANCEMENT

The Southern River and associated CCW wetland boundary associated with the Southern River has been set aside as areas of restoration and revegetation. The area is to be protected in 2 reserved areas, with these being a Bush Forever reserve along the banks of the River and a Parks and Recreation reserve within the adjoining upland area. Preliminary requirements for the protection methods and restoration strategies are outlined in the Riparian Restoration Plan and Wetland Management Plan produced by Bioscience. These include information on:

- Weed control
- Mechanical stabilization such as pinning of jut matting
- Revegetation with endemic riparian and upland flora species
- Suitable access and landuses within these areas

Furthermore, the Local Open space will incorporate suitable native species in its planting to increase the overall area of native vegetation alongside the Southern River. The location of each of these reserved areas can be seen in Figure 20. The reserve to be transferred to the Local and State Government as part of the subdivision application.

The treatment of water prior to it entering the Southern River via surface or groundwater will also assist with enhancing the waterway and surrounding riparian areas.

Further details on the management of the foreshore area can be found in the Riparian Restoration Plan and Wetland Management Plan.

10.2 NEW HABITAT CREATION

The planted drainage basins will also act as new riparian habitat, due to the ephemeral inundation and locally native wetland vegetation. These will expand the habitat options for fauna along the edge of the Southern River.

10.3 DISEASE VECTOR AND NUISANCE INSECT MANAGEMENT

The ephemeral nature of bioretention infiltration basins, means that they do not offer a suitable habitat for mosquito breeding. The basin is designed to drains significantly quicker than the guideline of less than 96 hours of rain ceasing. This will be achieved through the use of suitable media and the subsoil network.

The planting along the foreshore, will assist with reducing any midge movement from the Southern River to the residential areas by creating a screen to lights. The open areas of lawn and perimeter road will further assist with minimising mosquito travel from any breeding areas within pools of the Southern River.

The water quality management strategies and foreshore planting will also assist with improving the instream water quality, reducing the breeding of mosquitoes and midges.



Figure 20 POS Concept

11 MONITORING & MAINTENANCE

11.1 SURFACE AND GROUNDWATER MONITORING

A monitoring program has been designed in accordance with the joint Australian/New Zealand Standards (1998 a, b, c) to allow quantitative assessment of hydrological impacts of proposed development within the area. In particular the program addresses the monitoring of surface water quality, and seasonal fluctuation of groundwater levels and quality within the development area. The program may need to be modified as data is collected to increase or decrease the monitoring effort in a particular area or to alter the scope of the program itself. Any modification to the program would require the agreement of all parties (DWER, CoG, and the developer). The program is designed to operate over a three-year post-development period (After completion of 80% of the lots) to allow for time lag for full impacts of development on the receiving environment to occur.

As the proposed Precinct 3B(1) development has fragmented land ownership, it is suggested that a developer contribution scheme is set up to ensure that suitable monitoring is conducted on a holistic basis which meets the overall objectives of the monitoring of Precinct 3B(1).

Due to the limited predevelopment monitoring that has occurred, it is recommended that at least another year of groundwater monitoring is conducted and at least an initial winter monitoring is completed within Southern River. Proposed monitoring locations would be based on previous monitoring locations, being:

- Bore 1, 4 & 5
- Surface Water Site 6162260

Where these no longer exist, new sites will be established as close as practical to the original locations.

The following monitoring will be conducted for surface water, in line with DWER surface water sampling as SWS7:

- Total Suspended Solids (TSS)
- Total Nitrogen (TN)
- Total Phosphorus (TP)
- Soluble Reactive Phosphorus (SRP) - filtered
- Nitrogen as ammonia/ammonium (NH₃-N/NH₄-N) - filtered
- Total Oxidised Nitrogen (NO_x-N) - filtered
- Dissolved Organic Nitrogen (DOrgN) - filtered
- Dissolved Organic Carbon (DOC) - filtered
- Dissolved Oxygen
- Major Cations and Anions
- pH
- Specific Conductivity
- Field Observations

The following monitoring will be conducted for groundwater:

- Total Dissolved Solids (TDS)
- Total Nitrogen (TN)
- Total Phosphorus (TP)
- Soluble Reactive Phosphorus (SRP) - filtered
- Nitrogen as ammonia/ammonium (NH₃-N/NH₄-N) - filtered
- Total Oxidised Nitrogen (NO_x-N) - filtered
- Dissolved Organic Nitrogen (DOrgN) - filtered
- Dissolved Organic Carbon (DOC) - filtered
- Dissolved Oxygen
- Major Cations and Anions
- pH
- Specific Conductivity
- Field Observations

Tables 11 and 12 provide preliminary trigger values based on existing data. These will be amended once additional predevelopment monitoring is conducted.

Table 11 Preliminary Surface Water Trigger Values (based on 6162260 sampling)

Parameter	Mean	Std Dev.	n
Nox	0.16	0.07	7
TKN	0.88	0.32	7
TN	1.04	0.29	7
NH ₃ /NH ₄	0.03	0.02	6
DO	6.64	1.04	7
pH (no units)	7.32	0.23	8
PO ₄	0.07	0.02	6
TP	0.13	0.02	6
Temp (Deg C)	19.03	2.79	8
Turbidity (NTU)	11.10	3.09	7

Table 12 Preliminary Groundwater Trigger Values (on-site monitoring)

Parameter	Mean	Std Dev.	n
pH	6.12	0.66	16
EC (mS)	2.20	1.93	16
TN (mg/L)	1.32	2.07	16
Nitrate N (mg/L)	0.89	1.97	16
Amm. N (mg/L)	0.17	0.21	16
Total P (mg/L)	0.11	0.13	12
PO4 (mg/L)	0.19	0.24	16
Cl (mg/L)	522.86	642.06	8
SO ₄ (mg/L)	184.71	120.30	3
Fe (mg/L)	1.76	3.55	12

A detailed site specific post-development monitoring program and contingency plan with associated trigger values should be developed for the subdivision before any works are commenced. These programs should be in line with the LWMS. As a minimum, the contingency action plan must include communication with the landowners, DWER and the City of Gosnells as a priority action when trigger values are breached. Table 13 and 14 provides a summary of the monitoring schedule for Precinct 3B(1).

Table 13 Groundwater and surface water monitoring

Monitoring Type	Parameter	Location	Method	Frequency	Reporting
Groundwater Levels	Water levels (mAHD)	5 Existing predevelopment monitoring bores	Water Interface Probe	Quarterly for 2 years post 80% development.	Annual assessment reports to be submitted to DWER & CoG for 2 years post-development.
Groundwater Quality	pH, EC, TDS, Nitrogen, Phosphorus, DOC, Major Cation and Anions	5 Existing predevelopment monitoring bores	Pumped bore sample	Quarterly 2 years post 80% development (Mar, June, Sept and Dec).	
Storm Water Quality	pH, EC, TSS, Nitrogen, Phosphorus, DOC, Major Cation and Anions	Within 3 basins and at 3 outlets to Southern River	Grab Sample	Monthly sampling during periods of flow, typically June to October for 2 years.	Suitability of existing monitoring and reporting frequencies to be assessed annually with any modifications requiring agreement by all parties (DWER, CoG, & Developer)
Surface Water Quality	pH, EC, TSS, Nitrogen, Phosphorus, DOC, Major Cation and Anions	6162260 Southern River Road (downstream)	Grab Sample	Monthly sampling during periods of flow, typically June to October for 2 years.	

11.2 OTHER ITEMS - CONSTRUCTION PHASE

Installation of drainage control structures ahead of the construction phase of the subdivision development will be utilised. This will include the use of water sensitive urban design techniques such as sediment curtains, hydro mulching and temporary detention basins to maintain the quality of the water leaving the development area during construction.

Any temporary basins will be monitored for any damage, including compaction, sediment build up, oils and litter during and at the completion of construction to ensure the structure's effectiveness is not diminished.

Sediment and litter on roads will be monitored, with removal as necessary with street sweeping. Further details can be seen in Table 14.

11.3 OTHER ITEMS - POST-DEVELOPMENT -

LANDSCAPED POS BASIN

Compared to traditional engineered structures for stormwater runoff management, the WSUD elements will generally require routine maintenance that is generally of a landscape maintenance nature. The most common maintenance is the removal of weeds, debris and siltation. The most time intensive period of maintenance for a vegetated WSUD system is during plant establishment (which typically includes two growing seasons), when supplementary watering, plant replacement and weeding may be required.

It is recommended that vegetated WSUD elements are monitored by personnel with floristic knowledge and/or qualifications as they will be capable of identifying evasive species within the natively vegetated WSUD systems. Furthermore, personnel in charge of monitoring should have a good understanding of principles and the functional design of the WSUD elements and the treatment system. The maintenance activities prompted through monitoring activities will generally require coordination between landscape and civil services.

Maintenance inspections should be scheduled to be conducted after a significant storm event (mobilises sediments and coarse material). Inspections should focus on ponding time for the different systems, unequal surface flow distribution and scouring. As well as this, the maintenance will also include the factors outlined for the temporary basins above.

Performance monitoring of the basins will be undertaken to ensure the effective working of the system. Indicators will be used to provide cost effective methods to evaluate the adequacies of the operation and performance of WSUD elements. It can be assumed that if the WSUD elements operate in accordance with the designs, then it can be expected that they are delivering the desired management objectives.

The key aspects monitored will include:

- ensuring the inlet and outlet structures are free of debris;
- vegetative cover of the systems is maintained;
- sediment build up is not impeding the functionality;
- erosion is not present;
- soils are not compacted;
- litter is removed; and
- excessive hydrocarbons are not present in the system
- weeds controlled
- infiltration of stormwater is maintained

These are outlined further in Table 14.

POS IRRIGATION

The POS irrigation source is to be monitored to make sure that it is functioning as designed. This includes suitable flow rates and that the water quality is suitable for the plants being irrigated.

Table 14 Monitoring and Maintenance Schedule

Function	Item to Monitor	Details Monitored	Trigger for Immediate Action	Maintenance Action Required	Monitoring Frequency during maintenance period	Responsible Authority (Timeline)
CONSTRUCTION PHASE & POST-DEVELOPMENT						
Drainage Management Systems (includes traditional and WSUD systems)	Structural Design	Systems are constructed to engineer detailed design specification	Systems constructed differs to design specifications.	Remedial work to rectify systems to meet design specifications.	During and after construction	Developer until handover to Local Authority
	Structural Effectiveness (inlets, traps and outlets)	Inspection for debris, litter and sediments surrounding structural components	Debris, litter or sediments causing blockages or impairing functions.	Remove any debris or blockages. Inspect systems for any erosion related issues.	Monthly	Developer until handover to Local Authority
	Erosion	Inspection for erosion.	Presence of severe erosion or erosion impairing functions.	Investigate, identify and rectify the cause of the erosion. Replace filter media as required.	Monthly	Developer until handover to Local Authority
	Sediment Build Up	Inspection for sediment accumulation within pits, on the surface of bioretention systems and within basins.	Accumulation of large volumes of sediments and/or silts in pits or on the surface (according to Shire standards).	Investigate, identify and stabilise cause of sediment source. Remove accumulated sediments and replace filter media or plants removed.	Event based (mobilisation of sediments) and a minimum of every 3 months	Developer until handover to Local Authority
	Compaction	Inspection of filter media for compaction, could include being driven on.	Water remains ponding longer than designed in bioretention system after a storm event.	Investigate cause of compaction. If localised, remove top 500mm of filter media, break up the filter and then return to system without	Monthly	Developer until handover to Local Authority
	Weeds	Inspection for the presence of weeds.	Weeds are noxious or highly invasive or if weeds cover more than 25% of area.	Manual removal or targeting herbicide application, with waterway approved products.	Monthly	Developer until handover to Local Authority
	Plant Condition	Inspection of vegetation health and cover, and presence of dead plants.	Plants dying or a pattern of plant deaths.	Investigate cause of plant deaths and rectify. Infill planting may be required.	Monthly	Developer until handover to Local Authority
	Organic Litter	Inspection for the presence of organic litter (e.g.. leaves) on surface.	Organic litter coverage is thick or extensive, or detracting from the visual appearance of the system.	Investigate source of litter and undertake appropriate response e.g. alter landscaping maintenance practices, community education).Remove litter.	Monthly	Developer until handover to Local Authority
	Rubbish	Inspection for the presence of rubbish.	Rubbish is blocking structures or detracting from the visual appearance of the system.	Identify source of rubbish and undertake appropriate responses, including removal.	Every 3 months	Developer until handover to Local Authority
	Oil/Hydrocarbons	Inspection for the occurrence of oil on surface.	Oil coverage persists for more than 3 weeks.	Notify the EPA of the spill, if significant and clean up requirements.	Every 3 months	Developer until handover to Local Authority
POS Water Source	Irrigation Management in POS	Water source is effective for POS e.g. quality and quantity	Water is still present after 96 hours, excluding small volumes of groundwater inflow from subsoil	Check subsoil network and filter media is functioning as designed and repair/upgrade.	Every month over winter and spring	Developer until handover to Local Authority
			Water quality is deemed not suitable for irrigation. Water availability is likely to be compromised.	Treat water or find alternative water	Monthly during irrigation season.	Developer until handover to Local Authority

12 IMPLEMENTATION PLAN

The developer is committed to undertaking the water management strategies outlined in this report. The following information details the actions and works to be undertaken by the developer and relevant authorities as part of the development of the subject land.

Implementation of the strategies outline in this report will be undertaken prior to developmental works, as part of subdivisional works and into the post development phase. The relevant items are to be included in a UWMP. This is to include:

COMMITMENTS BY DEVELOPERS

- Undertake detailed drainage modelling including connections to Leslie St and outlet structures.
- Design and construction of overall drainage and subsoil system including basins.
- Appropriate fill used across the site.
- Monitoring of the site’s water as outlined in the monitoring regime including finalizing trigger values and monitoring locations.
- Sediment control during construction.
- Street sweeping undertaken until 80% of the development build out.
- Maintenance during agreed maintenance periods of the stormwater drainage systems and infrastructure.
- Produce and implement Construction and Sediment Control reports.
- Construct the Sewer and Potable water systems.
- Implementation of Foreshore protection and enhancement works.
- Implementation of approved landscaping plans.
- Securing and holding of groundwater licence for POS irrigation and dust suppression, with suitable volumes transferred to the City of Gosnells at handover of POS.
- Undertake detailed geotechnical investigation and additional Acid Sulfate Soils investigations associated with a Management Plan where deemed appropriate for deep sewer, dewatering, and/or foreshore works
- Transfer of groundwater licenses and/or amendment to intended purposes
- Produce a Foreshore Management Plan, where required
- Produce a Landscape Management Plan including irrigation requirements, where required
- Produce a Dewatering Management Plan, where required

REQUIREMENTS OF THE CITY OF GOSNELLS

- Review and approval of the UWMP’s
- Responsibility for the maintenance of the stormwater system after handover
- Approval of drainage design and other water management works.

- Approval of building licenses including on lot stormwater detention systems.
- Street sweeping after 80% build out of the development.
- Encouragement of Waterwise and nutrient wise practices for residents.
- Efficient and sustainable use of groundwater allocation provided for POS irrigation

REQUIREMENTS OF THE DEPARTMENT OF WATER AND ENVIRONMENTAL REGULATION

- Assist the City of Gosnells in relation to assessing the UWMP as required.

REQUIREMENTS OF THE WATER CORPORATION

- Review and approval of water servicing.
- Manage the potable water service post handover.
- Manage the wastewater servicing post handover.

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APPENDIX B ENGINEERING SERVICING REPORT

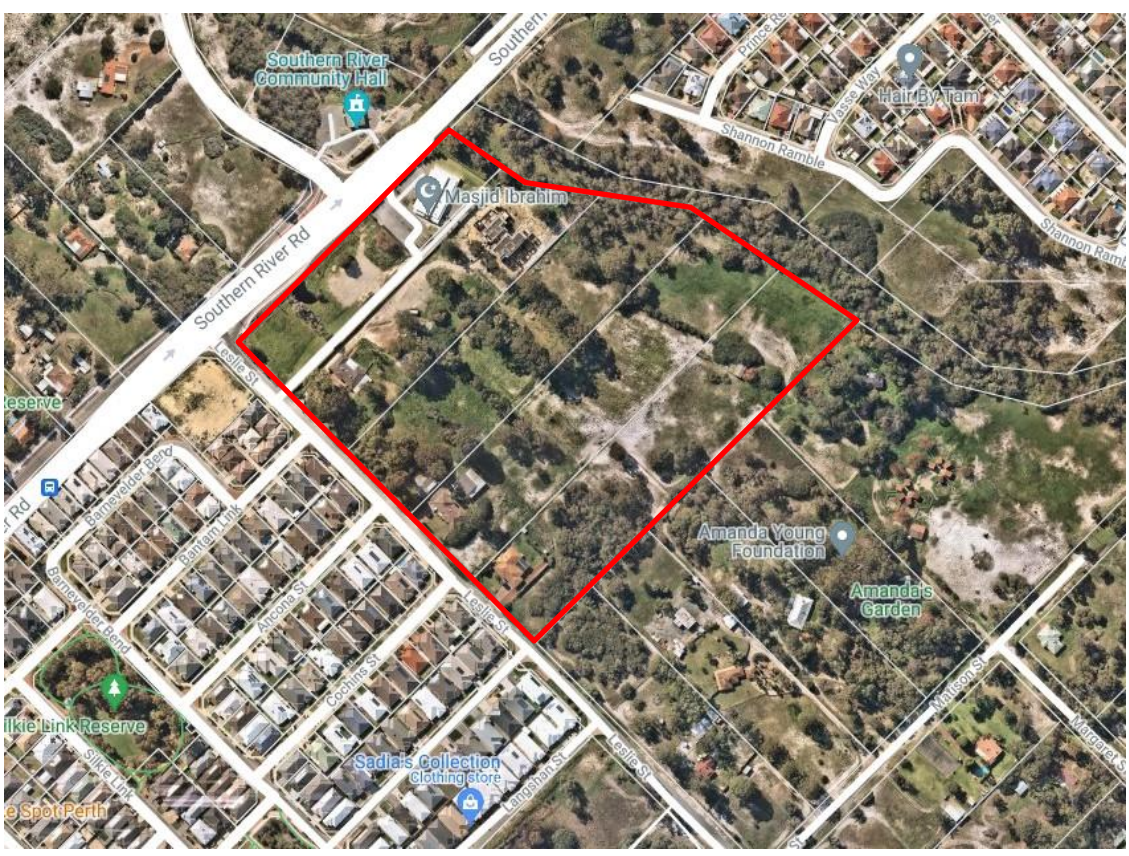
Report Name: 1522 – 1526 LESLIE STREET, SOUTHERN RIVER
Project No: PC21378
Project Title: Engineering Services Report

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2	Updated to reflect final structure plan	BB	EBF	EBF	16/12/2022

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1. INTRODUCTION

Peritas Group was commissioned by Auswide International Investments to review the engineering constraints and servicing requirements associated with the Development of the subject site.

The subject site comprises of Lots 1522, 1523, 1524, 1525, and 104 Leslie Street, Southern River with a total area of 94,452 m² which is made up of 23,220 m², 22,295 m², 20,519 m², 17,214 m², and 11,204 m² respectively. The subject site is bounded by Southern River Road to the northwest, Leslie Street to the southwest, the Southern River to the northeast, and undeveloped residential lots to the southeast as shown in in **Figure 2** below.



Figure 1 Aerial View

The subject site currently has several existing structures (two to be retained) and moderate vegetation.

In summary, this report highlights:

- The subject land is capable of sustaining development in keeping with the proposed residential development.
- The land is capable of being connected to and provided with all essential services to sustain residential development (based on current and future service authority planning).
- The proponent's strategy for the subject land will complement the natural landform by careful design of the bulk excavation, site grading and landscaping.

This report has been compiled based on the following terms of reference:

- Briefing discussions and a meeting with the client.
- Site inspection and site walkover.
- Numerous discussions with Local Government Agencies.
- Site data and documents included on this report.
- Servicing concepts and Regional Strategic Infrastructure planning by the regulatory authorities.

1.1. PROPOSED DEVELOPMENT

LEGEND

Metropolitan Regional Scheme
Region Scheme Reserves

- Regional Open Space
- Other
- Notice of Delegation Bush Reserve (Site 246)

Local Scheme
Local Scheme Reserves

- Public Open Space

Local Scheme Zones

- Local Centre
- Private Community Purposes
- Residential R25
- Residential R30

Other

- Structure Plan Boundary
- Conservation Category Wetland (CCW)
- CCW 50m Buffer
- Swan River Trust Boundary

1522

- Existing Lot Numbers and Boundaries
- Principal Shared Path (Indicative Road Location to be determined at subdivision stage)
- Approved Left in/Left out
- Existing Development (to be Retained)

Project Number: PC21378

2. SITE EVALUATION

2.1. GENERAL

Within this section, a detailed summary of the existing services and constraints information has been compiled and summarised for the subject site. The detailed analysis includes review of Dial Before You Dig (DBYD) information, aerial photography, review of DWER and DPLH Databases, Water Corporation records and correspondence obtained from service authorities.

The subject site generally has mild slopes with the ground surface ranging from approximately RL 15 m AHD to RL 19 m AHD as seen in **Figure 4**. The subject site generally slopes from south to north, with slopes ranging from approximately 1 in 10 in the south of the subject site to 1 in 200 in the north.

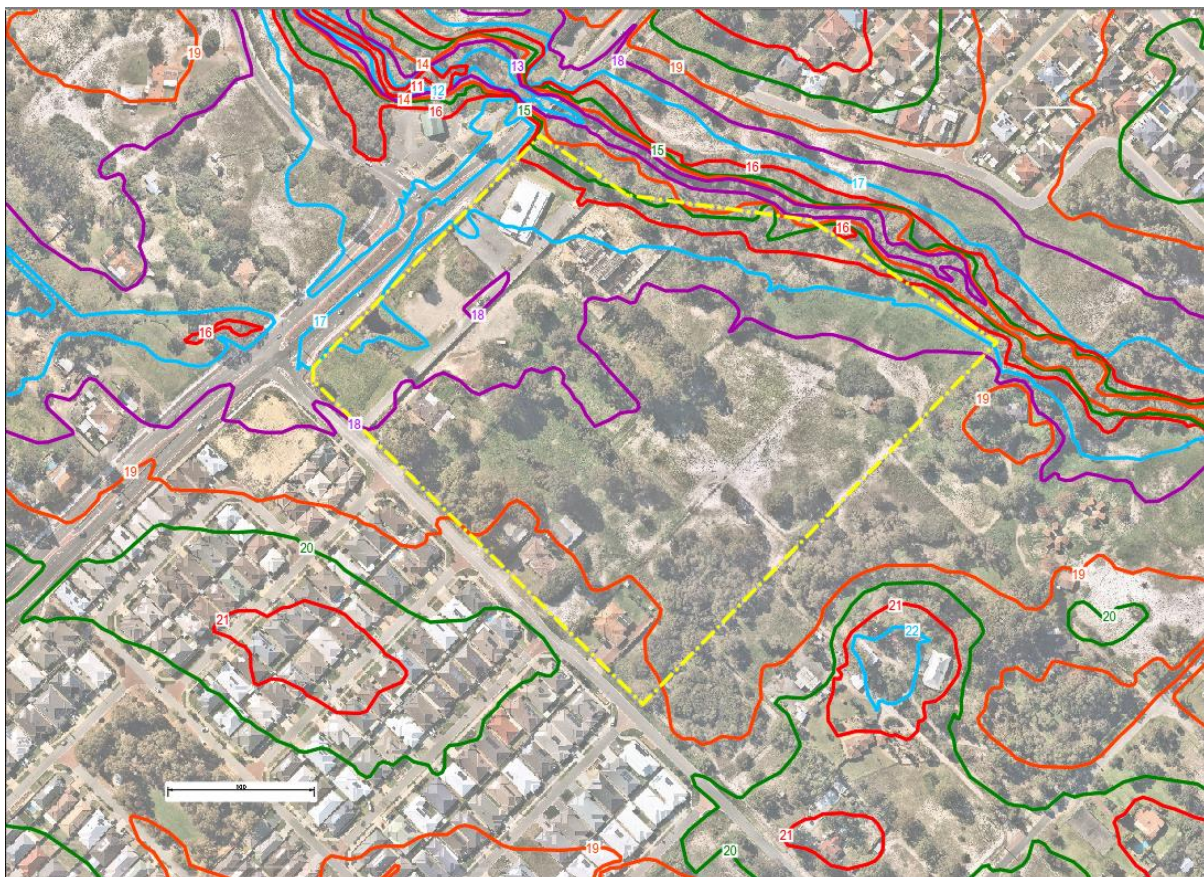


Figure 4 Approximate Site Contours

Subject to final development layout the land will require bulk earthworks to be completed to regrade the site to suit building footprint and to meet the stormwater, and site soil classification requirements. There may be some requirement for retaining walls to create a level building pad and to provide infrastructure servicing to the site.

2.2. SITE GEOLOGY

The subject site on the DMIRS 1:50,000 environmental geology map indicates that the majority of the subject site is underlain by S10 sand which is associated with S8 sand over various other units. A small portion of the southern section is underlain by S8 sand which is associated with white to pale grey at surface, yellow at depth, fine to medium-grained, moderately well sorted, subangular to subrounded quartz, of eolian origin. Around the vicinity of the Southern River to the north of site the ground surface geology is underlain by MS4 sand, which is associated with cream to pale brown alluvium, clayey in part, fine to medium-grained sand, of alluvial origin. See **Figure 5** Below for further details.



Figure 5 DMIRS Site 50000 Geology

A formal geotechnical investigation was undertaken for the subject site in 2010 by Bioscience Pty Ltd. The geotechnical investigation indicates that the subject site is generally consistent with the site surface geology, consisting typically of Bassendean sand over a layer of iron rich silty sand that is sometimes indurated (coffee rock) over sandy clay to depth.

Based on the geotechnical data available there could be significant costs involved with ensuring that the subject site soil is suitable for the proposed development. The subject site will require further investigation during specific development phases with due regard to the proposed development layout and drainage requirements.

2.3. GROUND WATER

Based on information from the Department of Water & Environmental Regulation (DWER), the maximum historical groundwater levels across the development site is approximately 18m AHD parallel to Leslie Street and down to 14m AHD at Southern River shown in **Figure 6** below. The natural ground levels of the site ranges from approximately 19 m AHD in the southern corner of the subject site down to 14 m AHD in the northern corner of the subject site. The depth to groundwater is estimated to vary between natural surface level and 1m AHD.

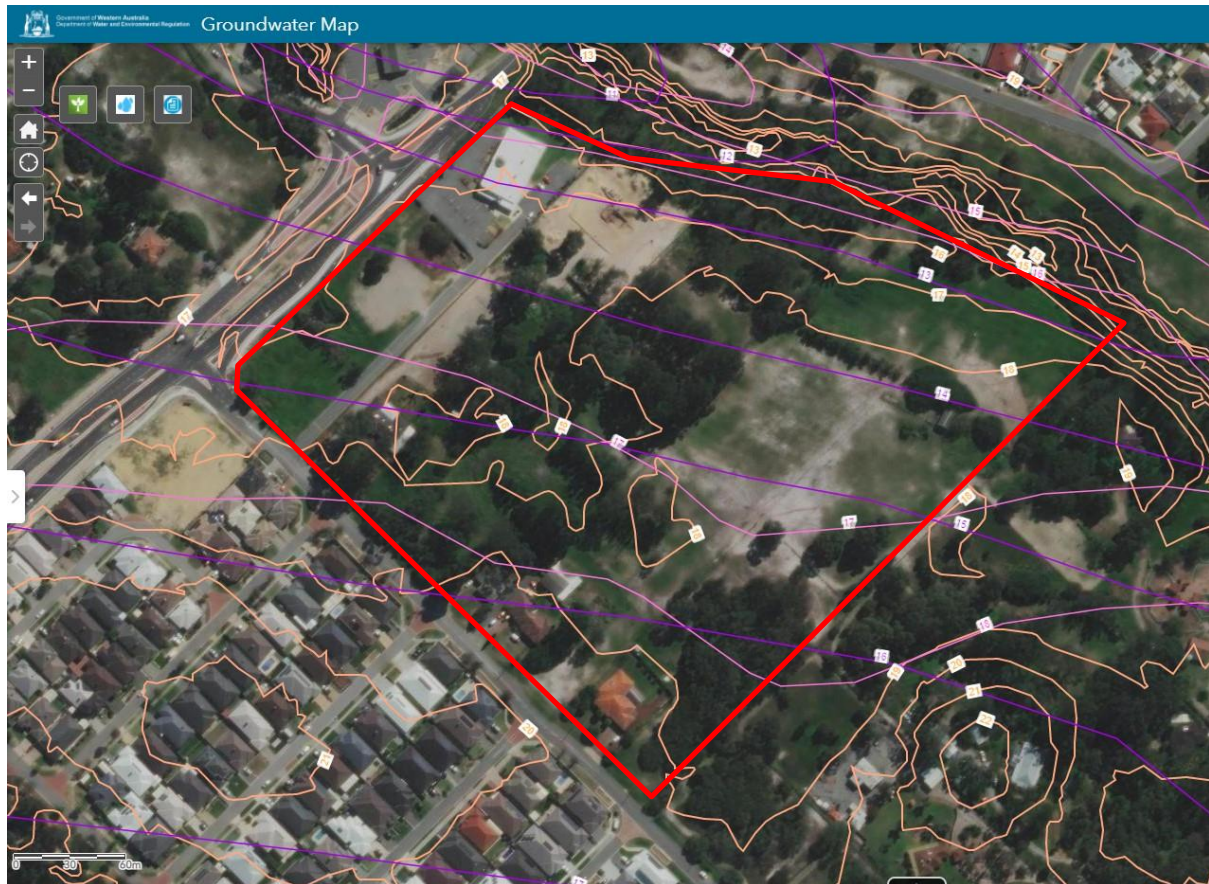


Figure 6 DWER Groundwater Map

Based on the information from DWER database and shown below in **Figure 7** there is a moderate Acid Sulfate Soils (ASS) risk for the majority of the subject site and a high risk around the Southern River. Groundwater salinity is between 500-1000mg/L.



Figure 7 DWER Groundwater Atlas Acid Sulfate Soil Risk

2.4. BUSHFIRE

The current online bushfire mapping listed on the Department of Fire & Emergency Services (DFES) website demonstrates that the subject site is within a Bushfire Prone Area as shown below in **Figure 8**. Additional planning and building requirements may apply to the proposed subdivisional development in accordance with Schedule 2 Part 10A of the Planning and Development (Local Planning Schemes) Regulations 2015, State Planning Policy 3.7, WA Guidelines for planning in Bushfire Prone Areas, and the Building Code of Australia.



Figure 8 DFES Bushfire Prone Area

2.5. ENVIRONMENTAL AND CONTAMINATION

A contaminated land search on the DWER website indicates the site is not within known contaminated sites. No further actions from an environmental contamination perspective are required for the proposed development site.

2.6. FLOOD

The subject site northeast boundary is located along the edge of the Southern River. Preliminary information from DWER provides the following advice:

The Southern River – Wungong Brook Flood Study shows that the general area is affected by flooding during a 1 in 100 (1%) AEP flood event, with the estimated 1 in 100 year AEP flood level shown on the attached map (Appendix D).

Based on the floodplain development strategy for the area, proposed development on the Lots (ie, filling, building, etc) is considered acceptable with respect to major flooding. However, we recommend proposed minimum habitable floor levels of 0.5 metre above the appropriate 1 in 100 (1%) AEP flood level to ensure adequate flood protection.

2.7. SITE GRADING & BULK EARTHWORK

General Principles & Approach

The subject land generally has mild slopes with multiple existing trees predominantly around the centre of the subject site and along the Southern River.

Site grading and remodelling will be kept to minimum limits wherever possible and will generally be limited by adjacent roads, creation of the building pads for future development and associated works within the following parameters:

- Creation of the building pads for the proposed development.
- Regarding site at the location of vehicle access points.
- Contouring of land to suit landscaping and servicing requirements of the development.
- Filling of land to suit proposed development soil grading requirements and services design levels.

Site grading will generally be determined by the building pad design and the sewer design requirements to ensure a sustainable as well as economic development.

Peritas anticipate that the bulk earthwork operations will be partly completed using material available from the area. If importation of sand is required, it will be sourced from existing sand mining operations within the locality.

Preparatory works prior to earth working should be limited to the following:

- Removal of existing structures (exclusive of Masjid Ibrahim place of worship and residence currently under construction) and fencing and other improvements as necessary.
- Stripping and grubbing of areas to be earth worked to the depth 1500mm for stripping and 700mm below existing ground level for grubbing.
- Strip and disposal of topsoil.
- Cut to fill operations and imported fill to selected areas to suit building pad designs.
- Stabilisation of any areas to be landscaped or where topsoil has not been respread on verges and embankments.

Site levels shall be set in accordance with the following parameters:

- Geotechnical and soil parameters to ensure that the site is capable of the development.
- Fill levels to provide clearance to groundwater (AAMGL and as prescribed by authority approvals). Possibly an issue for this site due to the possibility of high ground water levels.
- Appropriate minimum clearances above sewer and water reticulation services.
- Finished transformer site pad levels are to be set at least 1.0m above 100 year flood event and building pads are to be at least 300mm above.

Upon completion of bulk earthworks, any disturbed areas shall be stabilised either by respreading the stockpiled topsoil from the bulk earthwork operations or via hydro mulching stabilisation as appropriate or in accordance with the requirements of the local authority.

Land Stabilisation & Dust Suppression

Prior to construction taking place, a construction water supply will be established to provide water for dust suppression, temporary sand stabilisation and irrigation during the construction phases. Water trucks and spray equipment will be on site throughout the construction programme to damp down exposed sand surfaces until the surface is physically stabilised. In the event that adjacent occupied homes or trafficked roads are affected by sand drift, a sand trapping fence will be constructed fronting the affected section of the development.

In the event of strong winds blowing towards adjacent properties that cause blown sand to reach those properties, earthworks, including the stripping or resspreading of topsoil, will be temporarily suspended and dust suppression measures immediately implemented.

Stabilisation of the soil surface will be carried out, as required, immediately following topsoil re-spreading and minor regrading.

Soil stabilisation will be maintained until such time as the building construction commences.

3. ROAD NETWORK & TRAFFIC CONSIDERATIONS

3.1. VEHICULAR AND PEDESTRIAN ACCESS

Currently the subject site obtains vehicular access from Southern River Road and Leslie Street.

Southern River Road is a dual access carriage way road with an approximate sealed width of 24m, and a landscaped island with a varying width. Each of the carriage ways has kerbing on both sides of the road, and a 2.4m width pedestrian access way.

Southampton Drive has an approximate 7.6m seal width with kerbing on both sides of the road, and a pedestrian access way shoulder with a width of 2.0m on one side of the road.

There is an existing driveway access point for access onto the proposed development from Leslie Street from each of the 5 lots, and an access point from Southern River Road as well.

There are two bus stop locations located in close proximity to the subject site. The approximate locations of the bus stops are shown below in **Figure 9** circled in red.

The proposed development will have site access from Southern River Road and Leslie Street.

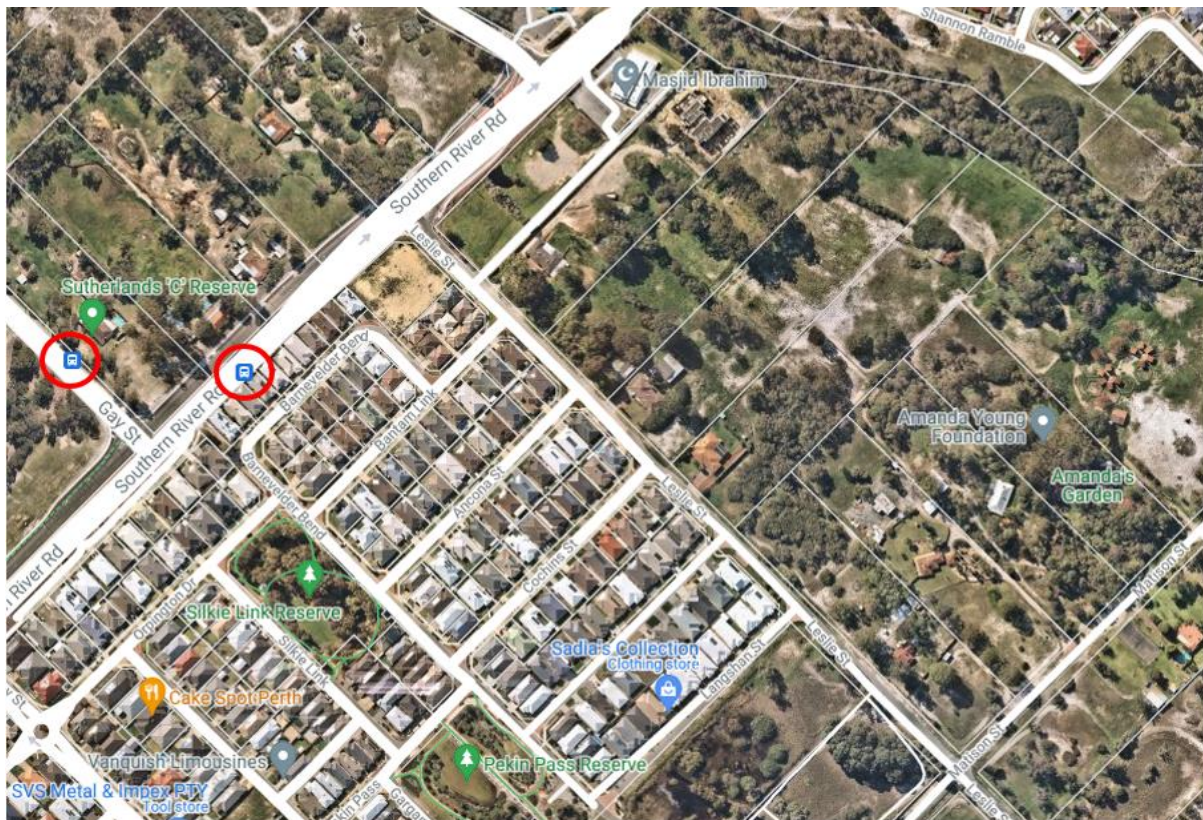


Figure 9 Existing Pedestrian and Public Transport Infrastructure

4. STORMWATER DRAINAGE

The existing stormwater drainage service information has been compiled from Dial Before You Dig information as shown below in **Figure 10**.

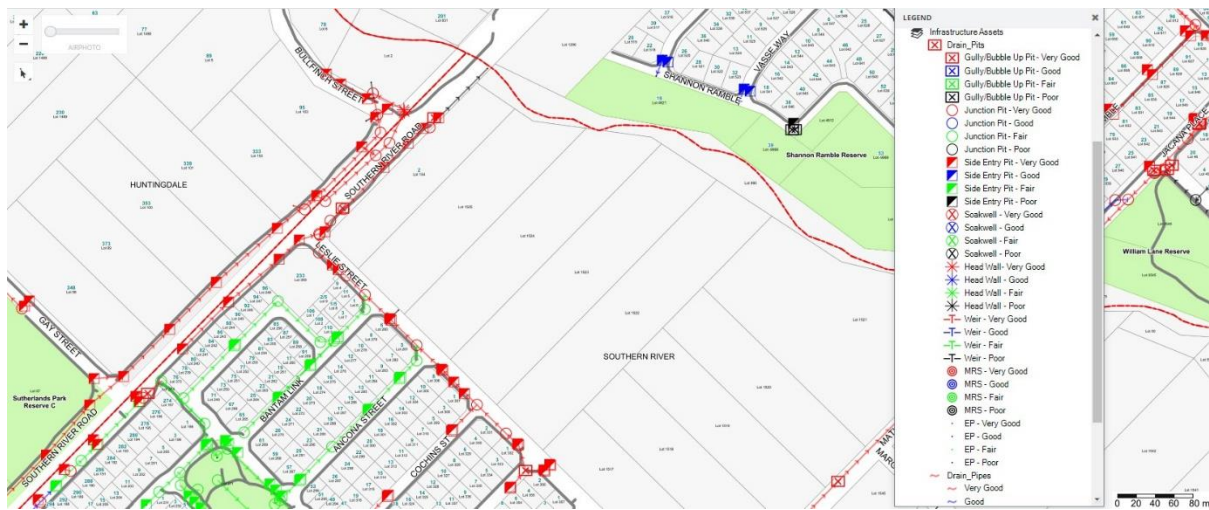


Figure 10 City of Gosnells Drainage Plan

The proposed Local Water Management Strategy prepared by Bioscience Pty Ltd is consistent with water sensitive urban design (WSUD) practices and addresses by the City of Gosnells and the Swan River Trust requirements as outlined below.

The proposed drainage conveyance and retention philosophy will follow the preceding outline:

- *Lots to cater for the critical 5 year ARI event via soakwells;*
- *Raingardens to be provided throughout the road reserve to cater for the 1 year 1 hour ARI for at-source treatment and infiltration;*
- *Provision will be made to pipe the 1 in 5 year ARI flows via a piped network. Specific details relating to the sizing and location of pits and pipes will be provided in subsequent UWMP(s);*
- *Stormwater exceeding the capacity of the piped network will be directed as overland flow within the road reserves to retention basins. This has been designed up to and including the 1 in 100 year ARI;*
- *Stormwater outflow to Southern River generated by Precinct 3B will be detained to pre-development levels utilising raingardens and retention basins located within Public Open Space areas; and*
- *External catchment flows will be allowed to pass through the development site unrestrained. This assumption works on the premise that adjacent stormwater flows passing through the site is either in its natural state or that development has limited flows to pre development levels. The overflow weir from Basin C2 will be sized to cater for these additional flows. This was explained in more detail within Section 4.9.3.*

Refer to LWMS prepared by Bioscience for further details for the stormwater management strategy within the subject land catchment and particularly outlining the 1 in 5 and 1 in 100 year ARI management strategies.

5. WASTEWATER DISPOSAL

Preliminary information from the WA Water Corporation indicates that there is a reticulated sewer service network in the area. A DN225 sewer main is located immediately outside the southern corner of the subject site in the northern verge of Leslie Street. There is a DN100 sewer main located in the southern verge of Leslie Street that connects to the existing development to the south of the proposed lot and also runs up Southern River Road.

Water Corporation has confirmed that the current existing wastewater infrastructure is sufficient to accommodate the proposed development without any required upgrades. Based on Water Corporation records the site has no existing sewer connections.

Peritas engaged in correspondence with Water Corporation to discuss the possibility of a private wastewater pump station (PPS) to discharge to the nearest approved receival sewers, however Water Corporation confirmed that it would not be an option since a gravity sewer option was already available and planned for (see **Figure 11** below)

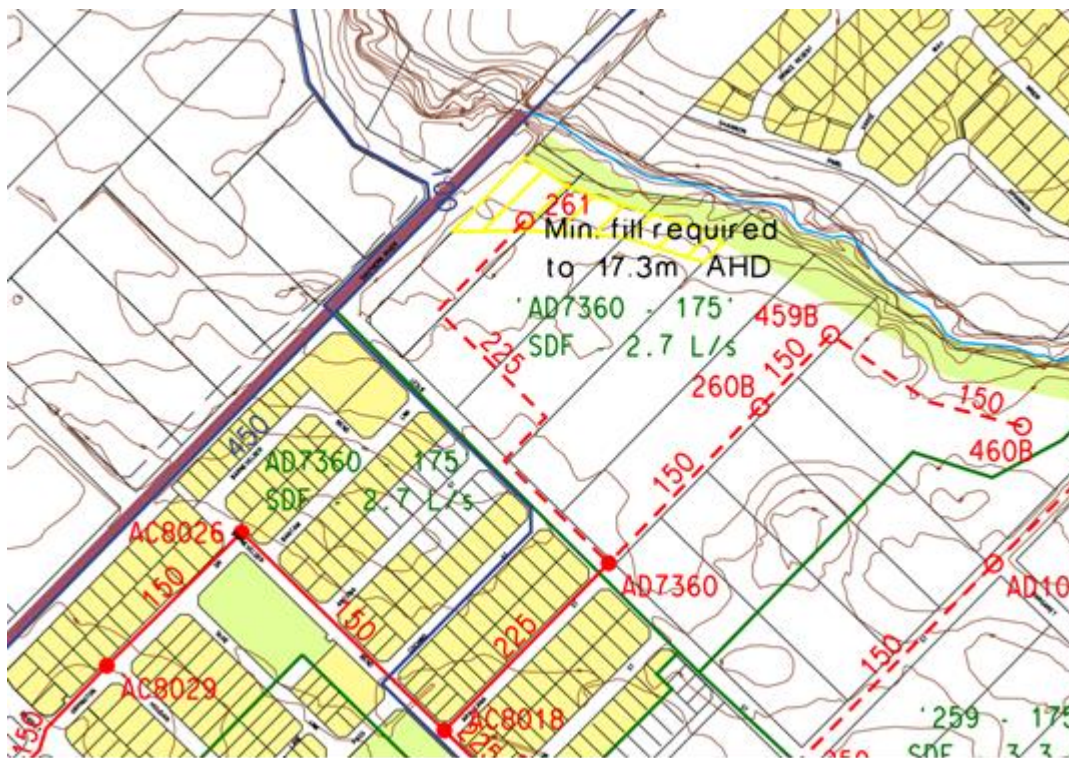


Figure 11 Water Corporation Sewer Scheme Plan

The current proposed option is for the sewer reticulation to connect to the existing DN225 gravity sewer reticulation to the south of the site on Leslie Street, circled in green in **Figure 12** below.



Figure 12 Water Corporation Wastewater Assets

All works in the vicinity of the existing sewer should be completed in accordance with Water Corporation Technical Guidelines for working near Water Corporation assets.

All developed lots would need to be served with a conventional gravity sewer system with the majority of the reticulation sewers located within road reserves. The internal sewer reticulation would be designed in accordance with the Water Corporation Sewerage Manual and connect to the existing network in Leslie Street as noted above.

Standard Water Corporation Headwork charges will apply to this development.

6. POTABLE WATER SUPPLY

Preliminary information from Water Corporation indicates that there is a potable water supply network in the area.

A DN100 CI potable water pipe is located immediately outside the subject site along the northern verge of the Leslie Street, a 200P-12 potable water pipe along the southern verge of Leslie Street, and a DN150 CI potable water pipe along the eastern verge of Southern River Road as shown below in **Figure 13**.



Figure 13 Water Corporation Potable Water Supply

Water Corporation has confirmed that the current existing water infrastructure is sufficient to accommodate the proposed development without any required upgrades. There are currently five potable water connections to the subject site, one to each of the lots.

The internal water reticulation shall be designed and constructed in accordance with standard Water Corporation requirements. Standard Water Corporation water headwork charges will apply to this development.

7. POWER, TELECOMMUNICATION & GAS

7.1. WESTERN POWER

The proposed development currently has underground HV and LV infrastructure in the vicinity, running in the verge of Leslie Street and Southern River Road, see **Appendix B** for further details. The proposed development also currently has overhead HV and LV infrastructure in the vicinity, running along the verge of Leslie Street and Southern River Road, see **Appendix C** for further details. Based on the expected requirements of the proposed development, the current electrical infrastructure will likely require upgrades to service the development.

7.2. TELECOMMUNICATION SERVICES

There is existing comms infrastructure along Leslie Street, Southern River Road and surrounding local streets. See **Appendix A** for further information.

The selected provider will install telecommunication facilities to the proposed development, subject to the developer paying connection fees.

Some additional cost may be applicable for relocation of existing pits and pipes subject to the development layout.

7.3. GAS SUPPLY

DBYD mapping indicates that reticulated gas services are available in the surrounding area. A DN155 PVC 70 kPa medium pressure gas main runs along the eastern verge of Southern River Road and the northern verge of Leslie Street as seen below in **Figure 14**.

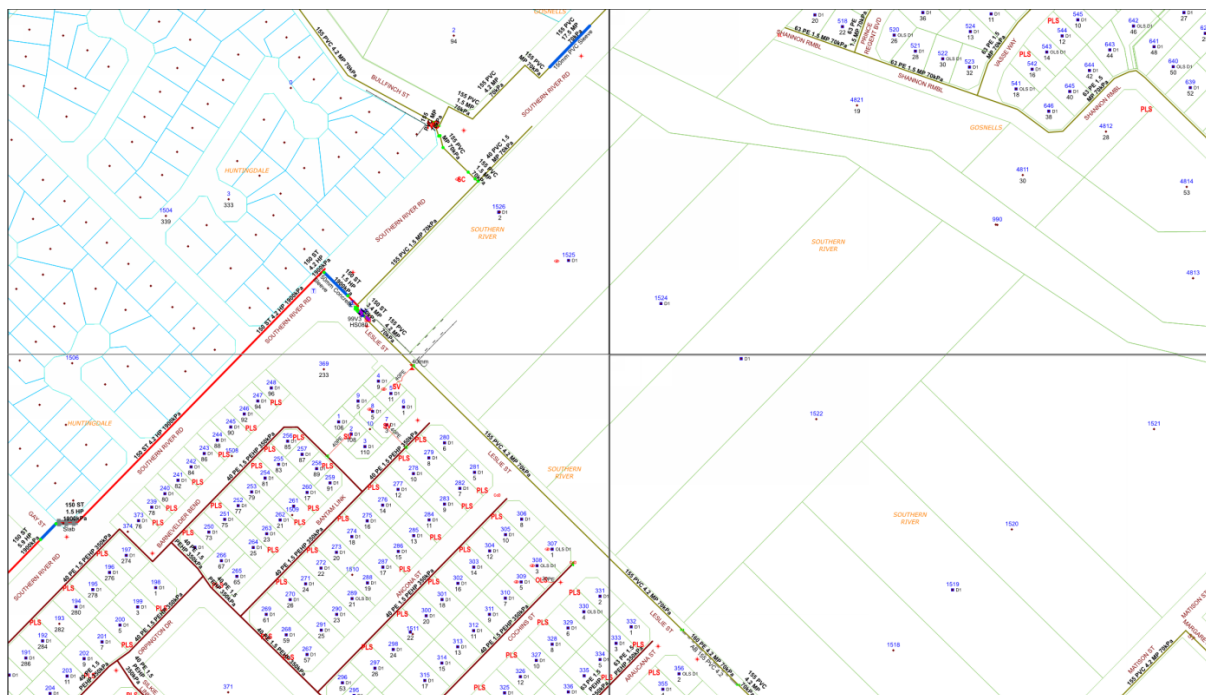


Figure 14 DBYD ATCO Gas Reticulation Map

Gas connection will be provided as on the application from the builder.

8. CONCLUSIONS & RECOMMENDATIONS

Peritas does not envisage any major servicing constraints for the proposed development and has allowed appropriate costs for major servicing infrastructure upgrades based on a stand-alone site development of the subject land.

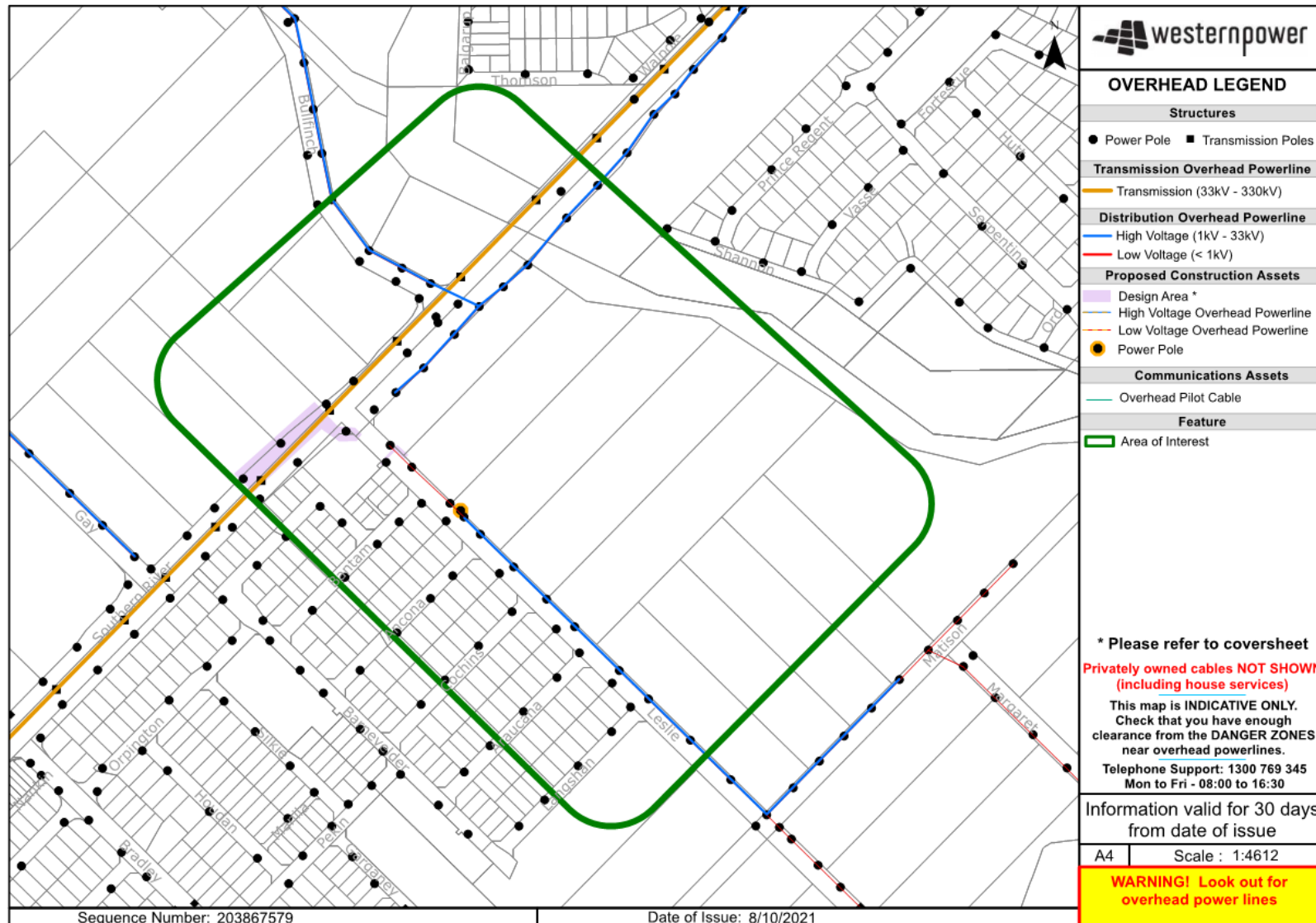
The site is capable of being serviced with all essential services, has no major identifiable problematic soil conditions based on preliminary inspection of the site and with careful considered design would result in a high-quality development.

It is recommended that additional detailed work be undertaken in conjunction with the regulatory authorities and service providers at development application stage to determine the land requirements associated with the necessary infrastructure changes as described in the report above. This would include the following:

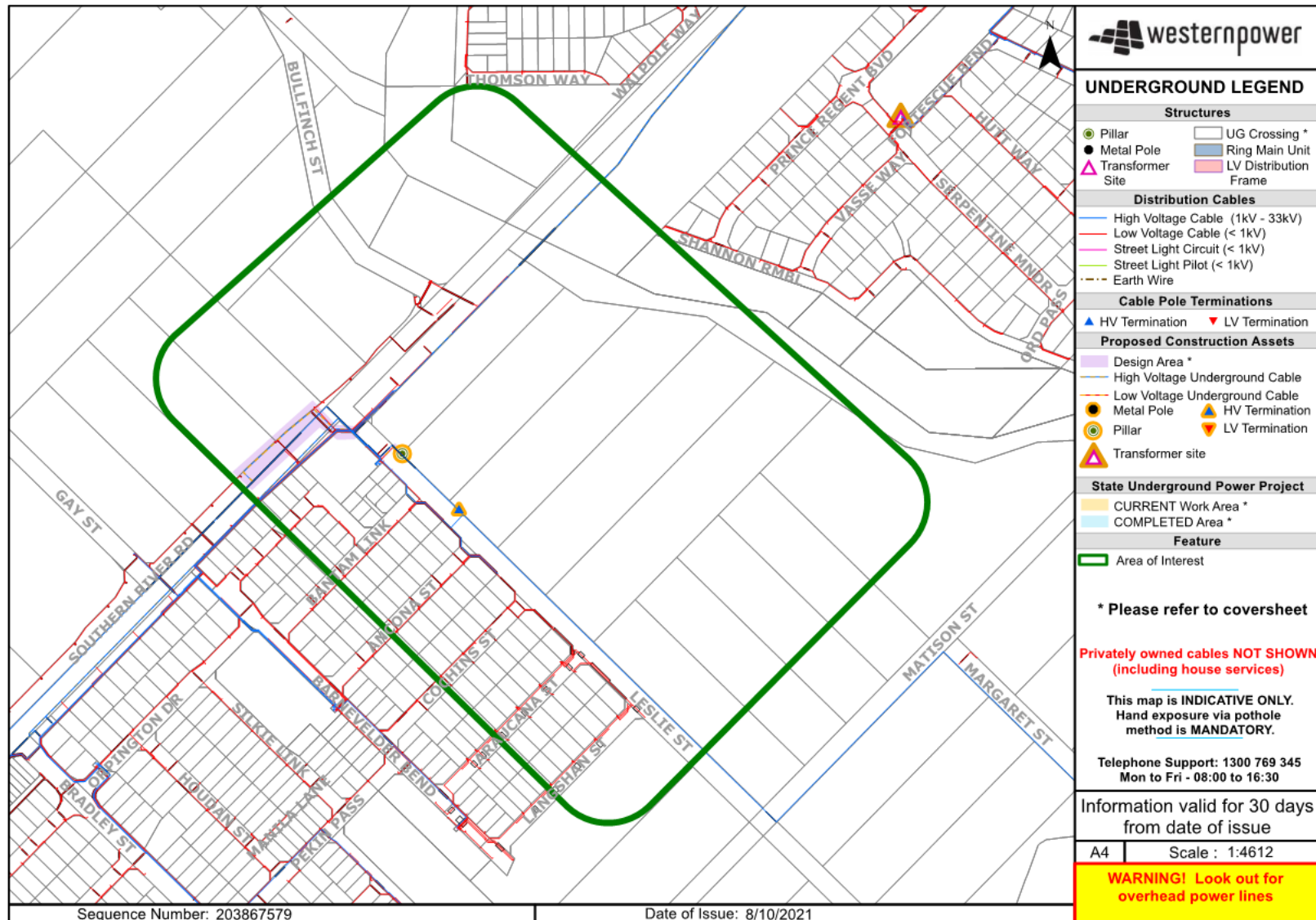
1. Undertake geotechnical site investigation to confirm permeability rates and depth of fill material, and depth to ground water level.
2. A survey be completed to confirm earthwork requirements.
3. Undertake traffic assessment report and confirm with City of Gosnells for access points.
4. Fill requirements for sewer and stormwater are recommended to be at a minimum FL of 17.25m AHD.
5. Liaise with Western Power and engage an Electrical Consultant to investigate whether the existing network capacity is sufficient to service the proposed development or if upgrades will be required.

Additionally, the major service authorities should be approached to formally confirm further details of any upgrade requirements so that the early planning major infrastructure can be undertaken, and forward work construction programmed.

APPENDIX B – WESTERN POWER OVERHEAD MAP



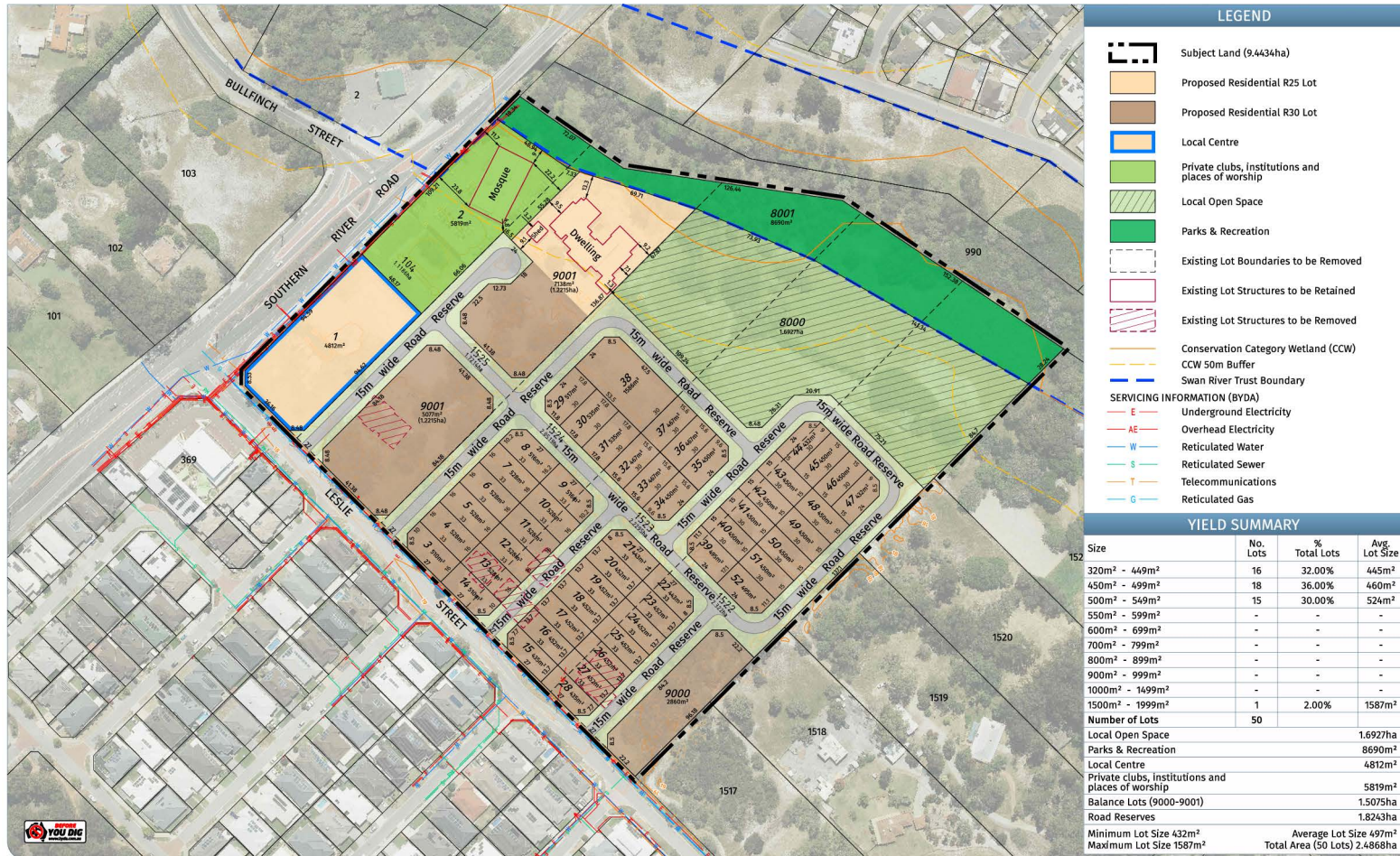
APPENDIX C – WESTERN POWER UNDERGROUND MAP



APPENDIX D – 100 YEAR FLOOD LEVELS



APPENDIX E – RESIDENTIAL LOT YIELD PLAN



FREEHOLD SUBDIVISION

Lots 104 (No. 2) and 1522-1525 Leslie Street,
SOUTHERN RIVER

Plan No. | 22377-07
Date | 04/08/25
Drawn | TJ
Checked | JS
Revision | H

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ALBANY | BUNBURY | BUSSELTON | FORRESDALE | PERTH

Scale | 1:2000@A3

NOTE: This plan has been prepared for planning purposes. Areas, Contours and Dimensions shown are subject to survey.

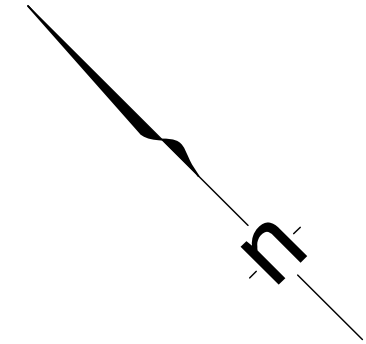
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SURVEYING | TOWN PLANNING | PROJECT MANAGEMENT

APPENDIX B SURVEY



LEGEND	
Ground level	Lot boundaries (SCDB)
Fence	Change of grade
Bollard	Fence
Sign	Stone wall
Bottom of kerb	Top of kerb
Light pole	Bottom of kerb
UG power box/pit	Edge of bitumen
Stay wire	Shoulder
Power pole	AE Aerial power
Earth pit	E Underground power (BYDA)
Cable marker	W Water (BYDA)
Hydrant (underground)	S Sewer (BYDA)
Water meter	G Gas (BYDA)
Comms pit	T Telecommunications (BYDA)
Contour interval: 0.25m	

NOTE: See Certificate of Titles 2979-973, 328-157A, 373-50A, 1326-273, and 1326-272 for interests and encumbrances over Lots 104, 1522-1525 respectively



DISCLAIMER
This plan has been prepared for Auswide International from a combination of field survey and existing records for the purpose of showing the physical features of the land to assist in designing future development. It should not be used for any other purpose.

The title boundaries shown hereon were not verified or marked at the time of survey but are derived from the SCDB June 2023. They are estimated to be accurate only to +/- 0.1m. This plan should not be used for building to boundary, or to prescribed set-backs, without further boundary survey.

AHD connection made to CVAL26A

Underground services shown on this drawing have been plotted from service authority records obtained from 'Before You Dig Australia' or a similar source. Unless indicated otherwise only surface features have been located by survey.

Before starting any demolition, excavation or construction on the site, the relevant person should make an independent and updated enquiry of 'Before You Dig Australia' and any relevant service providers to ascertain the existence of further services (if any) and the accurate location of those not surveyed at the time of preparing this plan (or data).

No responsibility can be accepted by Harley Dykstra for any damage caused to any underground service or any loss or injury so suffered if enquiry and verification have not been completed in accordance with this note.

Contractors to verify all survey control marks to be correct (by field checks) prior to utilisation for construction purposes.

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A	Original drawing	JB	20/07/23
rev	details	approved	date
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drawn	NP 19/07/23	checked	JB 20/07/23
horiz datum	PCG2020	level datum	AHD
scale at A2		all distances are in metres	
1 : 1000			
plan type		FEATURE & CONTOUR SURVEY	
client		Auswide International	
description		Lots 104 & 1522-1525 Leslie Street SOUTHERN RIVER	
drawing no		22377-05A	

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APPENDIX E | WETLAND MANAGEMENT STRATEGY



Integrating Resource Management

WETLAND MANAGEMENT STRATEGY

Southern River

Precinct 3B(1)

Prepared By: Samantha Jones BSc

Bioscience Pty Ltd



1. Introduction

Harley Dykstra, acting for Auswide Pty Ltd has commissioned Bioscience to prepare a Wetland Management Strategy, for the Southern River 3B-1 development. The purpose of this report is to detail a restoration and management strategy for the Conservation Category Wetlands UFI 16,151 and 16,153 to protect and enhance their functions, values, and attributes.

Conservation of our wetlands is vital for a sustainable environment for future generations to enjoy, and is achieved through community integrated management practices. The following restoration and management strategy will outline the existing wetland attributes, then outline targets and strategies to improve the physical, biological and cultural factors necessary to achieve environmental sustainability. This Wetland Management Strategy was prepared in accordance with DPAW guidelines (2008).

2. Site Description

2.1 Site Location

The site is located approximately 18 km from Perth CBD and around 20km from the coast (Figure 1). The site is bound by the Southern River, Southern River Road, Leslie Street and Road Reserve (TBA). Part of the area is mapped by DBCA as CCW wetlands.

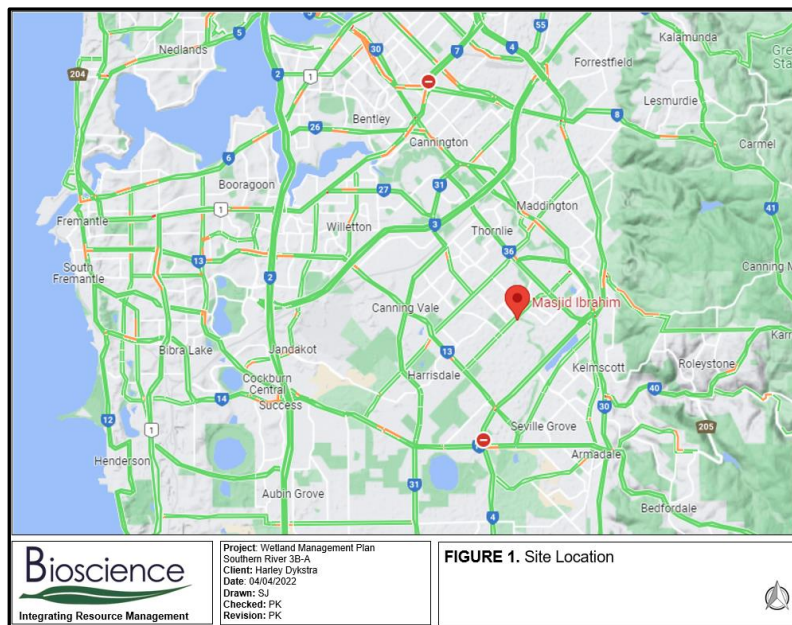


Figure 1: Site Location

2.2 Land Use and Zoning

2.2.1 Past and existing land use

The site is currently part of an urban development project. Previously the site has been used as a horse agistment, sheep grazing and semi-rural housing. The area is highly degraded due to past land use, soil is sandy, the vegetation is dominated by weedy grasses and invasive bulbous species, with some mature trees present within the site and surrounding perimeter.

2.2.2 Metropolitan Region Scheme (MRS)

The area adjacent to the Southern River is classed as parks and recreation under the Metropolitan Region Scheme and Lots 1523 to 1525 as Urban rural. The majority of CCWs UFI 16,151 band 16,153 are located within the Swan River Trust Development Control Area.



2.2.3 City of Gosnells Town Planning Scheme No. 6

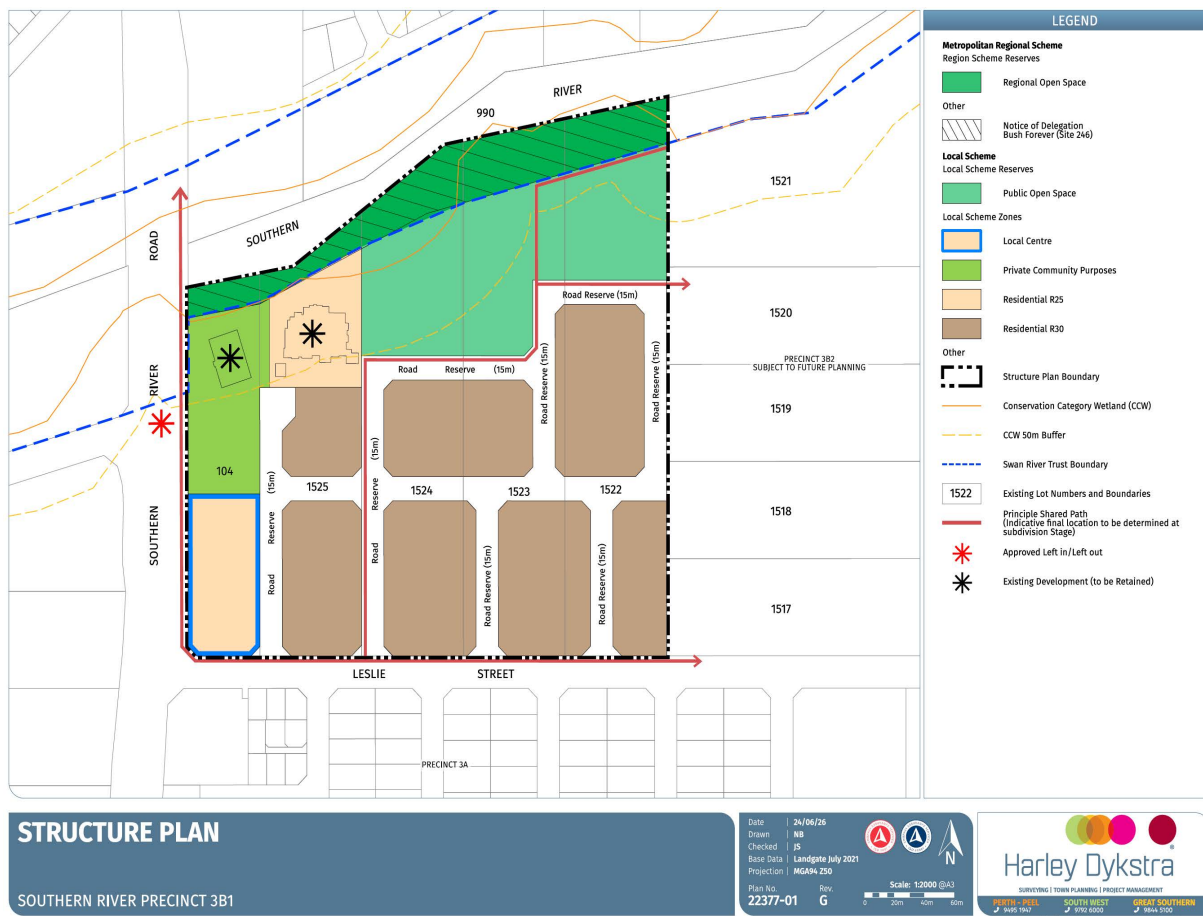
The area is zoned “Urban Development” under the City of Gosnells Local Planning Scheme No.24.

2.3 Proposed Development

The proposed Southern River 3B-1 development is an urban subdivision comprising of residential densities of R20 and R40, with a place of worship adjacent to Southern River Road. A Wetland reserve and a foreshore reserve will also be established along the Southern River in line with Swan River Trust management area boundaries, which will also act as public open space. The public open space will provide an area from the community to connect and engage with nature.

The wetland site is completely dry, with no available water source to the wetland area. From data gathered from past urban development’s surrounding Precinct 3B-1 and the dry nature of the wetland area, it can be concluded that the current amount of run off is not enough to sustain and promote environmental values. Until the completion of the development of the Southern River Precinct 3B-1, the wetland site should become wetter to assist with the establishment and survival of flora species and to promote the regeneration of the wetland function area.

The Southern River is the discharge receiver for local superficial groundwater, its level being well below that of the property shows the land is not inundated, nor waterlogged, thus will need water supplementation to sustain the values and functions of a wetland until the completion of development.





2.4 Geomorphic Wetland Dataset

Wetlands are valuable environments as they support a diversity of flora and fauna as well as provide many different hydrological and ecological functions. Wetlands on the Swan Coastal Plain have been extensively altered and destroyed since European settlement with only 20 percent remaining relatively undisturbed (DEC, 2011). The Swan Coastal Plain Wetlands Geomorphic dataset has the project site classified as Conservation Category Wetlands (UFI 16,153) with the remainder of the project site and the River itself is classified as a (CCW) Conservation Category Wetland (UFI 16,151).

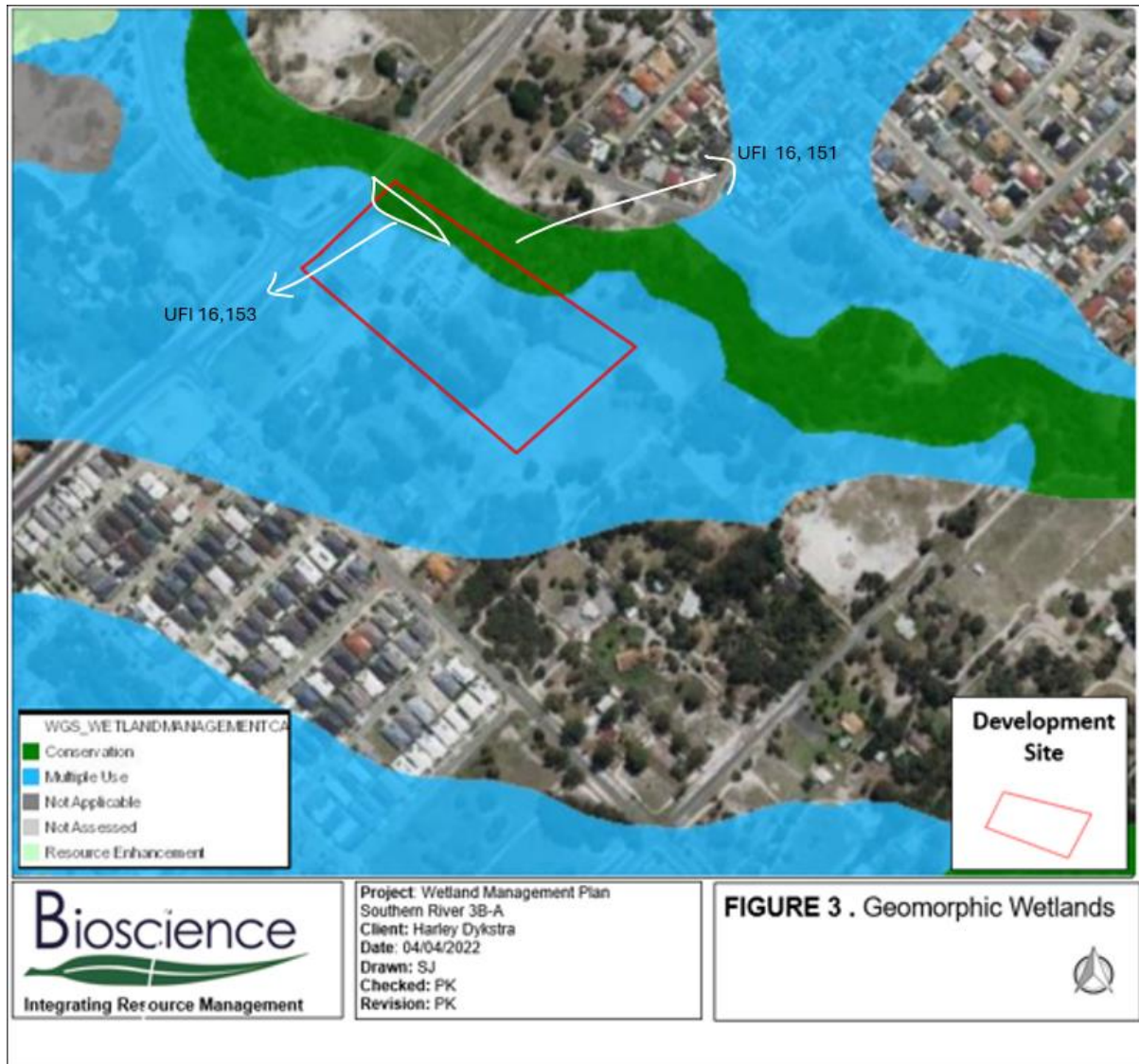


Figure 3: Geomorphic wetlands

2.5 Existing natural environment

2.5.1 Climate

The south-west of Western Australia is characterized by a Mediterranean climate of hot dry summers and cool wet winters. The average rainfall at Gosnells Station (No. 009106), the nearest weather station in the vicinity of the site as shown in (Table 1) below. The monthly distribution of rainfall indicates approximately 85% of the rainfall occurs during the months of May to October. The potential annual evaporation of the area is 1800 mm, which is significantly more than annual precipitation (Davidson and Yu, 2006). The prevailing wind is from a



south-westerly direction, however easterly winds are common, particularly in the summer months. It is expected that ancillary riparian replanting and restoration will reduce the evaporative impact of easterly winds on the wetland.

Australia is one of the driest continents in the world and the effects of climate change are no more obvious than in south-western Australia. Decreasing rainfall and increasing temperatures over south-western Australia has had dire consequences for the Swan Coastal Plain's diverse wetlands. These factors have left many wetlands dry due to decreased groundwater recharge and increased evaporation. The subject wetlands are situated in the central part of the Western Australian Swan Coastal Plain which contains a large chain of wetlands running approximately 3 to 5 km inland parallel to the coast as well as within the Bassendean sand dune system that runs parallel to the scarp. Approximately 70 percent of wetlands on the Swan Coastal Plain have been disturbed since European settlement with only about 20 percent remaining relatively undisturbed with high ecological values (DEC, 2011).

Table 1: BoM Gosnells Station No. 9976 Mean Rainfall Data

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	10.6	15.7	16.8	41.1	101.1	162.3	157.0	122.1	78.9	44.5	29.7	11.3

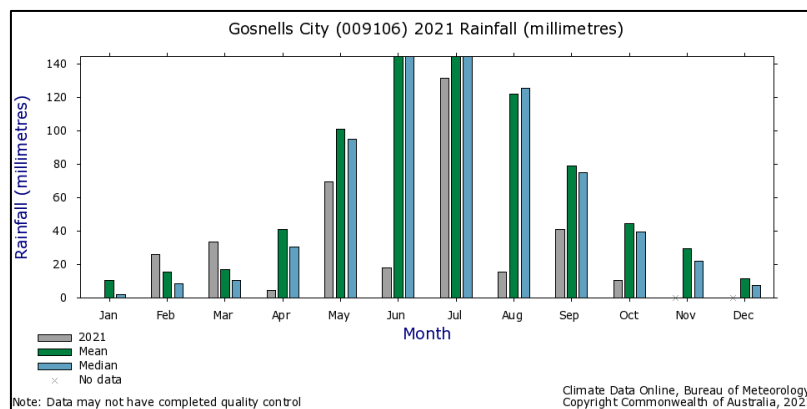


Table 2. BoM Gosnells Station No. 009106 Rainfall Data

2.5.2 Topography

The area has a low relief with minor variations in topography. The area generally lies between 18m AHD and 22m AHD with some areas above 22m AHD and with a steep decline to the Southern River which is at approximately 14m AHD. Gently undulating to flat terraces adjacent to major rivers, but below the general level of the plain, with deep well drained uniform brownish sands or loams are subject to periodic flooding.

2.5.3 Geology and Geomorphology

The subject site is located on the Swan Coastal Plain within the Bassendean dune system, an area characterised by low dunes of siliceous sand interspersed with poorly drained areas or wetlands. Soils tend to be a deep bleached grey colour sometimes with a pale-yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m.

Underlying the Bassendean formation is the Guildford formation. The soils of the Guildford formation are complex and comprise a successive layering of soils formed from erosion of material from the scarp to the east. Rivers and streams have mostly carried the eroded material, which is deposited from the water as fans of alluvium.

The Guildford formation is characterised by poor drainage due to the low permeability of sub-soil clays which prevent the downward infiltration of rainfall, consequently during the winter month's water logging and surface



inundation can occur. In addition, the clay fraction of the Guildford formation is known to have highly variable Plasticity Indices (Hillman et al., 2003).

The geology of CCW 15737 within the site as per the Geological Survey of Western Australia 1:50000 Environmental Geological Series Armadale Map part of sheet 2033 I and part of sheet 2133 IV is:

- **Ms4 – SANDY SILT** – Cream to pale brown alluvium, clayey in part, fine to medium grained sand, of alluvial origin.

This mapping is not consistent with in-field investigations undertaken during preparation of the Local Water Management Strategy which showed a sand layer over glauconitic clay at 2 m bgl.

2.5.4 Hydrogeology

2.5.4.1 Regional setting

The hydrology of the Southern River area on a broad scale is characterised by flat land of Bassendean sand dunes with quite low relief hosting a superficial aquifer which is about 30 m thick. The Southern River itself acts as a local discharge point for this superficial aquifer and is thus the lowest local groundwater level. The Southern River area is located on the eastern edge of the Jandakot groundwater mound, which is characterised by the high transmissivity of the Bassendean sand and shallow depth to groundwater. In this location the superficial aquifer discharges into the Southern River and is partly responsible for its base flow. The highly transmissive Bassendean sands overlay the clayey sediments of the Guildford formation clays, which form a less transmissive area of the Jandakot mound. The origin of Southern River is within the CCW UFI 15961 to the east, which in turn receives flow from the Forrestdale Main Drain and tributaries (e.g. the Ballenup Drainage systems) which drain Piara Waters and Harrisdale urban developments to the south).

Water quality in the Jandakot mound is highly variable and salinity ranges between less than 250mg/L in the central part of the mound to more than 1500mg/L in peripheral area. Water is generally acidic with pH varying from 4.0 - 6.5. Nutrients such as phosphate and nitrate can occur in elevated concentrations in the area. This is commonly the result of nutrient inputs from urban and agricultural development, such as septic tanks and fertilizers, which pollute the superficial aquifer. The subject area is located within the northeastern part of the Forrestdale main drain sub catchment within the Swan-Avon - Canning River catchment in the South West Division.

2.5.4.2 Local setting

The *Department of Water and Environmental Regulation's Perth Groundwater Map* DWER provides historical minimum and maximum groundwater contours for the site. According to DWER's map, the maximum groundwater table is estimated from 15 to 19 mAHd while the historical minimum is between 12 and 17 mAHd. The groundwater contours slope downwards in a north easterly direction parallel with the local alignment of the Southern River. The site's elevation ranges from 14 to 20 mAHd. Groundwater is thus, expected to be around 1 m below ground level (mBGL) during winter months and around 3 mBGL during summer months. CCW 16,153 is not seasonally inundated or waterlogged. Further site inspection on 16/12/2020 showed the groundwater levels to be around 2 meters below ground level considering the wet winter record rain events of November 2020 and the occurrence of glauconitic clay, this groundwater is more likely to be perched.

2.5.4.3 Acid Sulfate Soils

Acid sulfate soils (ASS) are naturally occurring soils which contain iron sulfides, most commonly pyrite (DEC, 2009b). These soils can produce a variety of iron compounds and sulfuric acid conditions when exposed to air. The resulting low pH can release other substances such as heavy metals into the surrounding environment which potentially threatens the health of receiving ecological systems (DEC, 2009b).

Minimising the disturbance of acid sulfate soils is recommended to prevent any detrimental impacts on the environment and its surroundings. Disturbance risk is assessed based on depth from natural ground-surface on the precept that most land development activities including drainage, excavations and dewatering generally do not extend to greater than 3m below natural ground-level.



The map includes areas where ASS risk has been predicted using available desk-top information and limited ground-truthing with areas where intensive on-ground mapping and soil analysis work has been carried out. The land holds a low - moderate risk of acid sulfate soils within 3m of natural soil surface and a high-moderate risk along the Southern River and fringing area (**Figure 4**).

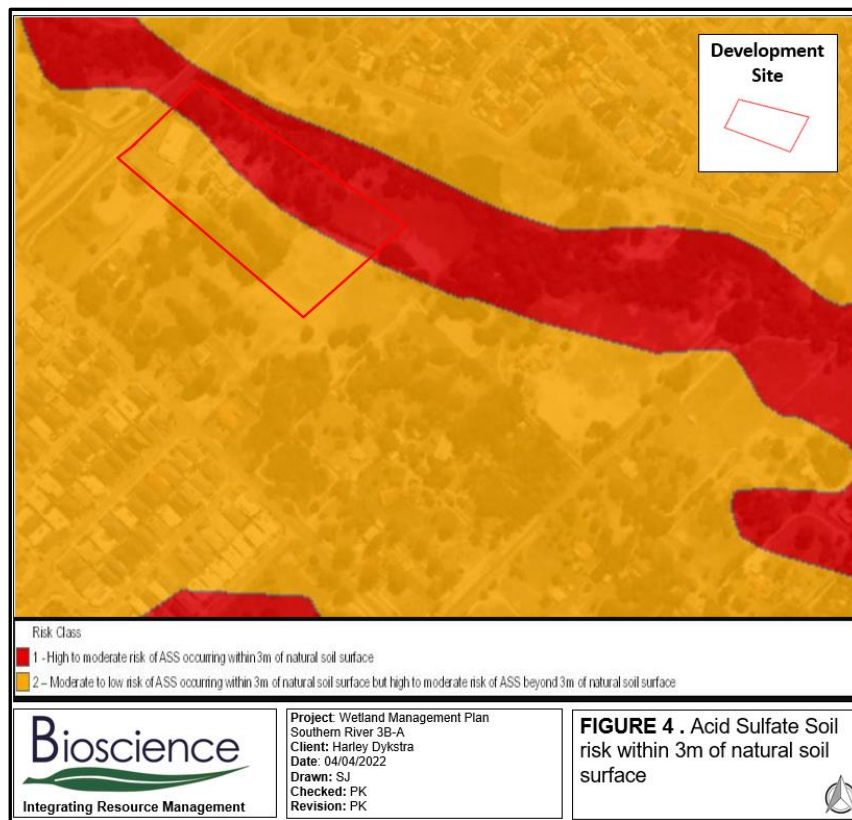


Figure 4: Acid Sulfate Soil risk

2.5.5 Vegetation and Flora

Historically, this biogeographic region has been extensively cleared for agricultural purposes. Four vegetation groups have been cleared to less than 20 percent. The subject site has historically been completely cleared in various stages and as such contains many introduced flora species. Vegetation is completely degraded according to the Bush Forever vegetation condition rating with varying floor cover of introduced grasses and annual weeds such as *Briza maxima* and *Ehrharta longiflora*. The border to the Southern River, adjacent the wetland area, which is the subject of this management strategy is dominated by invasive flora, consisting mostly of grass species and invasive bulbs. The upper story consists mainly of river red gums *E. calmaldulensis*, swamp gum *E. rudis*, paperbarks *Melaleuca raphiophylla*, and very few native plants.

2.5.6 Fauna

According to NatureMap (DEC, 2021) there are 72 fauna species known to inhabit the region with a radius of 2km from the centre of the site (402164mE, 6447517mN 50H). Of the 72 species 2 are listed as rare or priority fauna; Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is listed as Rare or likely to become extinct, and Southern Brown Bandicoot or Quenda (*Isodon obesulus* ssp. *Fusciventer*) is listed as a Priority 5 species.



3. Risk assessment

3.1 Potential impacts and threats

The site is currently very dry and degraded, the main threats to the site are further weed invasion, reduced hydrological function, and the potential failure of the wetland restoration due to the lack of water. The construction of a wetland will enhance the values of the site and the wetland. By revegetating the area with endemic flora species, a wetland area could be created by directing a water source into the wetland function area. The creation of a wetland area will also create habitat for native fauna, and a natural space for the community to enjoy. LWMS will direct runoff water into the into a compensation basin and the compensation basin is not the wetland area.

The main threats to wetlands UFI 16,151 and UFI 16,153 are:

- Hydrological functions
- Failure of riparian restoration and wetland function, due to lack of available water
- Introduction of plant disease and pathogens
- Indirect dumping (rubbish transported by wind)
- Sediment run-off

3.2 Management Commitments

City of Gosnell Policy 6.2.2 has been referred to when implementing a completion criteria.

	Management Objectives	Strategies	Monitoring	Contingency measures	Performance criteria
Hydrology	• Divert storm water runoff from roads into the compensation basin • Reduce the amount of nutrients and pollutants from road runoff • Create wet conditions to wetland site, to aid with riparian restoration	• Implement urban water strategy • Arrange watering trucks twice per week until development has been completed • Amend soil towards higher water holding capacity through the addition of 40% spongolite. • Minimisation of erosion and sediment impacting the river system	• Extract water samples every 3 months through existing piezometers during and after construction • Analyse samples against ANZECC guidelines and baseline data • Monitor and record survival rates of rehabilitated site • Monitor water levels •		• Reduce nutrient and contaminant input to wetland by 90% after construction and implementation of stormwater management system • Wetland revegetation successful and road runoff sufficient to maintain wetland into the future
Vegetation	• Rehabilitate wetland and riparian terrace to increase biodiversity, habitat and encourage	• Targeted weed control program to eliminate all invasive weeds, including watsonia	• Rehabilitation and Revegetation Management Strategy should be prepared and approved by the City	• Examine any causes for loss of plant stock to revegetated area	• 70% reduction in the distribution of weeds throughout the wetland within 5 years



	- native fauna to return to the wetland area - Create wet conditions to assist local plants in growing	- Revegetate the wetland area with locally indigenous species, to provide food and habitat to native wildlife by 'infill planting' established by hand using only propagated seedling stock - Create wet conditions until development has been completed and road run off has been diverted to assist with maintaining wetland conditions, that are vital to the survival and success of the revegetation area	- Monitor and record survival rates of native plant stock added to the revegetation area - Monitor and record any fauna in the area - Monitor and record the resilience and distribution of weeds - Remove weeds every 3 months - Remnant vegetation on site is to be retained and protected		- The revegetation site needs to achieve a minimum species richness of 33 native species. - The wetland area needs to have retained native tree in good condition.
Fauna	- Reduce fauna conflict with vehicles - Reduce conflict with domesticated animals	- Community education to reduce the impacts of domestic animals on the management area such as keeping dogs on a leash - Fauna crossing signs	- Monitor and record sightings or signs of damage from domestic animals - Monitor and record road fatalities to fauna	-	- Reduction to the amount of roadkill - Reduction in the presents of feral animals
Ecological Linkages	Keep sufficient ecological linkage between subject site and surrounding riparian bushland	Rehabilitate vegetation to create a safe passage for fauna to travel between sites	Monitor and record survival rates to linkage corridor	-	-
Disease	Reduce disease risk, such as Phytophthora	Send suspect flora or fauna for further analysis	Monitor health and abundance of fauna, record deaths if any.	Isolate and treat infected areas	No significant outbreaks throughout management period
Fire	Reduce the risk of fire	- Keep fuel load low, by removing dense weed cover and excessive dry wood (being mindful of fauna habitat) - Ensure firebreaks are kept clear in accordance with FESA and local council guidelines		Loss of vegetation and/or property damage	No major fires within 10 years
Commu	Increase community education and awareness of the site and	Create signage to create awareness of the impacts of domestic animals to natural	Remove rubbish and debris from path every 3 months		Meet with community and conservation groups within first year of



	surrounding area • Increase recreational use	environments, or dogs on leash signs • Create a dual use pathway that allows the community to engage and connect with the area • Create a nature play area • Educational plaques to educate the community about local flora and fauna, and the importance of maintain wetland areas • Circulate wetland strategy with stakeholders and arrange a meeting	• Maintain and remove rubbish from nature scape area every 2 months • Keep plaques maintained and cleaned, remove any graffiti • Maintain a good relationship with local community and conservation groups		management • Survey local community and gather data on community needs and appreciation
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4.1 Existing cultural and social value and use

4.1.1 Cultural heritage

A search of the Department of Indigenous Affairs Aboriginal Heritage Inquiry Database states there is one registered Aboriginal Heritage Site, ID 3511, the site is described as a Mythological, Camp, Hunting Place.

4.1.2 Community use and appreciation

The lots included within the development area are privately owned property and have historically been used for pastureland, as this is private property the community use and appreciation is quite limited to the wetland site.

5. Summary of wetland management strategy

5.1. Vision

This wetland management strategy is to enhance and maintain the quality of the wetlands within the Southern River 3B-1 development, this comprises of wetlands, CCW 15737. It is the intent to return the wetland to a functioning wetland area, while creating habitat for native wildlife and ecological linkage to surrounding bushland. This wetland strategy is also intended to create a community POS, allowing the community to connect and appreciate the area through recreation and environmental education.

5.2. Objectives

The objectives of this wetland management strategy area:



- 1.) Create wetland conditions with soil modification and stormwater redirection to assist with the establishment a new plant stock
- 2.) Restore and rehabilitate vegetation communities and create wildlife corridors to ensure the long-term viability of native flora and fauna
- 3.) Monitor and examine water quality and impacts. Investigate ways to maintain good water quality and prevent contamination
- 4) Create habitat for native fauna, such as the river rat ***
- 5) Amalgamate recreational needs with conservation values
- 6) Create a dual use pathway separating the wetland from riparian restoration areas
- 7) Promote conservation to local schools and residents through education and community involvement
- 8) Keep stakeholders informed and involved in all management processes

5.3. Strategies

The key strategies include:

- 1.) Implement stormwater management and soil amendment to incorporate into wetland management
- 2.) Establish and enhance ecological links with surrounding native bushland
- 3.) Eliminate invasive weeds and rehabilitate native flora
- 4.) Enhance recreational value and community education involvement

5.4. Plan

The purpose of this Wetland Management Strategy is to create a liveable community and connect the community to their environment, whilst increasing the functions, values, and attributes of the wetland areas.

This wetland management strategy will increase the functions, values, and attributes by using natural control methods to reduce the threats outlined previously. Natural methods include strategic use of different flora to reduce biological and hydrological impacts incurred since European settlement. The restoration and rehabilitation of the wetland is to use a gradual approach to introduce water flow back into the wetland site, so that the restoration is receiving enough water to create optimal conditions for wetland plants to establish and survive. Currently the site receives little water, and has not been inundated or waterlogged. Established wetlands provide vital habitat and food for native fauna.

The main threat that affects the wetland is the lack of water supply during in development construction and invasive weeds. These must be considered first before other strategies can be implemented.

Endemic native vegetation will be planted into spoil prepared by the incorporation to 1 m depth of 40% spongolite. Tree species will be planted from tubestock at a density of 0.5/m². Wetland shrubs will be planted at a density of 1/m², and sedges, rushes and herbs will be planted at a density of 5/m². The endemic species list is contained in Appendix 1.

5.5 Weed control

The first step towards increasing the wetlands values and functions is to control the invasive flora species on the project site. The control of invasive flora requires an ongoing program to eliminate the current infestation, as well as future incursions.

The invasive flora community needs to be eradicated and replaced with a native sedge and rush community, transitioning into riparian terrace vegetation. Due to the extremely high number of weeds, and the presence of *Watsonia*, the removal of the invasive flora would be best achieved by scalping the top layer of the area



using and excavator prior to soil modification. This will help to remove all the bulbs from the ground, reducing the seed bank and the amount of future weed control needed. This should be followed up with herbicide applications, in late autumn before winter rains, then again in mid spring.

Once the weeds are under control, restoration and rehabilitation of native species can be effectively achieved, with less management required. Rehabilitation with rushes and sedges will out-compete most re-establishing weeds due to the dense tuft-like growth habits. Sedges and rushes also provide great habitat for breeding birds. A list of some rehabilitation species is included in Appendix 1. Weeding after native establishment will be done 3 times per year.

6. Recreation and Performance

6.1 Recreation

The creation of a dual use path through the POS area, will allow the community to connect with natural area and appreciate the Southern River. The POS area will include, a bike path, park benches, and a nature scape play area. This will create long term health and wellness benefits for adults and children within the community. Natural areas provide children with places for creative play, self-tests of their developing strength and skill, and quiet retreat—all important resources for psychological well-being (Chawla, 2015).

While running and jumping on playground equipment keeps children moving, exposure to plant and animal life has great rewards. The cognitive benefits of sustained outdoor play in plant rich environments spill over into the classroom, providing children with increased attention after they go back inside (Holmes, Pelegriani, & Schmidt, 2006).

In addition to this, there will be a dual use water fountain for humans and pets. This will make the POS area accessible to most community members, while bringing the neighbourhood together for increased health and wellness in a liveable community environment.

6.2 Performance

To ensure that the vision of the management strategy is being achieved targets must be set within a dedicated time period as a way of measuring performance. Constant review of the management strategy is required for continual improvement and can be achieved by adopting the Plan – Do – Check – Act management principle. Plan: Establish objectives and create a plan to achieve the targets Do: Implement the plan Check: Measure the results Act: Correct and improve the plan Performance criteria are outlined in Table 3 above.

7. Implementation and Review

Implementation of the management strategy is the responsibility of the developer until the responsibilities are relinquished to the City of Gosnells. Evaluation and review of the objectives and actions is required throughout the period of the wetland management strategy. Review of the objectives set out by the management strategy is an essential tool for evaluation of the overall effect on the wetlands physical and biological characteristics. Using an adaptive management approach, the feedback accumulated from the monitoring programs can provide evidence to achieve better management objectives for continual improvement.

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APPENDIX 1

Flora species that will be used for revegetation

Type	Species	Family
Tree	<i>Eucalyptus rudis</i>	Myrtaceae
Tree	<i>Melaleuca preissiana</i>	Myrtaceae
Tree	<i>Melaleuca raphiophylla</i>	Myrtaceae
Shrub	<i>Hypocalymma angustifolium</i>	Myrtaceae
Shrub	<i>Pericalymma ellipticum</i>	Myrtaceae
Shrub	<i>Xanthorrhoea preissii</i>	Xanthorrhoeaceae
Sedge	<i>Lepidosperma longitudinale</i>	Cyperaceae
Rush	<i>Chaetanthus aristatus</i>	Restionaceae
Rush	<i>Baumea juncea</i>	Cyperaceae
Herb	<i>Centella asiatica</i>	Apiaceae
Herb	<i>Dampiera linearis</i>	Goodeniaceae
Herb	<i>Dasypogon bromeliifolius</i>	Dasypogonaceae
Herb	<i>Hypolaena exsulca</i>	Restionaceae
Herb	<i>Stylidium repens</i>	Stylidiaceae
Herb	<i>Lobelia sp.</i>	Lobeliaceae



The following table list the trees that could be used to revegetate the wetland and the riparian zone around it. It also classifies them into 3 categories of low, medium and high according to their potential to spread a bushfire. Some of these trees are mentioned to be fire retardant species and these may be planted in between the other aesthetically appealing trees to stop or slow down the spread of bushfire if ever there is one in the vicinity.

Table 2: List of species with their probable fire risk ratings and the ones prone to dieback are marked with an * after the name.

Genus	Species	Height of tree	Type of tree 	BAL rating to be low at height below
Acacia	saligna	Large shrub Exceed 3.6m-5m	Evergreen/deciduous 4-5m spread, resprout from seeds after fire	Low to medium
Acacia	Cyclops	3-8m high	3m wide, tolerates coastal conditions, and waterlogged soil, bushy shrub, multi-stemmed	Low
Agonis	flexuosa	More than 10m upto 15m	Evergreen/ deciduous 4-5m spread (very adaptable to sandy and all types of soil)	medium
Banksia	littoralis *	1.5m – 12m	Shrub in low-lying damp areas 5-8 m spread of foliage	Low to medium
Baumea	juncea	1m high	1m widespread Perennial wetland grass	Medium to high
Bolboschoenus	caldwellii	0.3m-1.2m high	Rhizomatous, perennial, grass-like or herb(sedge), swamps, or brackish river edges	Medium to high
Carex	appressa	0.5m- 2m high	Perennial herb, along swamps or watercourses	medium
Casuarina	Obesa	5m-10m tall	5m wide can be used for windbreak or erosion control, tolerates water-logged soils and salty areas. Fixes nitrogen in soil.	low
Centella	asiatica	Petiole 1-20 cm long mericarps with 3-5 prominent longitudinal ribs with reticulate connecting veins between them	Creeping perennial herb, rooting at the nodes	medium
Eucalyptus	rudis	5- 20 m high	Sandy or loam soils, upto 4m wide and tolerant of water logging, moderate drought and salt tolerant.	Medium to high
Eucalyptus(Salt rivergum)	Sargentii	5-10m tall	4-7m wide, highly salt tolerant and tolerant to some waterlogging , used	low



			for wind break, soil erosion control	
Hypocalymma	angustifolium	1.5m tall	1m wide spread, erect, multi-stemmed shrub, drought resistant, needs pruning	Medium to low
Juncus	kraussii	0.3 -1.2m	Perennial herb, Swampy places, rhizomatous	Medium to high
Juncus	pallidus	0.5- 2m high	Perennial herb, Swampy places, rhizomatous	Medium to high
Juncus	pauciflorus	0.3m – 1m	short, slender Perennial herb, Swampy places, rhizomatous,	Medium to high
Melaleuca	lateritia	1.5m- 2m height	Small-medium shrub	low
Melaleuca	Lanceolata	1-8m high, Fire retardant species	Grown in white sand or clay. Also grows on salt flats	low
Melaleuca	preissiana	4-9m height	Upto 5m of spread Evergreen deciduous tree	Medium
Melaleuca	rhaphiophylla	5m- 10m high	3-8m spread Evergreen native tree of wetland	medium
Regalia	ciliata	1.3m – 1.5m high	Rigid spreading shrub, 2m wide spread	medium
Paraserianthes	lophantha	5m high	Spreads quickly and makes a good cover for other species, wetland plant dispersal by wind and water.	medium
Pericalymma	Ellipticum*	3m high	Swamp tea-tree, erect shrub, perennial	Medium to low
Schoenoplectus (Softstem bulrush)	validus	0.8m- 2m high	Used for landscaping and erosion control on edges of streams and constructed wetlands, tall rush	Medium to high
Taxandria (swamp peppermint)	Juniperina	7m high	Upto 3m spread, fast growing, tolerates salt conditions, margins of swamps or watercourses. Fire retardant species	low



Viminaria	juncea	1-4m high	Erect, weeping shrub Near lakes or swamps, grows in fire- prone area and regenerates from seed after the fire.	low
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Appendix A

				Pre-construction			Post construction			
	Stage	Actions	Timing	Monthly	Quarterly	Yearly	Year 1	Year 2	Year 3	Year 4 and beyond
Hydrology	Completion Criteria	Reference Site Surveys and development of Completion Criteria	After winter rain				✓			
	Site Preparation	Establishment of drainage works and compensation basin; designed in relation to MGL					✓			
		Collecting baseline data for GW levels and water quality data from wetland					✓			
	Monitoring	Monitoring program to establish ambient conditions and trigger values			✓					
	Maintenance & Contingency Reporting	Drainage is maintained and use of native and minimal lawn to minimise irrigation dependency A Wetland Rehabilitation Report to be prepared by owner/consultant acting on behalf for the first five years including above actions				✓				✓
Vegetation	Completion Criteria	Reference Site Surveys and development of Completion Criteria	Spring				✓			
	Site Preparation	Surveying current floristic community and determination of soil type					✓			
		Removal of targeted weeds by hand or use of herbicide							✓	
		Revegetation by 'Infill Planting' of native species mostly similar to current ecological community	May-July						✓	
		Creating wet conditions until development has been completed					✓			
	Monitoring	Record of survival rates of native plant stock aiming at achieving a minimum sp richness of 33 native sp.	Spring						✓	
		70% reduction in the distribution of weeds throughout the wetland								✓
	Maintenance & Contingency	maintain wet conditions around wetland areas							✓	✓
	Removal of weeds			✓						
	Reporting	A Wetland Rehabilitation Report to be prepared by owner/consultant acting on behalf for the first five years including above actions				✓				
Fauna	Completion Criteria	Reference Site Surveys and development of Completion Criteria								
	Site Preparation	Fencing and adding road signs regarding road crossing and speed limits					✓			
		Adding pedestrian signage for community education					✓			
	Monitoring	Monitor and record sightings or signs of damage from domestic animals		✓						✓
		Monitor and record road fatalities to fauna		✓						✓
	Maintenance & Contingency Reporting	fauna survey conducted in the area to monitor reduction in the number of animals A Wetland Rehabilitation Report to be prepared by owner/consultant acting on behalf for the first five years including above actions				✓				
Ecological linkages	Completion Criteria	Reference Site Surveys and development of Completion Criteria					✓			
	Site Preparation	Determine area worth retaining as ecological linkage by professional consultants					✓			
		Signs and fencing to protect area of ecological linkage					✓			
	Monitoring	Record of native sp diversity					✓		✓	✓
	Maintenance & Contingency	Revegetating the ecological linkage to maintain biodiversity in the area				✓		✓		✓
	Reporting	A Wetland Rehabilitation Report to be prepared by owner/consultant acting on behalf for the first five years including above actions				✓				
Disease	Completion Criteria	Reference Site Surveys and development of Completion Criteria					✓			
	Site Preparation	Survey around the site to identify sign of dieback or other disease in plants					✓			
		send suspect flora or fauna for analysis					✓	✓		
	Monitoring	Record health and abundance of flora and fauna			✓					
	Maintenance & Contingency	Use dieback hygiene stations to sterilise boots and bikes before entering revegetated areas.					✓	✓	✓	✓
		Prevent dumping on site and carry out phytophthora control procedure when entering wetland areas					✓	✓	✓	✓
	Reporting	A Wetland Rehabilitation Report to be prepared by owner/consultant acting on behalf for the first five years including above actions								

APPENDIX F | RIPARIAN RESTORATION STRATEGY

RIPARIAN RESTORATION STRATEGY

SOUTHERN RIVER

3B (1)

Southern River

Western Australia



Riparian Restoration Strategy
Southern River 3B (1) Precinct

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Document Control

Issue	Date	Author	Reviewer	Approved
1	04/04/2022	S.Jones	P. Keating	P. Keating
2	30/08/2024	S.Jones	B.Lugun	P. Keating

INTRODUCTION

Bioscience has been asked to prepare a Riparian Restoration Strategy for CCW (UFI 16,153) and CCW (UFI 16,151) associated with Southern River. This Riparian Restoration Strategy aims to create conditions suitable to support the establishment of native tube stock used in the revegetation of the riparian zone. City of Gosnells Policy 6.2.2 has been referred to when preparing this document.

Conservation of our wetlands is vital for a sustainable environment for future generations to enjoy, which is achieved through community integrated management practices. The following Riparian Restoration Strategy will outline the targets and strategies to improve the physical, biological and cultural factors necessary to achieve environmental sustainability. Meticulous management of riparian lands is vital for conservation of Australia's unique biodiversity, for continued agricultural productivity and for its recreational, aesthetic and spiritual values.

SITE DESCRIPTION

Precinct 3B (1) consists of currently rural living lots, a place of worship (Lot 1526), and vegetated areas associated with the Southern River. Some lots have been used as horse paddocks or animal grazing, leading to the degradation of the site. There is a dominant surface water feature being the Southern River. The Precinct also contains significant areas of wetlands that have hydrological groundwater linkages with these waterways.

Bioscience has developed a plan for rehabilitation of this section of the Riparian terrace and (CCW) UFI 16,153 and (CCW) UFI 16,151, aiming to enhance the functions, values and attributes of the natural areas within the project site. The entire site and surrounding land, within 600 metres to several kilometres of the site, is classified as an Environmentally Sensitive Area (WALGA, 2016). Erosion, weed infestation and nutrient content are all key concerns for the Southern River, (CCW) UFI 16,153 and (CCW) UFI 16,151.

CLIMATE

The monthly distribution of rainfall indicates approximately 85% of the rainfall occurs during the months of May to October. The potential annual evaporation of the area is 1800 mm, which is significantly more than annual precipitation (Davidson and Yu, 2006). The prevailing wind is from a south-westerly direction, however easterly winds are common, particularly in the summer months. It is expected that ancillary riparian replanting and restoration will reduce the evaporative impact of easterly winds on the wetland.

GEOLOGY and HYDROLOGY

The geology of the Southern River area is typically characterised by Bassendean sand, with a component of clays and silts generally ranging in height from 18 - 16m AHD. The Southern River itself acts as a local discharge point for this superficial aquifer. The Perth Groundwater Atlas (DoE, 2004) shows the groundwater contours generally slope north easterly direction and locally towards the Southern River. Groundwater contours parallel to Leslie Street are approximately 18m AHD. Groundwater occurs between 2 and 4 metres below ground level and flows towards the Southern River. There are no surface water bodies within the site boundaries and the study area is not within the 1 in 100-year flood zone for the Southern River and has no recorded issues of flooding.

Southern River is main tributary to the Canning River, hence Swan River. Southern River Precinct 3B (1) drains surface water towards the Southern River which abuts the Precinct 3B (1) development. Precinct 3B (1) also receives predevelopment surface water flows from the neighbouring Precinct 3A.

CURRENT RIVER STRUCTURE

The site is extremely degraded, consisting mainly of invasive grasses and bulbs, with some scattered *Eucalyptus rudis* and *Eucalyptus patens* and one planted *Melaleuca preissiana*. The site is extremely dry and isn't seasonally inundated or waterlogged. The site will require water flow into the wetland function area, to enable the establishment of wetland plant species.

The wetland area (UFI 16,153) and the bank of the Southern River (UFI 16,151) within the 3B (1) development are currently infested with invasive flora species such as:

- *Watsonia bulbifera*
- *Ehrharta calycina*
- *Schinus terebinthifolius*
- *Bougainvillea* sp.
- *Oxalis* sp.
- *Cynodon dactylon*
- *Romulea rosacea*

SITE PREPARATION

PROPOSED EARTHWORKS

Rehabilitation of the foreshore area will require the mechanical removal of weeds from the bank of the Southern River. Mechanical removal will assist in removing bulbs, tubers and seeds left behind in the soil. This will help to reduce the seed bank, and thus minimizes ongoing management of the site.

FUTURE WORKS

WEED SUPPRESSION

Preliminary weed control will involve use of glyphosate bioactive to blanket spray out the invasive grasses dominating the understory of the site. Spot spraying using a knapsack should be used within the riparian zone to minimize the risk of drift spray and off target damage. Follow up targeted spot spraying, of reemerging weeds in the revegetation area should be done 6-8 weeks prior to revegetation activities commencing, after the proposed earthworks are completed, but before the commencement of rehabilitation works. On-going weed suppression will be carried out every 3 months until the completion criteria are met. All work will be carried out by a qualified operative.

MECHANICAL STABILISATION

Soil stabilisation will be necessary along the majority of the foreshore, as the lower story is dominated by invasive grass species that require removal. The bank of the Southern River within the site will require stabilization, until the bank is revegetated to prevent erosion. Coir matting to be used to stabilise the bank where possible. This will have the added advantage of weed suppression. Vegetative mats are biodegradable and add organic matter to the soil as they break down. The mats reduce changes in soil temperature, decrease evaporation and improve infiltration and soil water moisture content, resulting in improved plant survival rates.

Erosion control works will involve the installation of coir matting this will be applied to the transition zone and to the wetland function area. Mats will be laid to cover the zone of instability and will extend from below low water level to the top of the bank or, where bank slopes are less than 10%, to above high-water mark. from the low tide mark to the upper edge of the bank. Matting will be trenched in at the tops, bottoms and sides of the works area; each run of matting will be overlapped a minimum of 100 mm. Matting will be fixed down with steel pins at a density of 2 pins per m². Coir matting has a 2 to 3-year life expectancy allowing for a longer seedling establishment period, whilst reducing competition from weed species.

BIOLOGICAL STABILISATION

To provide long term stabilisation to the riparian terrace, the area is to be revegetated with endemic native plant species, that will stabilise the soil and suppress re-emerging weeds. Ground cover plants are important in the suppression of weed species and to provide habitat for native fauna. Lower down the riparian terrace endemic sedges, rushes and reeds are to be planted, this will stabilise the soil to the edge of the River. Suitable species to be used in the rehabilitation (Appendix C). Sedge stock will be installed along the lower end of the embankment at a density of 4-6 plants per m². The remaining plant stock will be installed at a density of 5 plants per m² with an additional 0.1 tree per m² as per the Council Policy 6.2.2.

MONITORING AND ASSESSMENT

Quarterly inspections are to be carried out to assess the rehabilitation area, to ensure that completion criteria are met. On-going weed management and green-stock maintenance to be carried out at least every 3 months to monitor and record the success of the rehabilitation plan and the weed control program. The site will be maintained by the owner for a minimum of 2 years after practical completion, on-going weed suppression will be carried out as necessary, until handover to the City of Gosnells. Monitoring should be carried out as per the City of Gosnell's Policy 6.2.2.

Completion criteria for the rehabilitation are considered to be:

- Establishment of a native plant density of at least 4 plants/m² in all zones, and 5 plants/m² for rushes and sedges in buffer zones
- Establishment of a minimum of 80% of the species planted and seeded; and
- Reduction of weed cover to less than 10% in all revegetation areas
- No declared pest plants or weeds of National Significance

SCHEDULE OF ACTIVITIES

Stage	Activity	Date
1	Excavation of riverbank and re-grading of the site	TBA
2	Bank rehabilitation	TBA
3	Initial weed control treatments (using Glyphosate Bioactive)	TBA
4	Install coir matting	TBA
5	Follow up spot spray of reemerging weeds	TBA
6	Rehabilitation – Planting of endemic flora species	TBA
7	Monitoring of weed species and planting survival rates.	Quarterly
8	Completion criteria and monitoring	Bi – Annually
9	Infill planting	TBA
10	Follow weed control treatment	Bi – Annually

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Figures

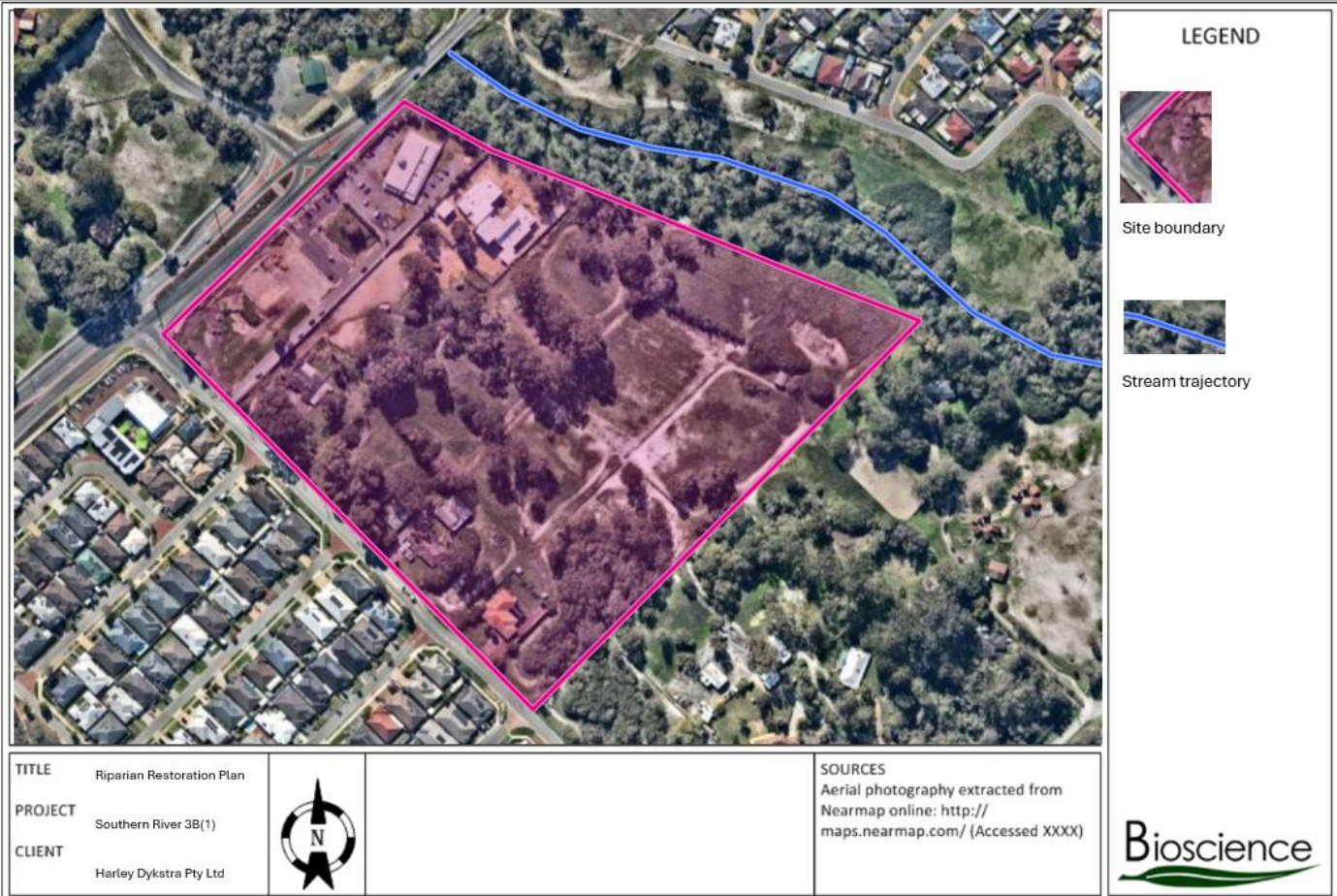


Figure 1–Site and Stream Position

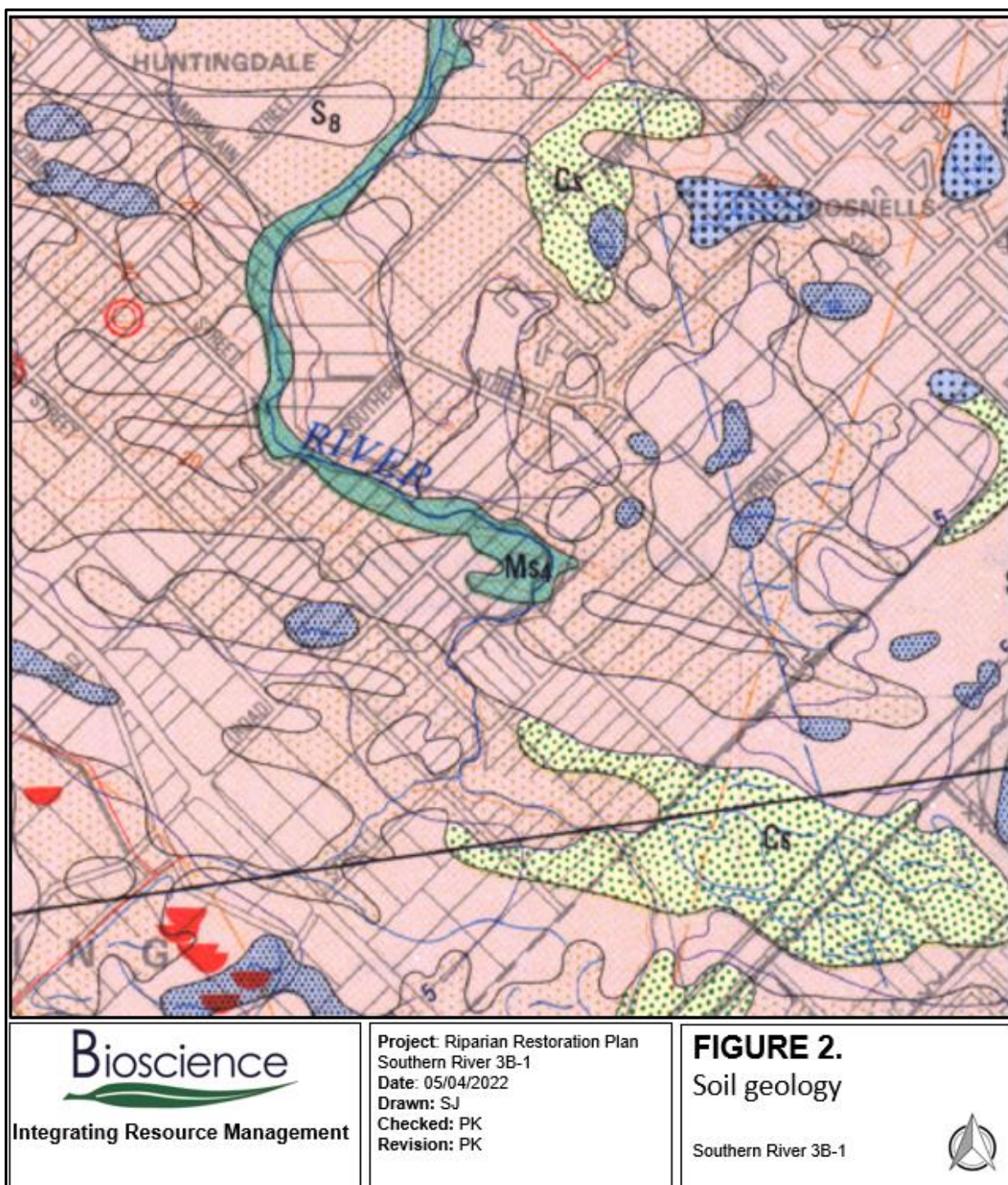


FIGURE 2—SOIL MAP

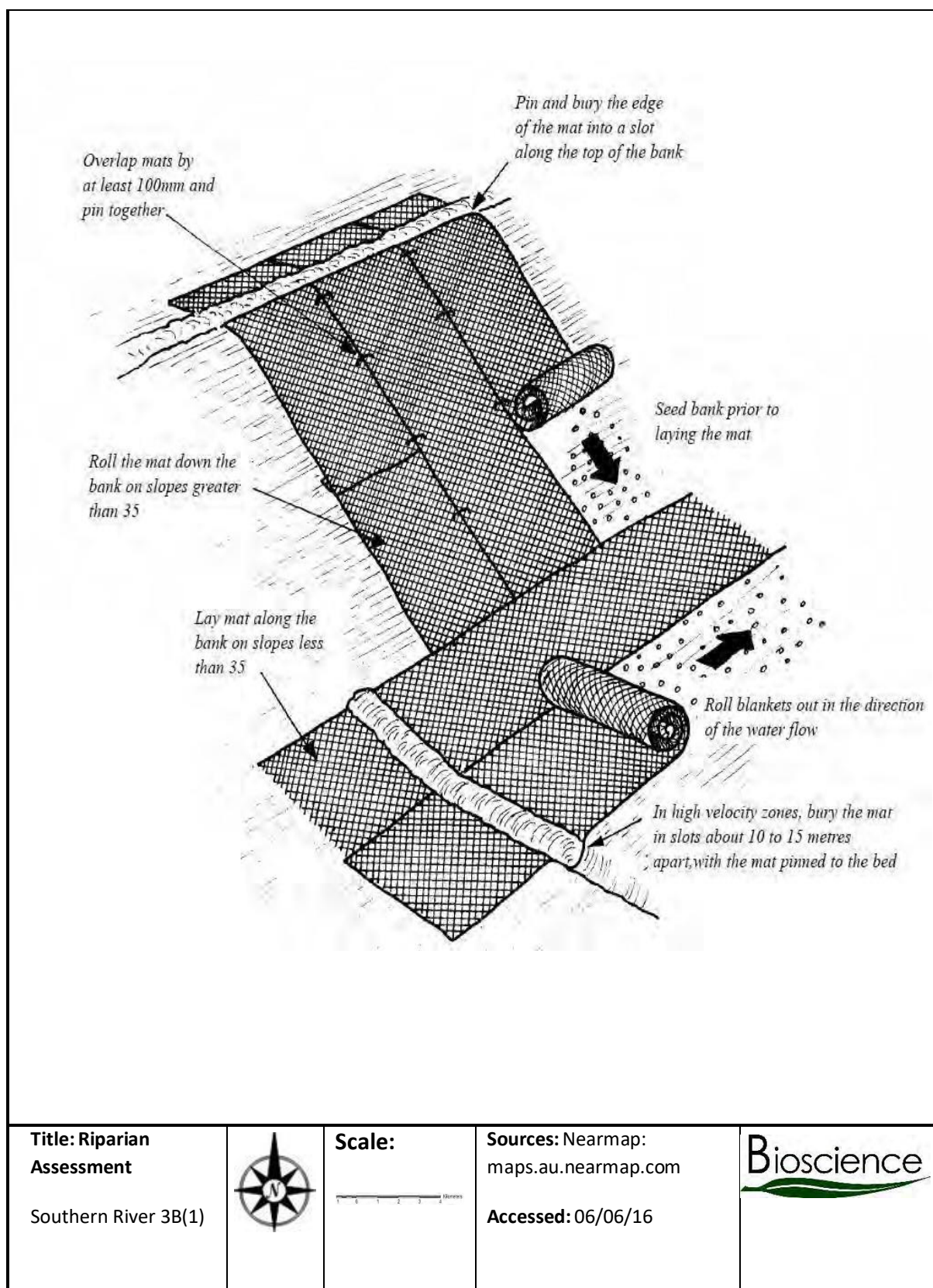


FIGURE3—GEOTEXTILEMAT LAYING PLAN

Appendix C - Possible Species List

Genus	Species	Genus	Species
Acacia	dentifera	Melaleuca	lateritia
Acacia	extensa	Melaleuca	preissiana
Acacia	pulchella	Melaleuca	rhaphiophylla
Acacia	saligna	Melaleuca	seriata
Agonis	flexuosa	Melaleuca	teretifolia
Astartea	scoparia	Melaleuca	viminea
Atriplex	cinerea	Myoporum	caprarioides
Banksia	armata	Myriophyllum	crispatum
Banksia	littoralis	Oxylobium	lineare
Baumea	junceae	Paraserianthes	lophantha
Baumea	preissii	Pericalymma	ellipticum
Baumea	Rubiginosa	Philotheca	spicata
Billardiera	fusiformis	Regelia	ciliata
Bolboschoenus	caldwellii	Regelia	inops
Carex	appressa	Sarcocornia	quinqueflora
Carex	tereticaulis	Schoenoplectus	validus
Casuarina	obesa	Sphaerolobium	medium
Centella	asiatica	Taxandria	linearifolia
Conostylis	candicans	Triglochin	huegelii
Corymbia	calophylla	Verticordia	acerosa
Cotula	coronopifolia	Villarsia	albiflora
Cyperus	gymnocaulos	Viminaria	junceae
Dielsia	stenostachya		
Eremaea	pauciflora		
Eucalyptus	gomphocephala		
Eucalyptus	rudis		
Ficinia	nodosa		
Haemodorum	paniculatum		
Hakea	erinacea		
Hakea	prostrata		
Hakea	trifurcata		
Hakea	varia		
Hypocalymma	angustifolium		
Jacksonia	furcellata		
Jacksonia	sternbergiana		
Juncus	kraussii		
Juncus	pallidus		
Juncus	pauciflorus		
Kunzea	glabrescens		
Kunzea	recurva		
Lobelia	alata		
Meeboldina	scariosa		
Melaleuca	cuticularis		

TABLE 1 – PLANT SPECIES TO BE USED AT SITE

Species	Area	Quantity
<i>Ficinia nodosa</i>	Basin	380
<i>Baumea preissii</i>	Stream	160
<i>Baumea rubiginosa</i>	Stream	160
<i>Carex tereticaulis</i>	Stream	200
<i>Juncus kraussii</i>	Stream	240
<i>Schoenoplectus validus</i>	Stream	160
<i>Banksia littoralis</i>	Upslope	20
<i>Billarderi fusiformis</i>	Upslope	200
<i>Centella asiatica</i>	Upslope	240
<i>Conostylis candicans</i>	Upslope	200
<i>Gastrolobium ebracteolatum</i>	Upslope	200
<i>Haemodorum paniculatum</i>	Upslope	40
<i>Hakea prostrata</i>	Upslope	40
<i>Hakea trifurcata</i>	Upslope	40
<i>Jacksonia furcellata</i>	Upslope	200
<i>Jacksonia sternbergiana</i>	Upslope	200
<i>Melaleuca cuticularis</i>	Upslope	20
<i>Melaleuca lateritia</i>	Upslope	200
<i>Melaleuca preissiana</i>	Upslope	20
<i>Melaleuca teretifolia</i>	Upslope	20
<i>Melaleuca viminea</i>	Upslope	120
<i>Regelia ciliata</i>	Upslope	220
<i>Regelia inops</i>	Upslope	220
<i>Viminaria juncea</i>	Upslope	80
		3,580

The following table lists the trees that could be used to revegetate the wetland and the riparian zone around it. It also classifies them into 3 categories of low, medium and high according to their potential to spread a bushfire. Some of these trees are mentioned to be fire retardant species and these may be planted in between the other aesthetically appealing trees to stop or slow down the spread of bushfire if ever there is one in the vicinity.

Table 2: List of species with their probable fire risk ratings and the ones prone to dieback are marked with an * after the name.

Genus	Species	Height of tree	Type of tree	BAL rating to be low at height below
Acacia	saligna	Large shrub Exceed 3.6m-5m	Evergreen/deciduous 4-5m spread, resprout from seeds after fire	Low to medium
Acacia	Cyclops	3-8m high	3m wide, tolerates coastal conditions, and water logged soil, bushy shrub, multi-stemmed	Low
Agonis	flexuosa	More than 10m upto 15m	Evergreen/ deciduous 4-5m spread (very adaptable to sandy and all types of soil)	medium
Banksia	littoralis *	1.5m – 12m	Shrub in low-lying damp areas 5-8 m spread of foliage	Low to medium
Baumea	junceae	1m high	1m wide spread Perennial wetland grass	Medium to high
Bolboschoenus	caldwellii	0.3m-1.2m high	Rhizomatous, perennial, grass-like or herb(sedge), swamps, or brackish river edges	Medium to high
Carex	appressa	0.5m- 2m high	Perennial herb, along swamps or watercourses	medium
Casuarina	Obesa	5m-10m tall	5m wide can be used for windbreak or erosion control, tolerates water-logged soils and salty areas. Fixes nitrogen in soil.	low
Centella	asiatica	Petiole 1-20 cm long mericarps with 3-5 prominent longitudinal ribs with reticulate connecting veins between them	Creeping perennial herb, rooting at the nodes	medium
Eucalyptus	rudis	5- 20 m high	Sandy or loam soils, upto 4m wide and tolerant of water logging, moderate drought and salt tolerant.	Medium to high
Eucalyptus(Salt river gum)	Sargentii	5-10m tall	4-7m wide, highly salt tolerant and tolerant to some waterlogging , used for wind break, soil erosion control	low
Hypocalymma	angustifolium	1.5m tall	1m wide spread, erect, multi-stemmed shrub, drought resistant, needs pruning	Medium to low
Juncus	kraussii	0.3 -1.2m	Perennial herb, Swampy places, rhizomatous	Medium to high
Juncus	pallidus	0.5- 2m high	Perennial herb, Swampy places, rhizomatous	Medium to high
Juncus	pauciflorus	0.3m – 1m	short, slender Perennial herb, Swampy places, rhizomatous,	Medium to high

Melaleuca	lateritia	1.5m- 2m height	Small-medium shrub	low
Melaleuca	Lanceolata	1-8m high, Fire retardant species	Grown in white sand or clay. Also grows on salt flats	low
Melaleuca	preissiana	4-9m height	Upto 5m of spread Evergreen deciduous tree	Medium
Melaleuca	rhaphiophylla	5m- 10m high	3-8m spread Evergreen native tree of wetland	medium
Regalia	ciliata	1.3m – 1.5m high	Rigid spreading shrub, 2m widespread	medium
Paraserianthes	lophantha	5m high	Spreads quickly and makes a good cover for other species, wetland plant dispersal by wind and water.	medium
Pericalymma	Ellipticum*	3m high	Swamp tea-tree, erect shrub, perennial	Medium to low
Schoenoplectus (Softstem bulrush)	validus	0.8m- 2m high	Used for landscaping and erosion control on edges of streams and constructed wetlands, tall rush	Medium to high
Taxandria (swamp peppermint)	Juniperina	7m high	Up to 3m spread, fast growing, tolerates salt conditions, margins of swamps or watercourses. Fire retardant species	low
Viminaria	junceae	1-4m high	Erect, weeping shrub Near lakes or swamps, grows in fire- prone area and regenerates from seed after the fire.	low

APPENDIX G | TRAFFIC IMPACT ASSESSMENT

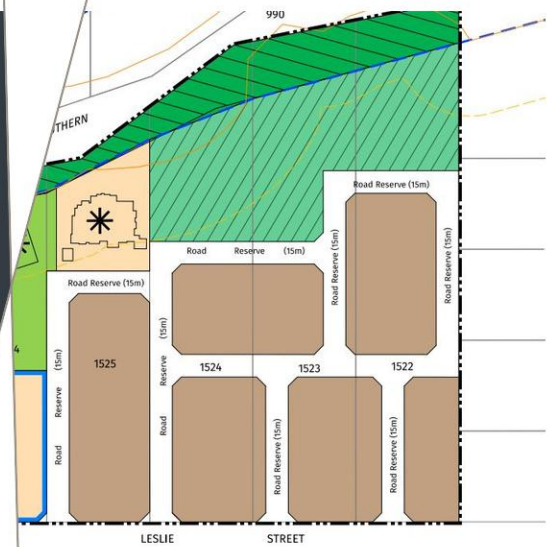
Transport Impact Assessment

Southern River Precinct 3B1

CW1200044/304900927

Prepared for
Auswide International Investments (Southern
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1 Introduction

1.1 Background

Cardno now Stantec was commissioned by Auswide International Investments (Southern River) Pty Ltd to undertake a Transport Impact Assessment (TIA) for the Southern River Precinct 3B1, located within the City of Gosnells. The purpose of the Transport Assessment is to address access requirements to the development area by all modes of transport and to identify the likely traffic generation and associated impacts on the surrounding road network, circulation, and safety of the proposed development. Discussion regarding pedestrian, cycle and public transport considerations are also provided.

This TIA has been prepared in accordance with the *Western Australian Planning Commission (WAPC) Transport Impact Assessment Guidelines for Developments: Volume 4 – Individual Developments (2016)* and will be accompanied by a Development Application (DA) for submission to the WAPC.

1.2 Site Location

The proposed development is located on Southern River Precinct 3B1 area, approximately 6km south-west of the Gosnells city centre. Leslie Street borders the south-west lot boundary while Southern River Road borders the north-west boundary.

The location of the proposed site is shown in **Figure 1-1**.

Figure 1-1 Site Location



Source Metro map

The subject land currently accommodates a place of worship in the north-east corner of the site as shown in **Figure 1-1**. The mosque is serviced by a left in crossover on Southern River Road and a full movement crossover on Leslie Street.

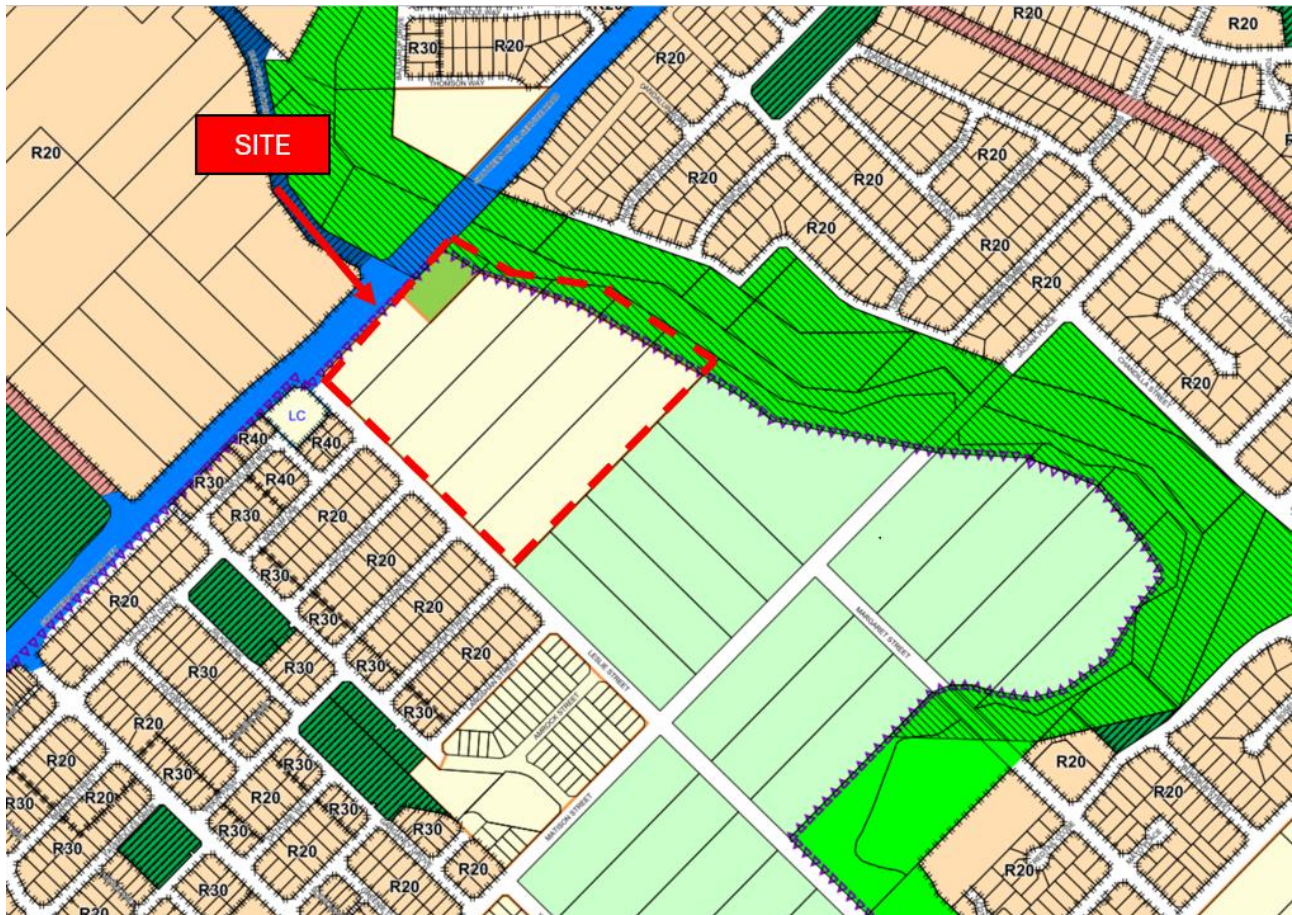
A separate Development Application has been submitted for consideration to facilitate increasing the number of attendees for the existing place of worship and the provision of a new childcare facility designed to accommodate a maximum of 86 children and 14 staff members on Lot 104.

2 Existing Situation

2.1 Surrounding Land Uses

As per the City of Gosnells Local Planning Scheme No.24 (LPS 24), the subject site is zoned “Urban Development” as shown in **Figure 2-1**. The site is surrounded by residential developments to the south and north. A ‘Parks and Recreation’ reserve covers a small portion of the subject site to the north-east.

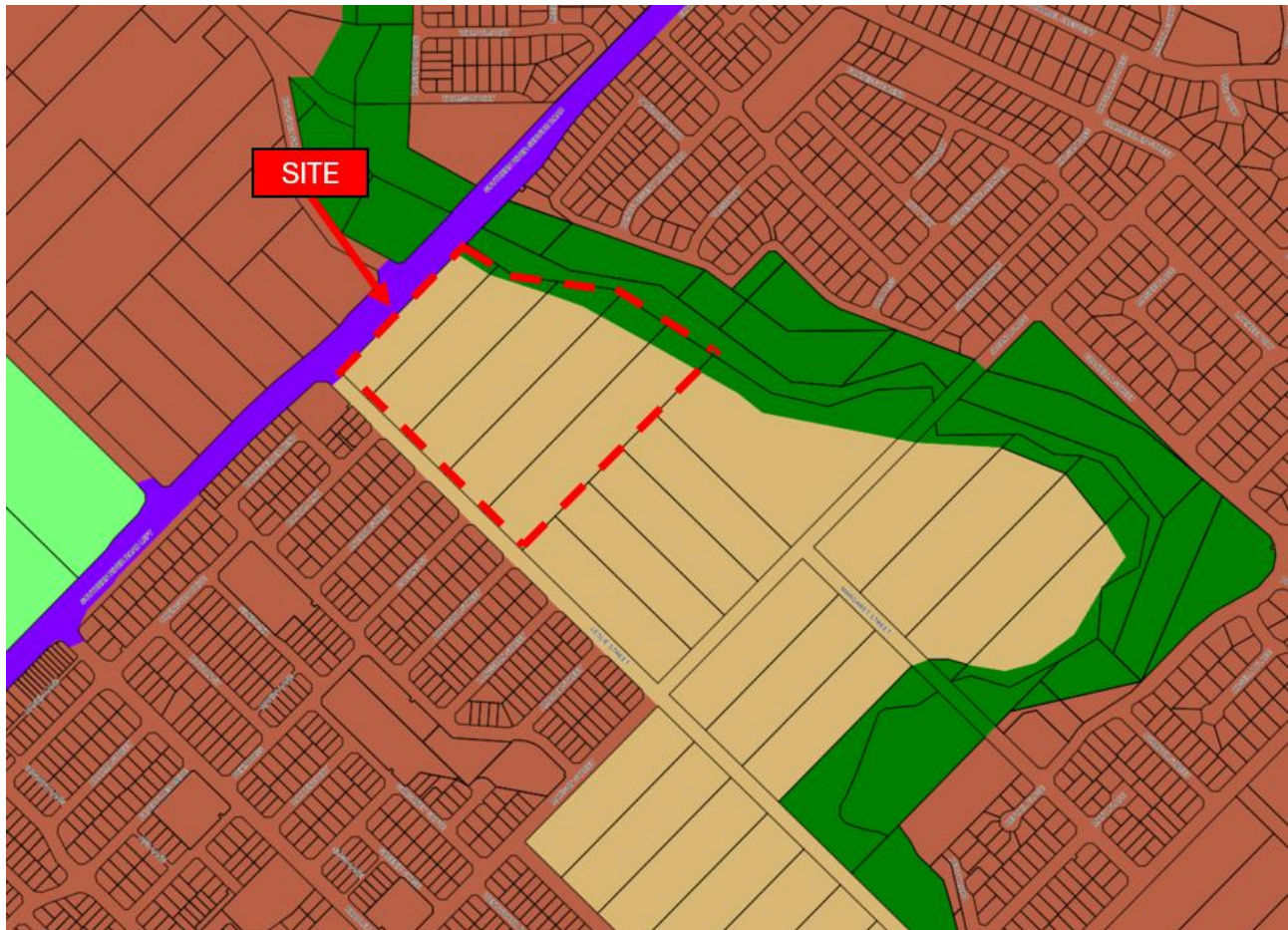
Figure 2-1 Existing Zoning



Source: City of Gosnells Local Planning Scheme No:24

According to the Metropolitan Region Scheme (MRS), the subject site is zoned as “Urban” as shown in Figure 2-2.

Figure 2-2 MRS Zoning Map



Source: City of Gosnells Local Planning Strategy

2.2 Existing Road Network

Road classifications are defined in the Main Roads Functional Hierarchy as follows:

- > **Primary Distributors (light blue):** Form the regional and inter-regional grid of Main Roads WA traffic routes and carry large volumes of fast-moving traffic. Some are strategic freight routes and all are National or State roads. They are managed by Main Roads.
- > **Regional Distributors (red):** Roads that are not Primary Distributors, but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.
- > **District Distributor A (green):** These carry traffic between industrial, commercial and residential areas and connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
- > **District Distributor B (dark blue):** Perform a similar function to District Distributor A but with reduced capacity due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and not through them, forming a grid that would ideally be around 1.5 kilometres apart. They are managed by Local Government.
- > **Local Distributors (orange):** Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local government.
- > **Access Roads (grey):** Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local government.

The site is bounded by Southern River Road to the West and Leslie Street to the South. **Figure 2-3** shows the surrounding area road hierarchy and the characteristics of the surrounding road network are summarised in **Table 2-1**

Figure 2-3 Road Hierarchy



Source: MRWA, Road Information Mapping System

Table 2-1 Road Network Classification

Road Name	Road Hierarchy	Jurisdiction	No. Lanes	No. of Footpaths	Pavement Width (m)	Posted Speed Limit (km/h)
Southern River Road	Distributor A	MRWA	4	2	23m (including 5.5m median)	60
Leslie St	Access Road	Local Government	2	1	7.5	50
Gay Street	Local Distributor	Local Government	2	1	6.5	50
Bullfinch Street	Distributor B	Local Government	2	1	6.5	50

2.3 Existing Traffic Volumes

Existing traffic volumes were sourced from Main Roads Western Australia (MRWA) Traffic map and the City of Gosnells and summarised in **Table 2-2**.

Table 2-2 Existing Traffic Volumes

Road Name	Year	Average Daily Traffic	Heavy Vehicle	Source
Southern River Road (West of Corfield Street)	2019/2020	7744	6.4%	MRWA
Southern River Road (East of Ranford Road)	2019/2020	9277	7.3%	MRWA
Southern River Road (South of Bradley Street)	2016	9858	4.7%	MRWA
Gay Street (West of Southern River Road)	2021	2120	7.3%	City of Gosnells
Bullfinch Street (East of Lambert Street)	2021	3797	2.2%	City of Gosnells
Chamberlain Street (east of Blackwood street)	2019	3382	3.0%	City of Gosnells

2.4 Existing Intersections

The following section describes the intersections in the vicinity of the site:

- > **Southern River Road/ Bullfinch St Intersection** is located to the west of the site as shown in **Figure 2-4**. The intersection is a T- intersection with give-way control and priority given to Southern River Road.

Figure 2-4 Southern River Road/ Bullfinch St Intersection



Source: Metro map

- > **Southern River Road / Leslie St Intersection** is located to the south of the site as shown in **Figure 2-5**. The intersection is a T- intersection with give-way control and priority given to Southern River Road.

Figure 2-5 Southern River Road / Leslie St Intersection



Source: Metro map

- > **Southern River Road / Gay St Intersection** is located to the south of the site as shown in **Figure 2-56**. The intersection is a T- intersection with give-way control and priority given to Southern River Road.

Figure 2-6 Southern River Road / Gay St Intersection



Source: Metro map

- > **Southern River Road / Bradley St Intersection** is located to the south of the site as shown in **Figure 2-7**. The intersection is a T- intersection with give-way control and priority given to Southern River Road.

Figure 2-7 Southern River Road / Bradley St Intersection



Source: Metro map

2.5 Existing Public Transport Facilities

The subject site is surrounded by a good network of public transport facilities. The nearest bus stop to the site is located along Southern River Road and is about 200m from the subject site with buses running at 20-minute intervals during the peak hours. **Figure 2-8** shows the public transport network within the locality and **Table 2-3** summarise the frequencies.

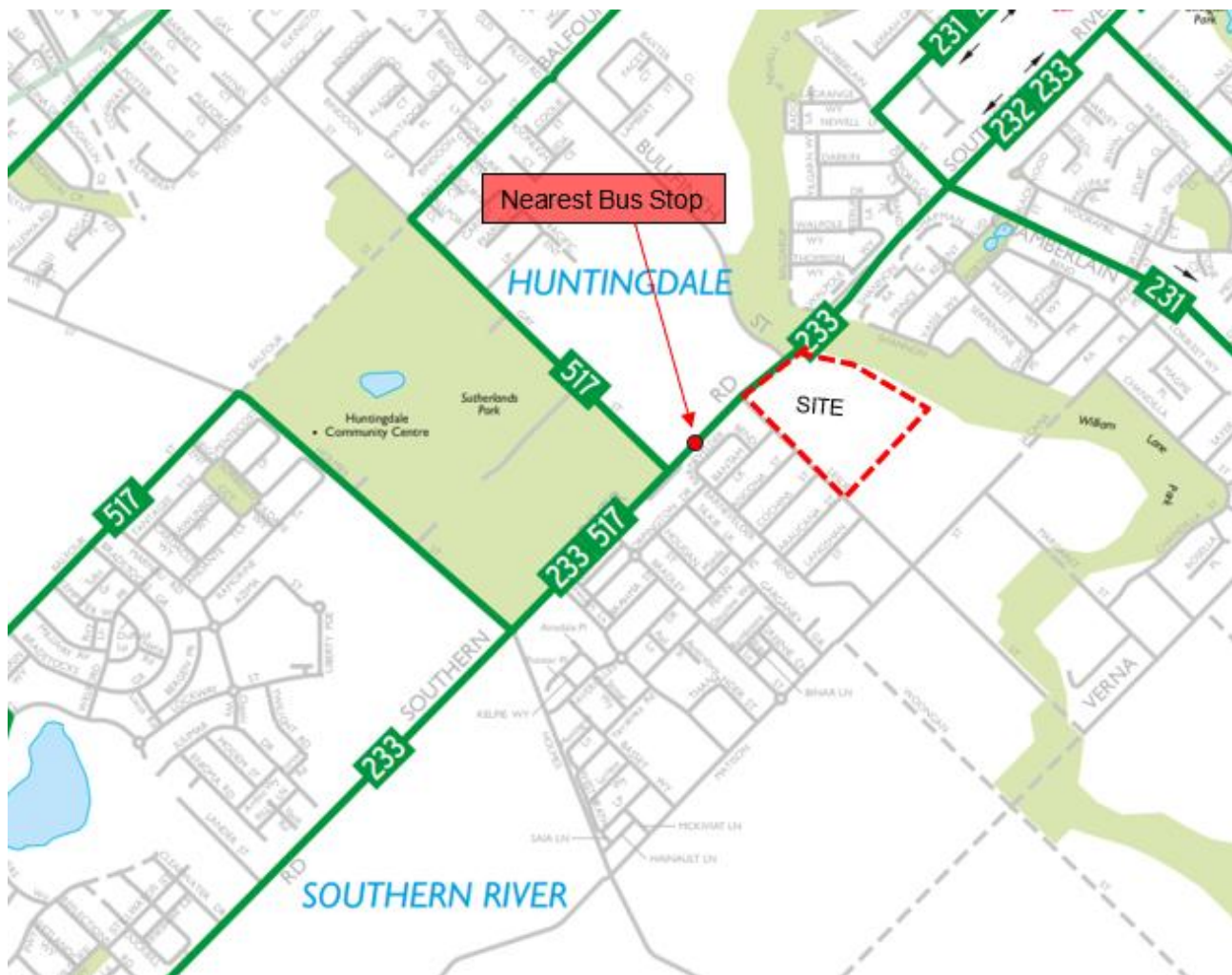
The area is also served by a train line (Armadale Line) and a train station (Gosnells Station) which are located approximately 2km to the north of the Site and are accessible via public transport along Southern River Road.

Table 2-3 Bus Route and Frequency

Route No.	Route Description	Weekday Frequency	Saturday Frequency	Sunday and Public Holidays
517	Canning Vale to Murdoch	30 minutes (Peak) 60 minutes (Off Peak)	60 minutes	No service
233	Cockburn Station to Gosnells Station	20 minutes (Peak) 60 minutes (Off Peak)	60 minutes	60 minutes

Source: Transperth (2021)

Figure 2-8 Existing Public Transport Facilities



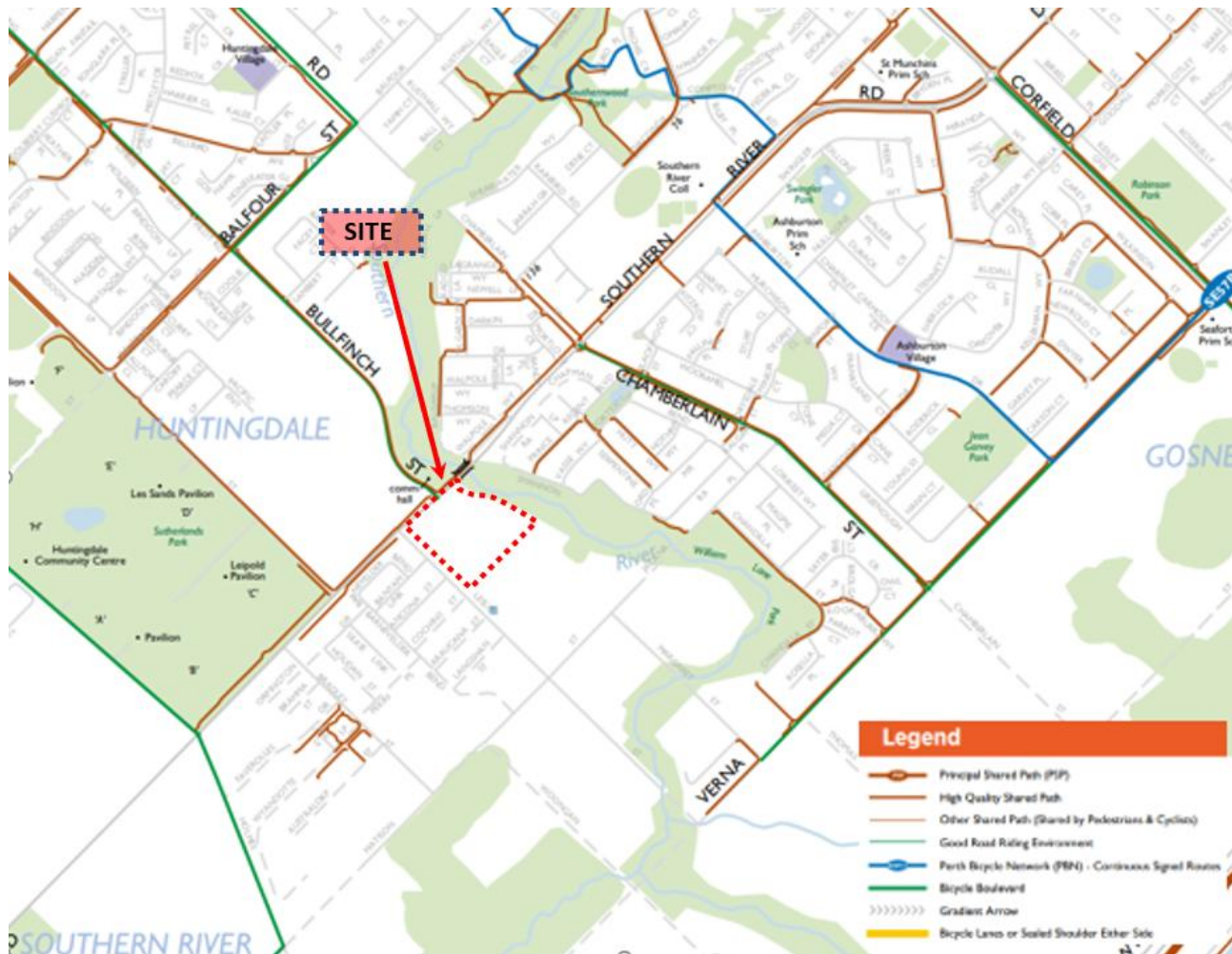
Source: Transperth Network Maps (2021)

2.6 Existing Pedestrian/Cycle Network Facilities

The existing pedestrian / cycle networks surrounding the area includes a high-quality shared path along Southern River Road, Bullfinch Street and Gay Street.

Figure 2-9 illustrates the existing bicycle network within the surrounding area of the Site.

Figure 2-9 Pedestrian and Cycling Network



Source: Department of Transport

Overall, the site is surrounded by good pedestrian/cycle networks that provides access to and from the Site as well as facilitates safe and efficient movement in all directions.

2.7 Crash Analysis

A crash assessment for the surrounding road network of the site has been completed using the Main Roads WA Reporting centre. The assessment covers all the recorded accidents for the 5-year period between 1 January 2017 to 31 December 2021 at the following intersections and sections of road.

- > Southern River/Leslie Street;
- > Southern River/ Bullfinch Street;
- > Southern River/ Gay Street; and
- > Southern River/ Bradley Street.

The crashes recorded at identified intersections and midblock are summarised in **Table 2-5** through to **Table 2-4** and **Figure 2-10** shows the crash map.

Table 2-4 Total Crashes

TOTAL CRASHES						
Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Rear End	-	-	2	1	4	7
Right Angle	-	-	-	11	1	12
Right Turn Thru	-	1	-	-	-	1
Hit Object	-	-	1	-	-	1
Total	-	1	3	12	5	21

Table 2-5 Southern River/Leslie Street Intersection Crashes

Intersection Crashes						
Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Right Angle	-	-	-	4	-	4
Total	-	-	-	4	-	4

Table 2-6 Southern River/ Bullfinch Street Intersection Crashes

Intersection Crashes						
Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Rear End	-	-	1	-	2	3
Right Angle	-	-	-	4	1	5
Right Turn Thru	-	1	-	-	-	1
Total	-	1	1	4	3	9

Table 2-7 Southern River/ Gay Street Intersection Crashes

Intersection Crashes						
Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Right Angle	-	-	-	2	-	2
Rear End	-	-	1	-	-	1
Total	-	-	1	2	-	3

Table 2-8 Southern River/ Bradley Street Intersection Crashes

Intersection Crashes						
Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Rear End	-	-	-	1	-	1
Right Angle	-	-	-	1	-	1
Total	-	-	-	2	-	2

Table 2-9 Midblock Crashes

Mid Block Crashes						
Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Rear End	-	-	-	-	2	2
Hit Object	-	-	1	-	-	1
Total	-	-	1	-	2	3

From the crash assessment conducted above, the following is concluded:

- > A total of 21 crashes were recorded on the surrounding road network in the vicinity of the proposed site;
- > One recorded crash resulted in hospitalisation and three required medical attention;
- > Three midblock crashes were recorded in the vicinity of the proposed site;
- > The majority of crashes were right angle crashes resulting in major property damage.

Overall, the number of crashes that occurred within the surrounding area appears to be relatively low.

Figure 2-10 Crash Locations



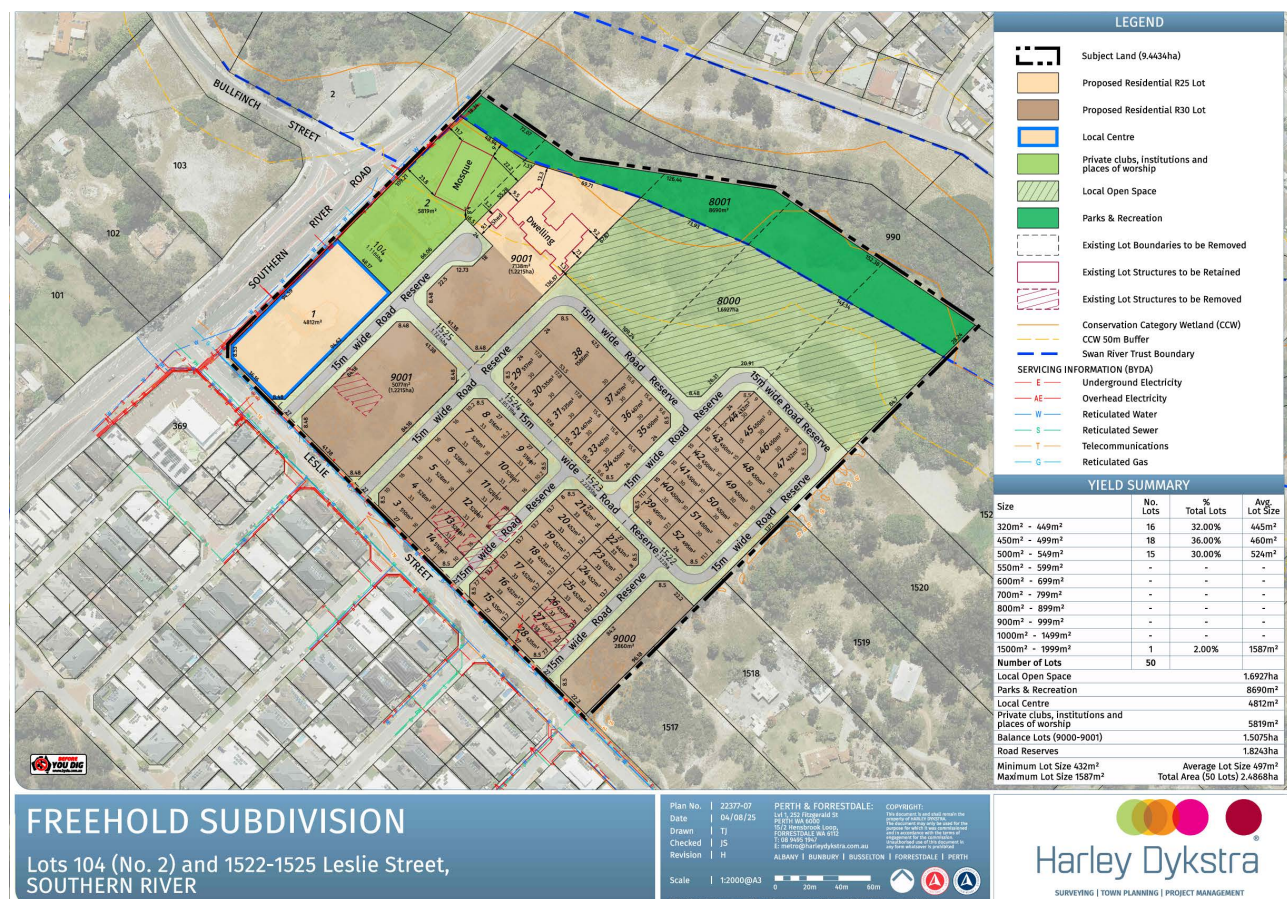
Source: Crash Map

3 Development Proposal

3.1 Proposed Development

The structure plan area is proposed to be developed into a residential area comprising of 50 residential dwellings. A local open space is also provided as shown in **Figure 3-1**. Larger scale site plans are provided in **Appendix B**.

Figure 3-1 Concept Plan



3.2 Access Arrangements

Site access and egress will be provided through Leslie Street. The access for childcare and Mosque will be via Access A. The proposed access arrangements include a total of four access points as shown in **Figure 3-2**:

- > Access A - Full movement access ;
- > Access B – Full movement access;
- > Access C – Full movement access;
- > Access D – Full movement access.

Figure 3-2 Access Arrangements



Source: Harley Dykstra Planning & Survey Solutions

4 Changes to Surrounding Transport Network

4.1 External Road Network

The City of Gosnells have advised there are no short-term plans to modify Southern River Road sections as the sections between Bullfinch Street and Holmes Street have been duplicated recently.

4.2 Pedestrian/Cycle Networks

The Western Australian Bicycle Network (WABN) Plan identifies the need for a Long-Term Cycle Strategy for Perth representing a vision for a fully integrated cycling network across Perth and Peel.

There are three main types of network functions in the hierarchy (Primary, Secondary, and Local) as shown in **Figure 4-1**, as well as two complementary network function designations (Road Cycling Routes and Transport Trails) that are to be developed in future.

Figure 4-1 Long Term Cycle Network Plan



Source: Department of Transport – Long Term Cycle Network (LTCN)

4.3 Public Transport Networks

The Public Transport Authority (PTA) has advised that there are no planned changes to the Public Transport network surrounding the proposed site in the short-medium term. However, PTA indicated that there are long term plans to operate an additional route between Murdoch Station and Gosnells Station via Southern River Road, Leslie Street, Matison Road to Ranford Road.

5 Integration with Surrounding Area

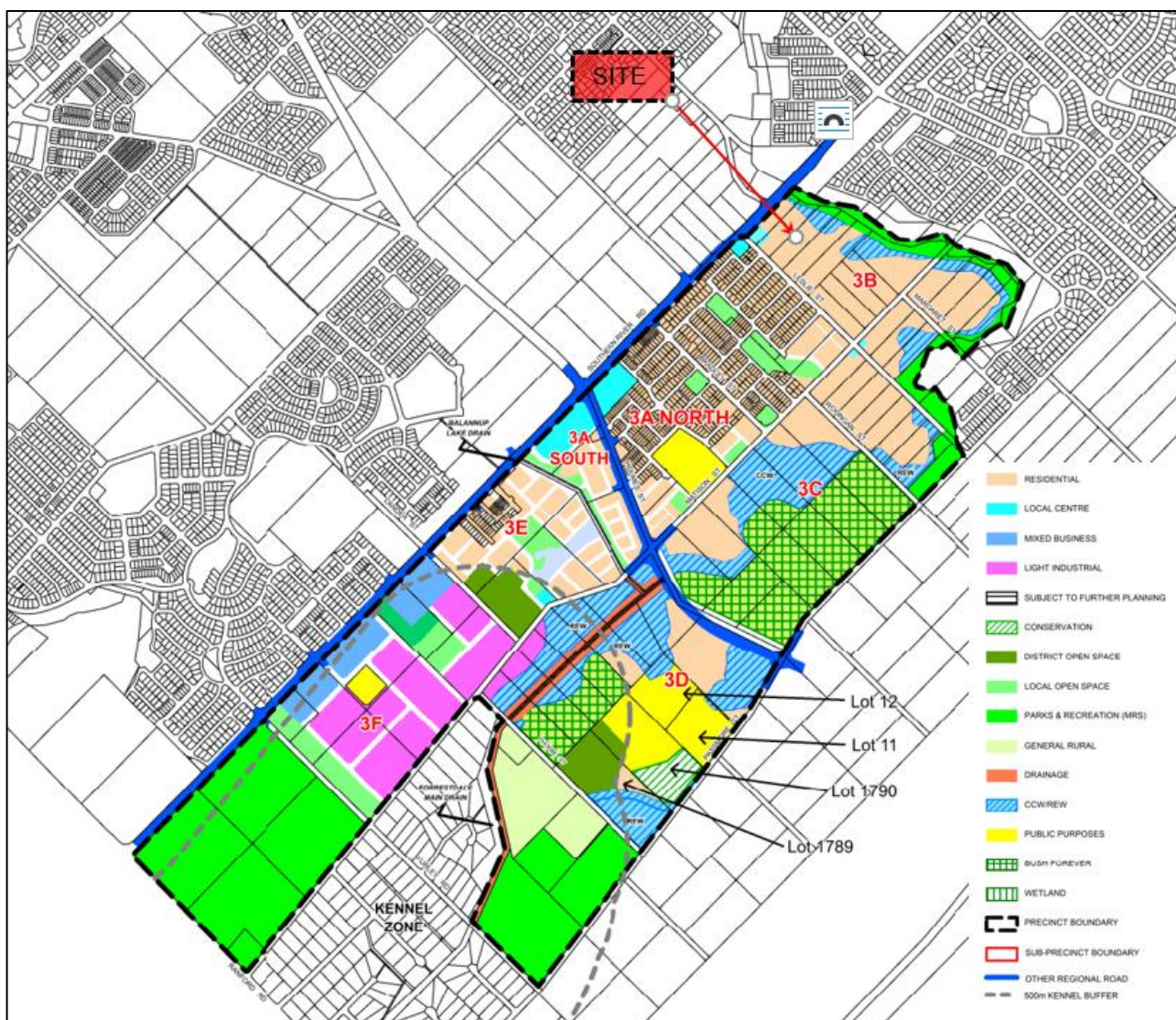
5.1 Surrounding Attractors and Generators

Trips generated by the proposed development are anticipated to be primarily journey to work trips since the proposed Structure Plan is mainly residential. The expected destinations of these trips are anticipated to be similar to current workplaces for the City of Gosnell's population.

5.2 Proposed Changes to Surrounding Land Uses

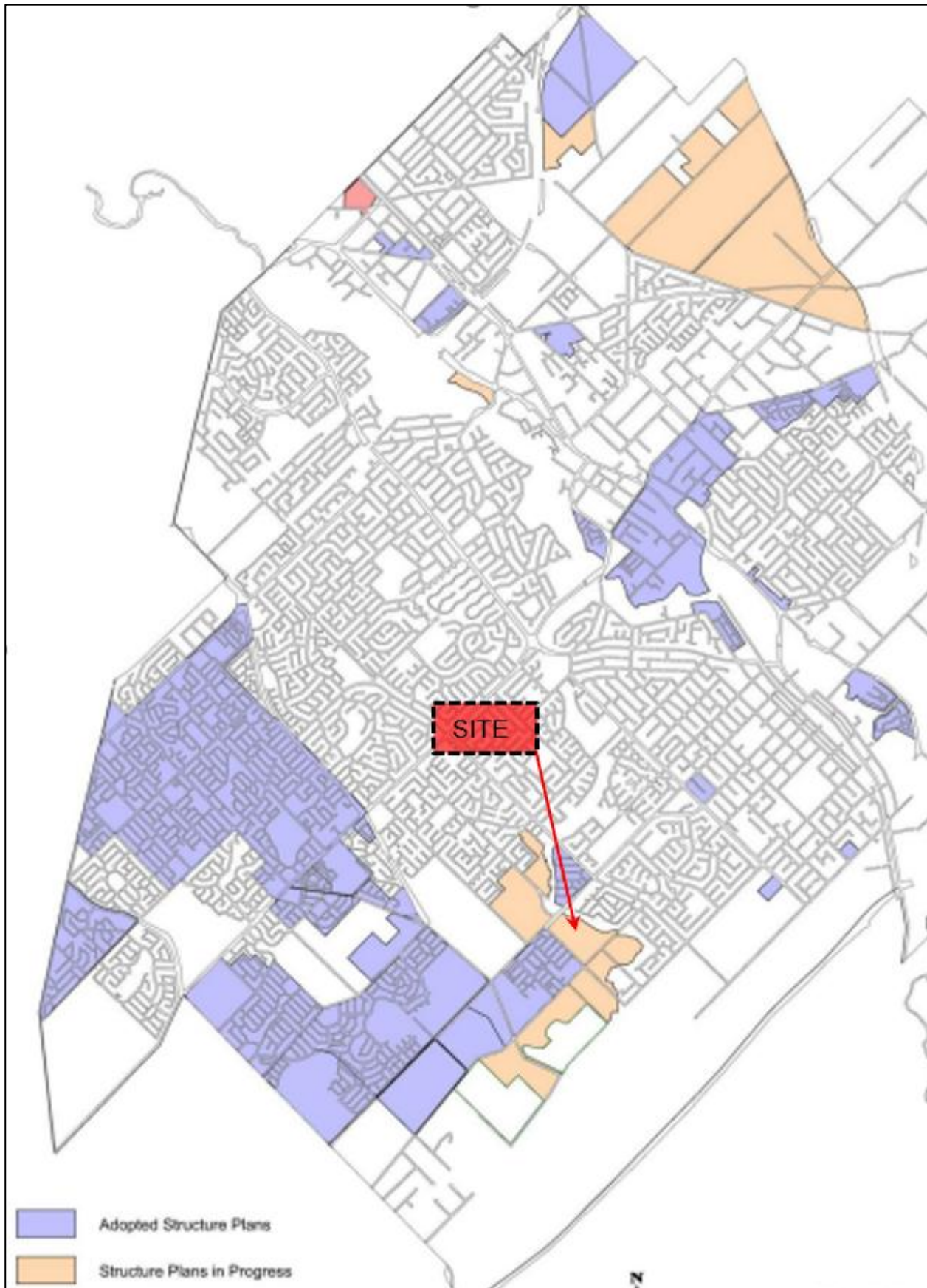
The Southern River Precinct 3 Guide Plan covers 365 hectares of land bound by Southern River Road, Ranford Road, the Kennel zone, Passmore Street and the Southern River. The plan has been prepared to guide development of the area and to resolve regional and/or localised issues involving land use and infrastructure provision. The plan has been prepared in accordance with the City's *Local Planning Policy 3.3 - Southern River Precinct 3 Planning Framework* to inform the preparation of amendments, structure plans and associated development contribution plans for the provision of shared infrastructure and land for public purposes. **Figure 5-1** shows the structure plan within the Southern River Precincts indicating the future land use zoning within the surrounding area and **Figure 5-2** shows the location of proposed and adopted structure plans within the City of Gosnells.

Figure 5-1 Guide Plan for Southern River Precinct 3



Source: Southern River Precinct Guide Plan 2019

Figure 5-2 Location of Proposed and Adopted Structure Plans



Source: Local Planning Strategy- July 2019 City of Gosnells

6 Traffic Analysis

6.1 Analysis Overview

To determine the impact of the proposed development on the surrounding network, the intersection of Southern River Road / Leslie Street was identified for analysis using the SIDRA analysis software.

6.2 Analysis Scenarios

The AM and PM weekday peak hours were assessed based on Main Roads Traffic Map data. Peak times selected are 8.00AM to 9.00AM and 4.00PM to 5.00PM respectively for the morning and afternoon peak periods.

The following scenarios have been modelled and analysed for this assessment:

- > Scenario 1: 2021 Base Scenario;
- > Scenario 2: 2024 Opening year without development (AM and PM);
- > Scenario 3: 2024 Opening year with development (AM and PM);
- > Scenario 4: 2034 Future year without development (AM and PM).
- > Scenario 5: 2034 Opening year without development (AM and PM).

6.3 Key Assumptions

The following assumptions were made for the analysis:

- > As per the traffic data obtained from MRWA, the peak hour period occurs between 8.00AM to 9.00AM and 4.00 PM to 5.00 PM on weekdays.
- > For the purpose of this assessment, the assumed completion year for all the developments in the structure plan is 2024.
- > A 1% annual growth rate has been applied to the background traffic for all future scenarios. This growth rate has been derived based on historic traffic growth from the Main Roads WA Traffic map along Southern River Road.
- > No heavy vehicles are anticipated to be generated by the development during peak hours.
- > The trips generated from the childcare facility located within the structure plan precinct has been taken into consideration in this assessment.
- > The current patronage of the existing mosque is proposed to be increased to 385 from the existing 175 persons. It is assumed that attendance on weekdays is not expected to be higher than 50% of the maximum capacity and those trips are included in our intersection analysis for a more robust assessment.
- > The network was modelled in accordance with MRWA Operational Modelling Guidelines in SIDRA 9.
- > Heavy vehicle volumes are based on the percentages provided from MRWA Traffic map and traffic count data.

6.4 Traffic Generation

Trip generation rates from the Institute of Transportation Engineers (ITE) Trip Gen Manual 10th edition as detailed in **Table 6-1** were used to calculate the estimated trip generation for the Site. **Table 6-2** shows the directional distribution and **Table 6-3** summarises the total expected trips to be generated by the proposed development.

Table 6-1 Trip Generation Rate

Land Use	ITE Code/Source	Yield	AM Peak	PM Peak
Residential Dwellings	ITE 210	116	0.74 per dwelling	0.99 per dwelling

Table 6-2 Directional Distribution

Land Use	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
Residential Dwellings	25%	75%	63%	37%

Table 6-3 Total Trips Generated by the Proposed Development

Land Use	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
Residential Dwellings	22	64	72	43

Table 6-4 summarises the expected trips generated from the proposed childcare and increase in attendees to the mosque which is included in our intersection analysis. The trips for the childcare centre and proposed increase in mosque attendees was extracted from the traffic report that was submitted as part of the Development Application for Lot 104. **Table 6-5** shows the total net trips generated.

Table 6-4 Estimated trips to be generated by proposed childcare and increase in Mosque Attendees

Land Use	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
Childcare	36	32	28	32
Mosque	53	53	53	53
Total	89	85	81	84

Table 6-5 Total Net Trips

Land Use	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
Residential Dwellings	22	64	72	43
Childcare	36	32	28	32
Mosque	53	53	53	53
Total Trips	111	149	153	128

6.5 Trip Distribution

It is anticipated that the majority of trips generated by the proposed development during peak hours will be journey to-work trips undertaken by residents. Turning distributions at intersections are calculated based on existing traffic count data. **Figure 6-1** shows the proposed development trip distribution.

Figure 6-1 Proposed Development Trip Distribution

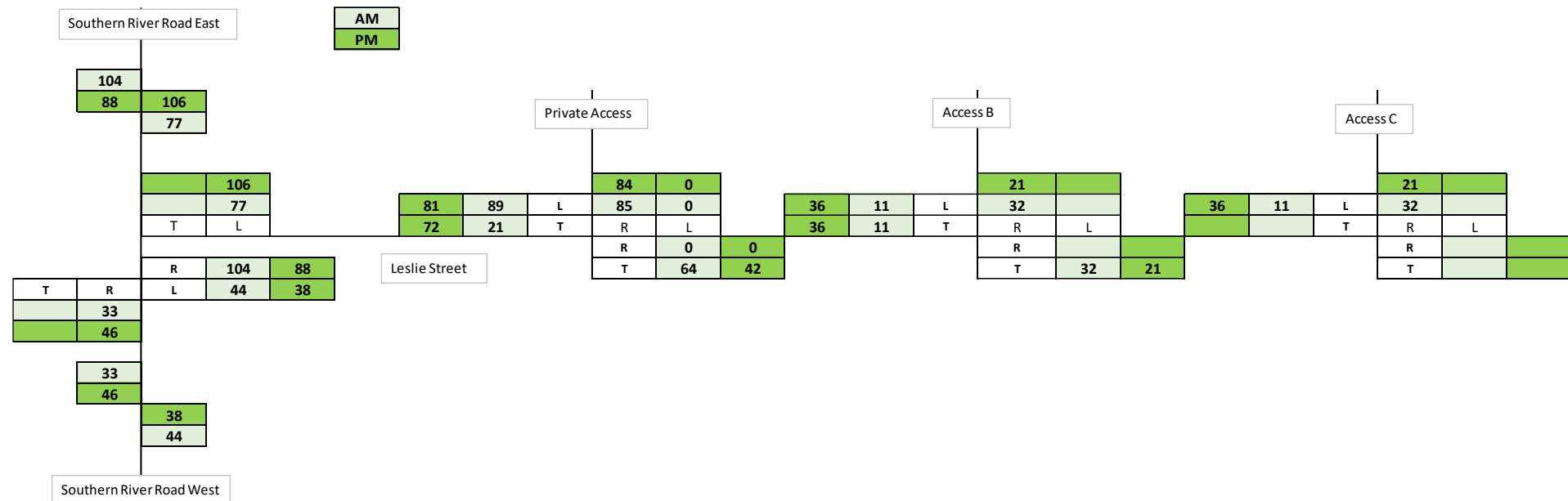


Source: Metro map

6.6.2 Development Traffic

Development traffic from the residential development and the from the childcare and mosque land uses are shown in **Figure 6-3**.

Figure 6-3 Development Traffic



6.6.3 Future Traffic Volumes

Figure 6-4 to Figure 6-7 shows the traffic volumes for Scenario 2, 3, 4 and 5 respectively.

Figure 6-4 2024 Projected Background Traffic Volumes

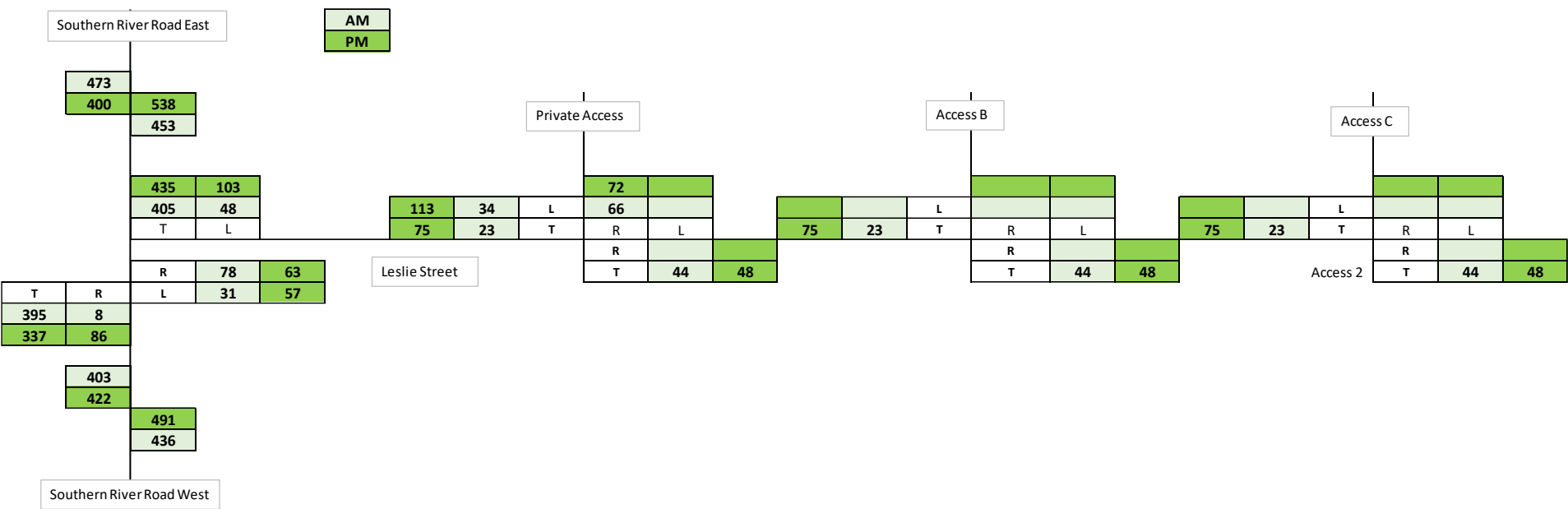


Figure 6-5 2024 Background + Development Traffic Volumes



The diagram illustrates the traffic flow and vehicle counts for the Southern River Road East to West section. The road is oriented vertically, with Southern River Road East at the top and Southern River Road West at the bottom. The diagram includes several access points and a private access point, each with associated traffic flow and vehicle counts.

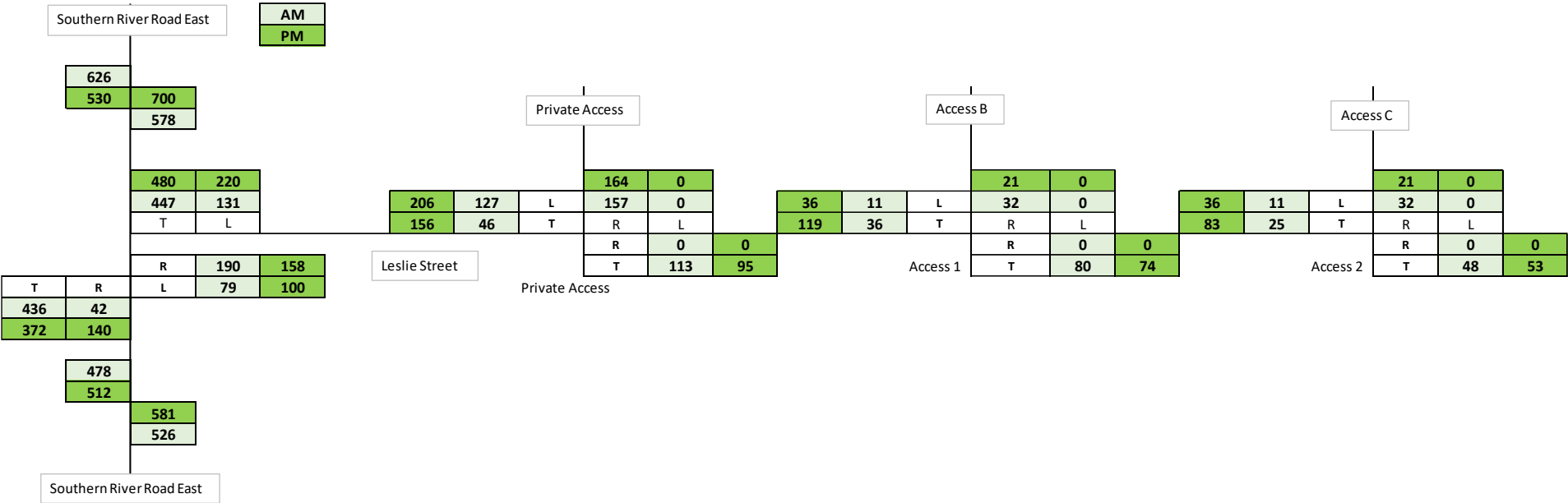
Legend:

- AM (Morning Peak)
- PM (Evening Peak)

Vehicle Counts and Flow:

- Southern River Road East:**
 - Top: 522 (AM), 442 (PM), 594 (PM), 501 (PM)
 - Left: 480 (AM), 114 (PM), 447 (PM), 53 (PM), T (AM), L (PM)
 - Right: 480 (AM), 114 (PM), 447 (PM), 53 (PM), T (AM), L (PM)
- Private Access:**
 - Top: 79 (AM), 72 (PM), 72 (PM), 48 (PM), 53 (PM)
 - Left: 125 (AM), 38 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
 - Right: 125 (AM), 38 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
- Access B:**
 - Top: 83 (AM), 25 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
 - Left: 83 (AM), 25 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
 - Right: 83 (AM), 25 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
- Access C:**
 - Top: 83 (AM), 25 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
 - Left: 83 (AM), 25 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
 - Right: 83 (AM), 25 (PM), 83 (PM), 25 (PM), L (AM), T (PM)
- Leslie Street:**
 - Top: 86 (AM), 69 (PM), 34 (PM), 63 (PM), R (AM), L (PM)
 - Left: 86 (AM), 69 (PM), 34 (PM), 63 (PM), R (AM), L (PM)
 - Right: 86 (AM), 69 (PM), 34 (PM), 63 (PM), R (AM), L (PM)
- Southern River Road West:**
 - Top: 445 (AM), 467 (PM), 543 (PM), 481 (PM)
 - Left: 445 (AM), 467 (PM), 543 (PM), 481 (PM)
 - Right: 445 (AM), 467 (PM), 543 (PM), 481 (PM)

Figure 6-7 2034 Background + Development Traffic Volumes



6.7 Intersection Performance

Analysis of the potential impact of the proposed development has been undertaken for the following intersection:

- > Southern River Road/Leslie Street

The identified intersection has been analysed using the Sidra analysis program. This program calculates the performance of intersections based on input parameters, including geometry and traffic volumes. As an output SIDRA provides values for the Degree of Saturation (DOS), queue lengths, delays, level of service, and 95th Percentile Queue. These parameters are defined as follows:

- > Degree of Saturation (DOS): is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The theoretical intersection capacity is exceeded for an un-signalized intersection where $DOS > 0.80$;
- > 95% Queue: is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected;
- > Average Delay: is the average of all travel delays for vehicles through the intersection. An unsigned intersection can be operating at capacity where the average delay exceeds 40 seconds for any movement; and
- > Level of Service (LOS): is the qualitative measure describing operational conditions within a traffic system and the perception by motorists and/or passengers. The different levels of service can generally be described as shown in **Table 6-6**

Table 6-6 Level of Service (LOS) Performance Criteria

LOS	Description	Signalized Intersection	Unsignalized Intersection
A	Free flow conditions (best condition)	≤ 10 sec	≤ 10 sec
B	Reasonable free flow operations	10 – 20 sec	10 – 15 sec
C	At or near free flow operations	20 – 35 sec	20 – 35 sec
D	Decreasing free flow levels	35 - 55 sec	35 - 55 sec
E	Operations at capacity	55 – 80 sec	55 – 80 sec
F	A breakdown in vehicular flow (worst condition)	≤ 80 sec	≤ 80 sec

A LOS exceeding these values indicates that the road section is exceeding its practical capacity. Above these values, users of the intersections are likely to experience unsatisfactory queueing and delays during the peak hour periods. Details of the results are presented in **Appendix C**.

6.8 SIDRA Analysis Results

6.8.1 Southern River Road/Leslie Street Intersection

The existing Southern River Road/Leslie Street intersection is modelled as a staged right turn from Leslie Street to Southern River Road in SIDRA. **Figure 6-8** shows the SIDRA layout for the existing intersection. **Table 6-7**, **Table 6-8** and **Table 6-9** shows the results of the AM and PM peak hour respectively for all the scenarios assessed.

Figure 6-8 SIDRA Layout for Southern River Road/Leslie Street Intersection

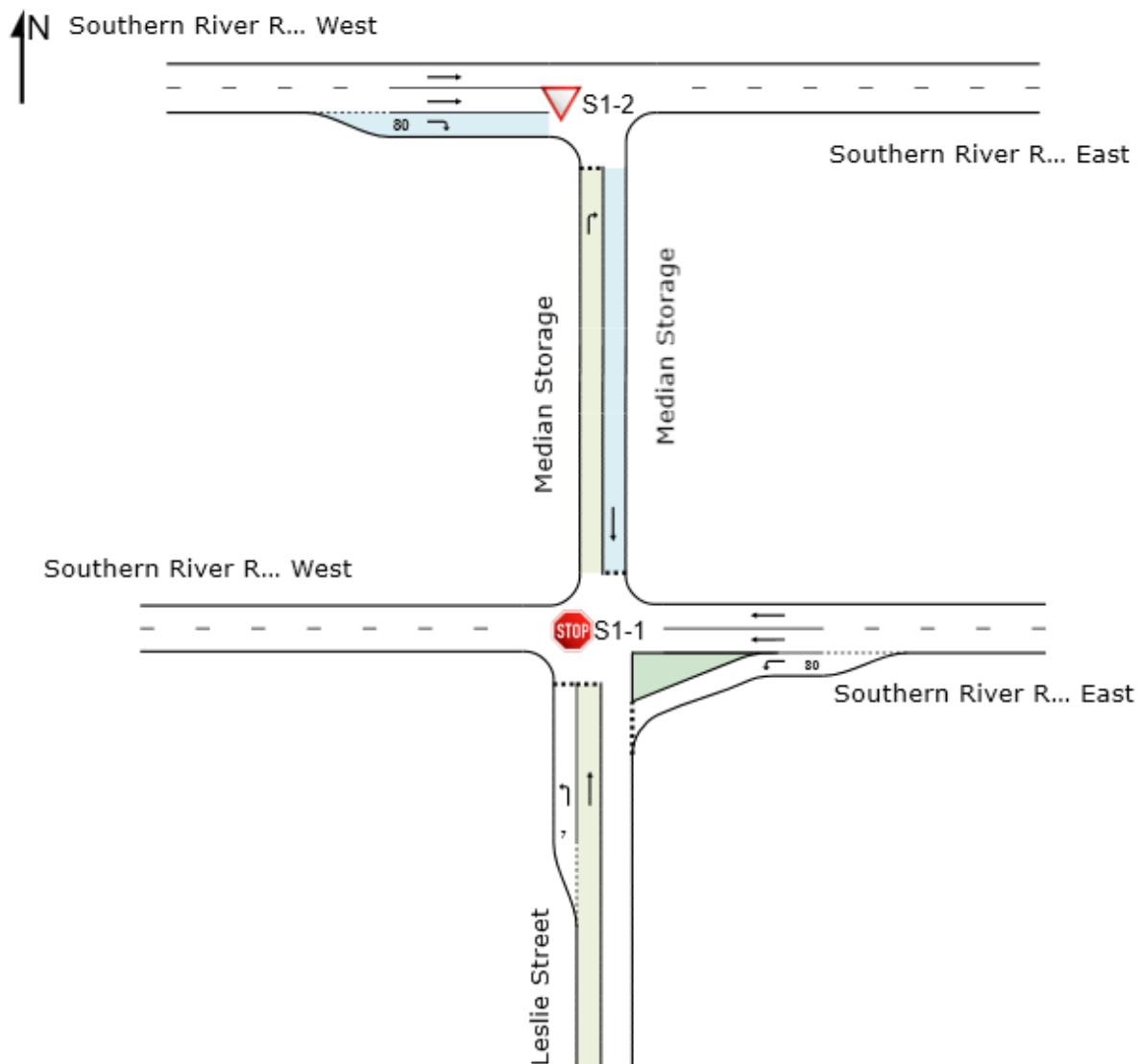


Table 6-7 Southern River Road / Leslie Street Intersection – Scenario 1

Intersection Approach	AM Peak					PM Peak			
		DOS	Delay	LOS	95% Queue (m)	DOS	Delay	LOS	95% Queue (m)
Southern River Rd (W)	T	0.113	0.0	A	0.0	0.093	0.0	A	0.0
	R	0.013	7.2	A	0.1	0.173	8.8	A	2.1
Southern River Rd (E)	L	0.035	5.7	A	0.4	0.082	6.1	A	1.0
	T	0.114	0.0	A	0.0	0.119	0.0	A	0.0
Leslie Street(S)	L	0.024	6.2	A	0.3	0.044	6.3	A	0.5
	R	0.195	10.9	A	2.3	0.160	11.1	A	1.8

Table 6-8 Southern River Road / Leslie Street Intersection – Scenario 2 (2024 Base + Development)

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay	LOS	95% Queue (m)	DOS	Delay	LOS	95% Queue (m)
Southern River Rd (W)	T	0.116	0.0	A	0.0	0.095	0.0	A	0.0
	R	0.065	7.3	A	0.4	0.290	9.1	A	3.6
Southern River Rd (E)	L	0.096	5.8	A	1.2	0.183	6.5	A	2.4
	T	0.118	0.0	A	0.0	0.123	0.0	A	0.0
Leslie Street(S)	L	0.059	6.3	A	0.7	0.076	6.4	A	0.9
	R	0.489	12.6	B	6.5	0.422	12.9	A	5.3

Table 6-9 Southern River Road / Leslie Street Intersection – Scenario 3 (2031 Base + Development)

Intersection Approach		AM Peak				PM Peak			
		DOS	Delay	LOS	95% Queue (m)	DOS	Delay	LOS	95% Queue (m)
Southern River Rd (W)	T	0.124	0.0	A	0.0	0.102	0.0	A	0.0
	R	0.069	7.5	A	0.5	0.318	9.4	A	3.9
Southern River Rd (E)	L	0.099	5.8	A	1.3	0.192	6.5	A	2.6
	T	0.126	0.0	A	0.0	0.132	0.0	A	0.0
Leslie Street(S)	L	0.063	6.4	A	0.8	0.081	6.4	A	1.0
	R	0.529	13.5	B	7.1	0.455	13.9	B	5.9

6.9 SIDRA Analysis Summary

Comparing the results of the SIDRA analysis for the intersection of Southern River Road with Leslie Street the following observations were noted:

- > SIDRA analysis results show that the intersection of Southern River Road/Leslie Street will operate at an acceptable level of service for Scenarios 1, 2 and 3.

Overall, the proposed development is not anticipated to have a material impact on the traffic operations of the intersection of Southern River Road with Leslie Street.

7 Conclusions and Summary

This report has been prepared in accordance with the *Australian Planning Commission (WAPC) Transport Impact Assessment Guidelines Volume 2 – Planning Schemes, Structure Plans and Activity Centre Zones (2016)*.

The following conclusions have been made in regard to the proposed development:

- > The proposed Structure Plan contemplates 116 residential dwellings and is estimated to generate up to 86 trips during AM Peak Hour and 115 trips during PM Peak Hour respectively.
- > The net trips generated by incorporating the childcare and increase in attendees to the mosque contributes to a total of 260 trips during the AM peak hour and 281 trips during the PM peak hour period.
- > External to the site there is good connectivity to public transport and walking/cycling networks. It is recommended that consideration be given to providing well- connected pedestrian and cycling networks within the proposed site.
- > The SIDRA results show that the Southern River Road/Leslie Street intersection is expected to operate at an acceptable level of service for all scenarios assessed.

Overall, the proposed structure plan is not anticipated to have a material impact on the traffic operations and safety on the surrounding road network.

APPENDIX

A

WAPC CHECKLIST



now



ITEM	PROVIDED	COMMENTS
Summary		
Introduction/Background	Section 1	
Subdivision proposal		
regional context	Section 3	
proposed land uses	Section 3	
table of land uses and quantities	Section 3	
major attractors/generators	Section 3	
specific issues	N/A	
Existing situation		
existing land uses within structure plan	Section 2	
existing land uses within 800 metres of subdivision	Section 2	
existing road network within subdivision	Section 2	
existing pedestrian/cycle networks within subdivision	Section 2	
existing public transport services within structure plan area	Section 2	
existing road network within 2 (or 5) km of subdivision	Section 2	
traffic flows on roads within subdivision area (PM and/or AM peak hours)	Section 2	
traffic flows on roads within 2 (or 5) km of within subdivision area (AM and/ or PM peak hours)	Section 2	
existing pedestrian/cycle networks within 800m of subdivision	Section 2	
existing public transport services within 800m of subdivision area	Section 2	
Proposed internal transport networks		
changes/additions to existing road network or proposed new road network	N/A	
road reservation widths	N/A	
road cross-sections & speed limits	N/A	
intersection controls	N/A	
pedestrian/cycle networks and crossing facilities	N/A	
public transport routes	N/A	
Changes to external transport networks		
road network	Section 4	
intersection controls	N/A	
pedestrian/cycle networks and crossing facilities	Section 4	
public transport services	Section 4	
Integration with surrounding area		
trip attractors/generators within 800 metres	Section 5	
proposed changes to land uses within 800 metres	N/A	
travel desire lines from structure plan to these attractors/generators	N/A	

ITEM	PROVIDED	COMMENTS
adequacy of external transport networks	N/A	
deficiencies in external transport networks	N/A	
remedial measures to address deficiencies	N/A	
Analysis of internal transport networks		
assessment year(s) and time period(s)	Section 6	
subdivision generated traffic	Section 6	
extraneous (through) traffic	Section 6	
design traffic flows (that is, total traffic)	Section 6	
road cross-sections	N/A	
intersection sight distances	N/A	
intersection operation and method of control	N/A	
frontage access strategy	N/A	
pedestrian/cycle networks	N/A	
safe walk/cycle to school assessment (residential subdivisions only)	N/A	
pedestrian permeability & efficiency	N/A	
access to public transport	N/A	
Analysis of external transport networks		
base flows for assessment year(s)	Section 6	
total traffic flows	Section 6	
road cross-sections	N/A	
intersection layouts & controls	Section 6	
pedestrian/cycle networks	N/A	
Safety issues		
Identify issues	N/A	
Remedial measures	N/A	
Conclusions	Section 7	

APPENDIX

B

CONCEPT PLAN



now





LEGEND

Metropolitan Regional Scheme

Region Scheme Reserves

Regional Open Space

Other

Notice of Delegation
Bush Forever (Site 246)

Local Scheme

Local Scheme Reserves

Public Open Space

Local Scheme Zones

Local Centre

Private Community Purposes

Residential R25

Residential R30

Other

Structure Plan Boundary

Conservation Category Wetland (CCW)

CCW 50m Buffer

Swan River Trust Boundary

1522

Existing Lot Numbers and Boundaries

Principle Shared Path
(Indicative final location to be determined at subdivision Stage)

*

Approved Left in/Left out

*

Existing Development (to be Retained)

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STRUCTURE PLAN

SOUTHERN RIVER PRECINCT 3B1

Date

24/06/26

Drawn

NB

Checked

JS

Base Data

Landgate July 2021

Projection

MGA94 Z50

Plan No.

22377-01

Rev.

G

Scale: 1:2000 @A3

0

20m

40m

60m

ISO 9001

ISO 45001

N

Harley Dykstra

SURVEYING | TOWN PLANNING | PROJECT MANAGEMENT

PERTH - PEEL

9495 1947

SOUTH WEST

9792 6000

GREAT SOUTHERN

9844 5100

info@harleydykstra.com.au

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LEGEND

Subject Land (9.4434ha)

Proposed Residential R25 Lot

Proposed Residential R30 Lot

Local Centre

Private clubs, institutions and places of worship

Local Open Space

Parks & Recreation

Existing Lot Boundaries to be Removed

Existing Lot Structures to be Retained

Existing Lot Structures to be Removed

Conservation Category Wetland (CCW)

CCW 50m Buffer

Swan River Trust Boundary

SERVICING INFORMATION (BYDA)

E

Underground Electricity

AE

Overhead Electricity

W

Reticulated Water

S

Reticulated Sewer

T

Telecommunications

G

Reticulated Gas

YIELD SUMMARY

Size	No. Lots	% Total Lots	Avg. Lot Size
320m² - 449m²	16	32.00%	445m²
450m² - 499m²	18	36.00%	460m²
500m² - 549m²	15	30.00%	524m²
550m² - 599m²	-	-	-
600m² - 699m²	-	-	-
700m² - 799m²	-	-	-
800m² - 899m²	-	-	-
900m² - 999m²	-	-	-
1000m² - 1499m²	-	-	-
1500m² - 1999m²	1	2.00%	1587m²
Number of Lots	50		
Local Open Space			1.6927ha
Parks & Recreation			8690m²
Local Centre			4812m²
Private clubs, institutions and places of worship			5819m²
Balance Lots (9000-9001)			1.5075ha
Road Reserves			1.8243ha
Minimum Lot Size 432m²			Average Lot Size 497m²
Maximum Lot Size 1587m²			Total Area (50 Lots) 2.4868ha



FREEHOLD SUBDIVISION

Lots 104 (No. 2) and 1522-1525 Leslie Street,
SOUTHERN RIVER

Plan No. | 22377-07

Date | 04/08/25

Drawn | TJ

Checked | JS

Revision | H

PERTH & FORRESTDALE:
Lvl 1, 252 Fitzgerald St
PERTH WA 6000
15/2 Hensbrook Loop,
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ALBANY | BUNBURY | BUSSELTON | FORRESTDALE | PERTH

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Scale | 1:2000@A3

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Harley Dykstra

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APPENDIX

C

SIDRA RESULTS



now

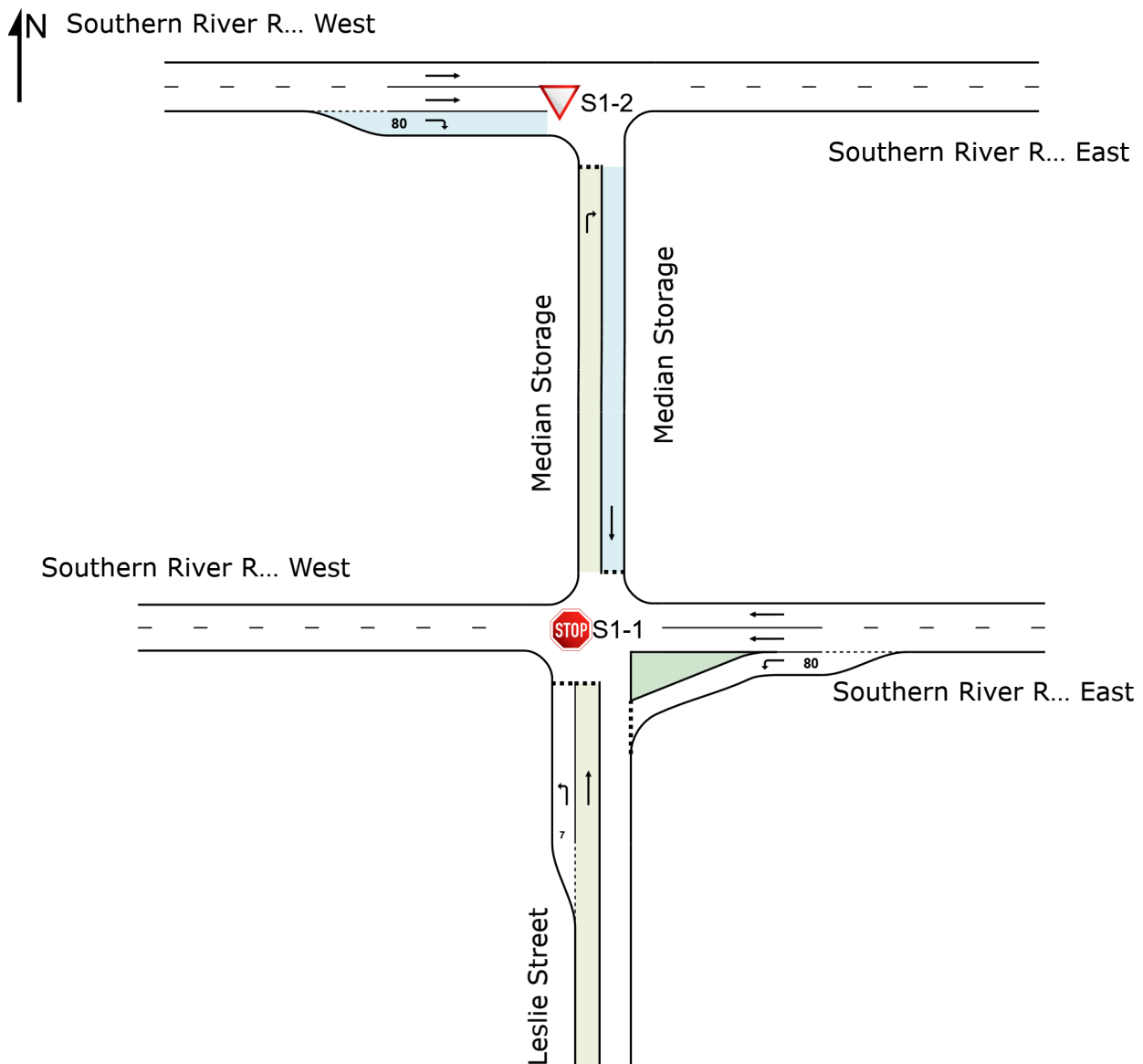


NETWORK LAYOUT

■ Network: SCTI-B [Souther River/Leslie Street 2021 AM
(Network Folder: 2021 Base)]

Staged Crossing at T Intersection Type B
Network Category: (None)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	CCG ID	Site Name
▽S1-2	NA	Southern River Road/Leslie AM Street North
STOP S1-1	NA	Southern River /Leslie Street AM South

MOVEMENT SUMMARY

 **Site: S1-1 [Southern River /Leslie Street AM South (Site Folder: 2021 Base)]**

 **Network: SCTI-B [Southern River/Leslie Street 2021 AM (Network Folder: 2021 Base)]**

Staged Crossing at T Intersection Type B
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist m				km/h
South: Leslie Street														
1	L2	32	2.0	32	2.0	0.024	6.2	LOS A	0.0	0.3	0.29	0.56	0.29	52.1
2	T1	80	2.0	80	2.0	0.116	8.8	LOS A	0.2	1.5	0.54	0.72	0.54	46.7
Approach		112	2.0	112	2.0	0.116	8.1	LOS A	0.2	1.5	0.47	0.68	0.47	48.9
East: Southern River Road East														
3	L2	49	2.0	49	2.0	0.035	5.7	LOS A	0.1	0.4	0.05	0.53	0.05	53.5
4	T1	414	7.0	414	7.0	0.114	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		463	6.5	463	6.5	0.114	0.6	LOS A	0.1	0.4	0.00	0.06	0.00	59.2
North: Median Storage														
5	T1	8	0.0	8	0.0	0.008	1.4	LOS A	0.0	0.1	0.40	0.24	0.40	50.9
Approach		8	0.0	8	0.0	0.008	1.4	LOS A	0.0	0.1	0.40	0.24	0.40	50.9
All Vehicles		583	5.5	583	5.5	0.116	2.1	NA	0.2	1.5	0.10	0.18	0.10	57.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: K:\Projects\CW1200044_Auswide International Investments_Southern River Precinct_TIA\5_Technical\Traffic\Modelling\Staged Crossing-Leslie st V2.sip9

MOVEMENT SUMMARY

Site: S1-2 [Southern River Road/Leslie AM Street North (Site Folder: 2021 Base)]

Network: SCTI-B [Southern River/Leslie Street 2021 AM (Network Folder: 2021 Base)]

Staged Crossing at T Intersection Type B

Site Category: (None)

Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist m				km/h
South: Median Storage														
1	R2	80	2.0	80	2.0	0.079	2.1	LOS A	0.1	0.8	0.38	0.43	0.38	48.4
Approach		80	2.0	80	2.0	0.079	2.1	LOS A	0.1	0.8	0.38	0.43	0.38	48.4
West: Southern River Road West														
2	T1	403	8.0	403	8.0	0.113	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	8	2.0	8	2.0	0.005	5.8	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		412	7.9	412	7.9	0.113	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		492	6.9	492	6.9	0.113	0.5	NA	0.1	0.8	0.06	0.08	0.06	58.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: S1-2 [Southern River Road/Leslie PM Street North (Site Folder: 2021 Base)]

Network: SCTI-B [Southern River/Leslie Street 2021 PM (Network Folder: 2021 Base)]

Staged Crossing at T Intersection Type B

Site Category: (None)

Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist m				km/h
South: Median Storage														
1	R2	64	2.0	64	2.0	0.060	1.8	LOS A	0.1	0.6	0.34	0.38	0.34	48.7
Approach		64	2.0	64	2.0	0.060	1.8	LOS A	0.1	0.6	0.34	0.38	0.34	48.7
West: Southern River Road West														
2	T1	344	6.0	344	6.0	0.093	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	87	2.0	87	2.0	0.048	5.8	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		432	5.2	432	5.2	0.093	1.2	NA	0.0	0.0	0.00	0.13	0.00	58.7
All Vehicles		496	4.8	496	4.8	0.093	1.3	NA	0.1	0.6	0.04	0.16	0.04	57.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site: S1-1 [Southern River /Leslie Street PM South (Site Folder: 2021 Base)]**

 **Network: SCTI-B [Southern River/Leslie Street 2021 PM (Network Folder: 2021 Base)]**

Staged Crossing at T Intersection Type B
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist m				km/h
South: Leslie Street														
1	L2	58	2.0	58	2.0	0.044	6.3	LOS A	0.1	0.5	0.31	0.57	0.31	52.1
2	T1	64	2.0	64	2.0	0.100	9.3	LOS A	0.2	1.2	0.56	0.74	0.56	46.1
Approach		122	2.0	122	2.0	0.100	7.9	LOS A	0.2	1.2	0.44	0.66	0.44	49.8
East: Southern River Road East														
3	L2	105	2.0	105	2.0	0.082	6.1	LOS A	0.1	1.0	0.22	0.53	0.22	52.9
4	T1	444	6.0	444	6.0	0.119	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		549	5.2	549	5.2	0.119	1.2	LOS A	0.1	1.0	0.04	0.10	0.04	58.4
North: Median Storage														
5	T1	87	55.6	87	55.6	0.125	3.0	LOS A	0.2	2.1	0.49	0.43	0.49	30.8
Approach		87	55.6	87	55.6	0.125	3.0	LOS A	0.2	2.1	0.49	0.43	0.49	30.8
All Vehicles		759	10.5	759	10.5	0.125	2.5	NA	0.2	2.1	0.16	0.23	0.16	54.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: K:\Projects\CW1200044_Auswide International Investments_Southern River Precinct_TIA\5_Technical\Traffic\Modelling\Staged Crossing-Leslie st V2.sip9

MOVEMENT SUMMARY

▼ Site: [Southern River Rd/Leslie St 2024 Base+Dev AM (Site Folder: 2024 Base+Dev)]

■ Network: SCTI-B [Southern River/Leslie St 2024 Base+Dev AM (Network Folder: 2024 Base+Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] m				
South: Median Storage														
1	R2	192	2.0	192	2.0	0.191	2.3	LOS A	0.3	2.0	0.41	0.48	0.41	48.1
Approach		192	2.0	192	2.0	0.191	2.3	LOS A	0.3	2.0	0.41	0.48	0.41	48.1
West: Southern River Road West														
2	T1	416	8.0	416	8.0	0.116	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	43	2.0	43	2.0	0.023	5.8	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		459	7.4	459	7.4	0.116	0.6	NA	0.0	0.0	0.00	0.06	0.00	59.4
All Vehicles		651	5.8	651	5.8	0.191	1.1	NA	0.3	2.0	0.12	0.18	0.12	56.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site:** [Southern River Rd /Leslie St 2024 Base+Dev AM (Site Folder: 2024 Base+Dev)]

 **Network:** SCTI-B [Southern River/Leslie St 2024 Base+Dev AM (Network Folder: 2024 Base +Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] m				
South: Leslie Street														
1	L2	79	2.0	79	2.0	0.059	6.3	LOS A	0.1	0.7	0.31	0.57	0.31	52.1
2	T1	192	2.0	192	2.0	0.298	10.3	LOS B	0.6	4.5	0.62	0.85	0.69	45.0
Approach		271	2.0	271	2.0	0.298	9.1	LOS A	0.6	4.5	0.53	0.77	0.58	47.9
East: Southern River Road East														
3	L2	132	2.0	132	2.0	0.096	5.8	LOS A	0.2	1.2	0.13	0.52	0.13	53.2
4	T1	426	7.0	426	7.0	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		558	5.8	558	5.8	0.118	1.4	LOS A	0.2	1.2	0.03	0.12	0.03	58.2
North: Median Storage														
5	T1	43	0.0	43	0.0	0.042	1.5	LOS A	0.1	0.4	0.41	0.30	0.41	50.7
Approach		43	0.0	43	0.0	0.042	1.5	LOS A	0.1	0.4	0.41	0.30	0.41	50.7
All Vehicles		872	4.3	872	4.3	0.298	3.8	NA	0.6	4.5	0.20	0.33	0.22	55.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▼ Site: S1-2 [Southern River Rd/Leslie St 2024 Base+Dev PM
(Site Folder: 2024 Base+Dev)]

■ Network: SCTI-B [Southern River/Leslie St 2024 Base+Dev PM (Network Folder: 2024 Base +Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist m				
South: Median Storage														
1	R2	159	2.0	159	2.0	0.149	1.9	LOS A	0.2	1.5	0.37	0.42	0.37	48.5
Approach		159	2.0	159	2.0	0.149	1.9	LOS A	0.2	1.5	0.37	0.42	0.37	48.5
West: Southern River Road West														
2	T1	355	6.0	355	6.0	0.095	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	138	2.0	138	2.0	0.090	5.8	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		493	4.9	493	4.9	0.095	1.6	NA	0.0	0.0	0.00	0.18	0.00	58.2
All Vehicles		652	4.2	652	4.2	0.149	1.7	NA	0.2	1.5	0.09	0.24	0.09	56.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site:** [Southern River /Leslie Street 2024 Base+Dev PM (Site Folder: 2024 Base+Dev)]

 **Network:** SCTI-B [Southern River/Leslie St 2024 Base+Dev PM (Network Folder: 2024 Base +Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Leslie Street														
1	L2	100	2.0	100	2.0	0.076	6.4	LOS A	0.1	0.9	0.32	0.58	0.32	52.0
2	T1	159	2.0	159	2.0	0.273	11.0	LOS B	0.5	3.8	0.64	0.86	0.70	44.3
Approach		259	2.0	259	2.0	0.273	9.2	LOS A	0.5	3.8	0.51	0.75	0.55	48.3
East: Southern River Road East														
3	L2	220	2.0	220	2.0	0.183	6.5	LOS A	0.3	2.4	0.32	0.57	0.32	52.6
4	T1	458	6.0	458	6.0	0.123	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		678	4.7	678	4.7	0.183	2.1	LOS A	0.3	2.4	0.10	0.18	0.10	57.3
North: Median Storage														
5	T1	138	55.6	138	55.6	0.200	3.3	LOS A	0.3	3.6	0.52	0.49	0.52	30.6
Approach		138	55.6	138	55.6	0.200	3.3	LOS A	0.3	3.6	0.52	0.49	0.52	30.6
All Vehicles		1075	10.6	1075	10.6	0.273	4.0	NA	0.5	3.8	0.26	0.36	0.26	52.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [Southern River Rd/Leslie St 2031 Base+Dev AM (Site Folder: 2031 Base+Dev)]

Network: SCTI-B [Southern River/Leslie St 2031 Base+Dev AM (Network Folder: 2031 Base+Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist m				km/h
South: Median Storage														
1	R2	198	2.0	198	2.0	0.203	2.5	LOS A	0.3	2.1	0.43	0.50	0.43	47.9
Approach		198	2.0	198	2.0	0.203	2.5	LOS A	0.3	2.1	0.43	0.50	0.43	47.9
West: Southern River Road West														
2	T1	445	8.0	445	8.0	0.124	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	44	2.0	44	2.0	0.024	5.8	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		489	7.5	489	7.5	0.124	0.5	NA	0.0	0.0	0.00	0.06	0.00	59.4
All Vehicles		687	5.9	687	5.9	0.203	1.1	NA	0.3	2.1	0.12	0.19	0.12	57.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site:** [Southern River Rd /Leslie St 2031 Base+Dev AM (Site Folder: 2031 Base+Dev)]

 **Network:** SCTI-B [Southern River/Leslie St 2031 Base+Dev AM (Network Folder: 2031 Base +Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist] m				km/h
South: Leslie Street														
1	L2	82	2.0	82	2.0	0.063	6.4	LOS A	0.1	0.8	0.32	0.58	0.32	52.0
2	T1	198	2.0	198	2.0	0.326	11.0	LOS B	0.7	5.0	0.64	0.89	0.76	44.2
Approach		280	2.0	280	2.0	0.326	9.7	LOS A	0.7	5.0	0.55	0.80	0.63	47.4
East: Southern River Road East														
3	L2	136	2.0	136	2.0	0.099	5.8	LOS A	0.2	1.3	0.13	0.52	0.13	53.2
4	T1	457	7.0	457	7.0	0.126	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		593	5.9	593	5.9	0.126	1.4	LOS A	0.2	1.3	0.03	0.12	0.03	58.2
North: Median Storage														
5	T1	44	0.0	44	0.0	0.045	1.7	LOS A	0.1	0.5	0.43	0.32	0.43	50.5
Approach		44	0.0	44	0.0	0.045	1.7	LOS A	0.1	0.5	0.43	0.32	0.43	50.5
All Vehicles		917	4.4	917	4.4	0.326	3.9	NA	0.7	5.0	0.21	0.34	0.23	55.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: S1-2 [Southern River Rd/Leslie St 2031 Base+Dev PM
(Site Folder: 2031 Base+Dev)]

Network: SCTI-B [Southern River/Leslie St 2031 Base+Dev PM (Network Folder: 2031 Base+Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist m				km/h
South: Median Storage														
1	R2	164	2.0	164	2.0	0.157	2.1	LOS A	0.2	1.6	0.38	0.44	0.38	48.4
Approach		164	2.0	164	2.0	0.157	2.1	LOS A	0.2	1.6	0.38	0.44	0.38	48.4
West: Southern River Road West														
2	T1	380	6.0	380	6.0	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	144	2.0	144	2.0	0.099	5.8	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		524	4.9	524	4.9	0.102	1.6	NA	0.0	0.0	0.00	0.17	0.00	58.2
All Vehicles		688	4.2	688	4.2	0.157	1.7	NA	0.2	1.6	0.09	0.24	0.09	56.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

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NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

Delay Model: SIDRA Standard (Geometric Delay is included).

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

 **Site:** [Southern River /Leslie Street 2031 Base+Dev PM (Site Folder: 2031 Base+Dev)]

 **Network:** SCTI-B [Southern River/Leslie St 2031 Base+Dev PM (Network Folder: 2031 Base +Dev)]

Staged Crossing at T Intersection Type B
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance														
Mov ID	Turn	DEMAND FLOWS		ARRIVAL FLOWS		Deg. Satn	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total HV] veh/h	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Leslie Street														
1	L2	104	2.0	104	2.0	0.081	6.4	LOS A	0.1	1.0	0.34	0.59	0.34	52.0
2	T1	164	2.0	164	2.0	0.298	11.8	LOS B	0.6	4.3	0.66	0.89	0.76	43.4
Approach		268	2.0	268	2.0	0.298	9.7	LOS A	0.6	4.3	0.53	0.77	0.59	47.8
East: Southern River Road East														
3	L2	228	2.0	228	2.0	0.192	6.5	LOS A	0.3	2.6	0.33	0.57	0.33	52.5
4	T1	491	6.0	491	6.0	0.132	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		719	4.7	719	4.7	0.192	2.1	LOS A	0.3	2.6	0.10	0.18	0.10	57.4
North: Median Storage														
5	T1	144	55.6	144	55.6	0.219	3.6	LOS A	0.3	3.9	0.54	0.52	0.54	30.4
Approach		144	55.6	144	55.6	0.219	3.6	LOS A	0.3	3.9	0.54	0.52	0.54	30.4
All Vehicles		1132	10.6	1132	10.6	0.298	4.1	NA	0.6	4.3	0.26	0.36	0.28	51.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

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Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

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APPENDIX H | SERVICING REPORT

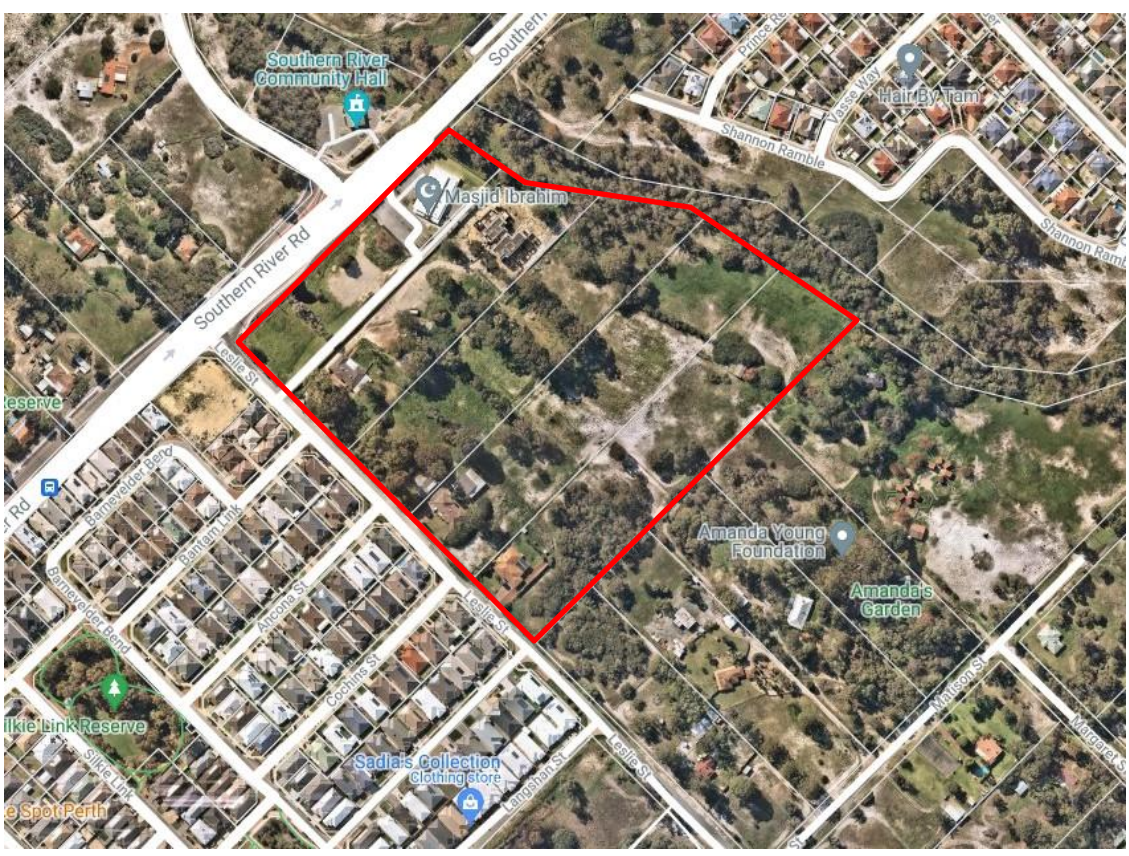
Report Name: 1522 – 1526 LESLIE STREET, SOUTHERN RIVER
Project No: PC21378
Project Title: Engineering Services Report

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Date:	16/11/22

Revision	Description	Author	Checked	Approved	Date
0	First issue	BB	EBF	EBF	15/10/2021
1	Re-issue	BB	EBF	EBF	16/11/2022
2	Updated to reflect final structure plan	BB	EBF	EBF	16/12/2022

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1. INTRODUCTION

Peritas Group was commissioned by Auswide International Investments to review the engineering constraints and servicing requirements associated with the Development of the subject site.

The subject site comprises of Lots 1522, 1523, 1524, 1525, and 104 Leslie Street, Southern River with a total area of 94,452 m² which is made up of 23,220 m², 22,295 m², 20,519 m², 17,214 m², and 11,204 m² respectively. The subject site is bounded by Southern River Road to the northwest, Leslie Street to the southwest, the Southern River to the northeast, and undeveloped residential lots to the southeast as shown in in **Figure 2** below.



Figure 1 Aerial View

The subject site currently has several existing structures (two to be retained) and moderate vegetation.

In summary, this report highlights:

- The subject land is capable of sustaining development in keeping with the proposed residential development.
- The land is capable of being connected to and provided with all essential services to sustain residential development (based on current and future service authority planning).
- The proponent's strategy for the subject land will complement the natural landform by careful design of the bulk excavation, site grading and landscaping.

This report has been compiled based on the following terms of reference:

- Briefing discussions and a meeting with the client.
- Site inspection and site walkover.
- Numerous discussions with Local Government Agencies.
- Site data and documents included on this report.
- Servicing concepts and Regional Strategic Infrastructure planning by the regulatory authorities.

The City of Gosnells Zoning Plan of the subject site can be found in **Figure 2** below:



Figure 2 City of Gosnells Zoning Plan

1.1. PROPOSED DEVELOPMENT

The proposed development will consist of approximately 0.5 ha of residential R25 zoned lots, 2 ha of R30 residential zoned lots, approximately 0.48 ha proposed for a local centre, 0.58 ha for places of worship, and approximately 1.7 ha of public open space (POS) as shown in the proposed Structure Plan is shown in **Figure 3** below and proposed Lot Yield Plan is shown in **Appendix E**.

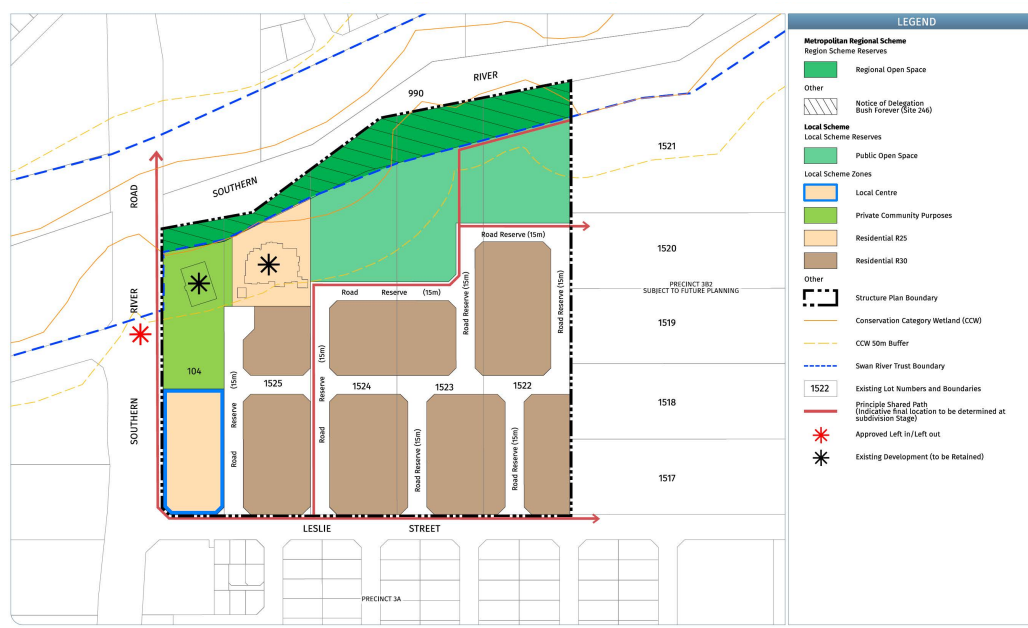


Figure 3 Proposed Structure Plan

2. SITE EVALUATION

2.1. GENERAL

Within this section, a detailed summary of the existing services and constraints information has been compiled and summarised for the subject site. The detailed analysis includes review of Dial Before You Dig (DBYD) information, aerial photography, review of DWER and DPLH Databases, Water Corporation records and correspondence obtained from service authorities.

The subject site generally has mild slopes with the ground surface ranging from approximately RL 15 m AHD to RL 19 m AHD as seen in **Figure 4**. The subject site generally slopes from south to north, with slopes ranging from approximately 1 in 10 in the south of the subject site to 1 in 200 in the north.

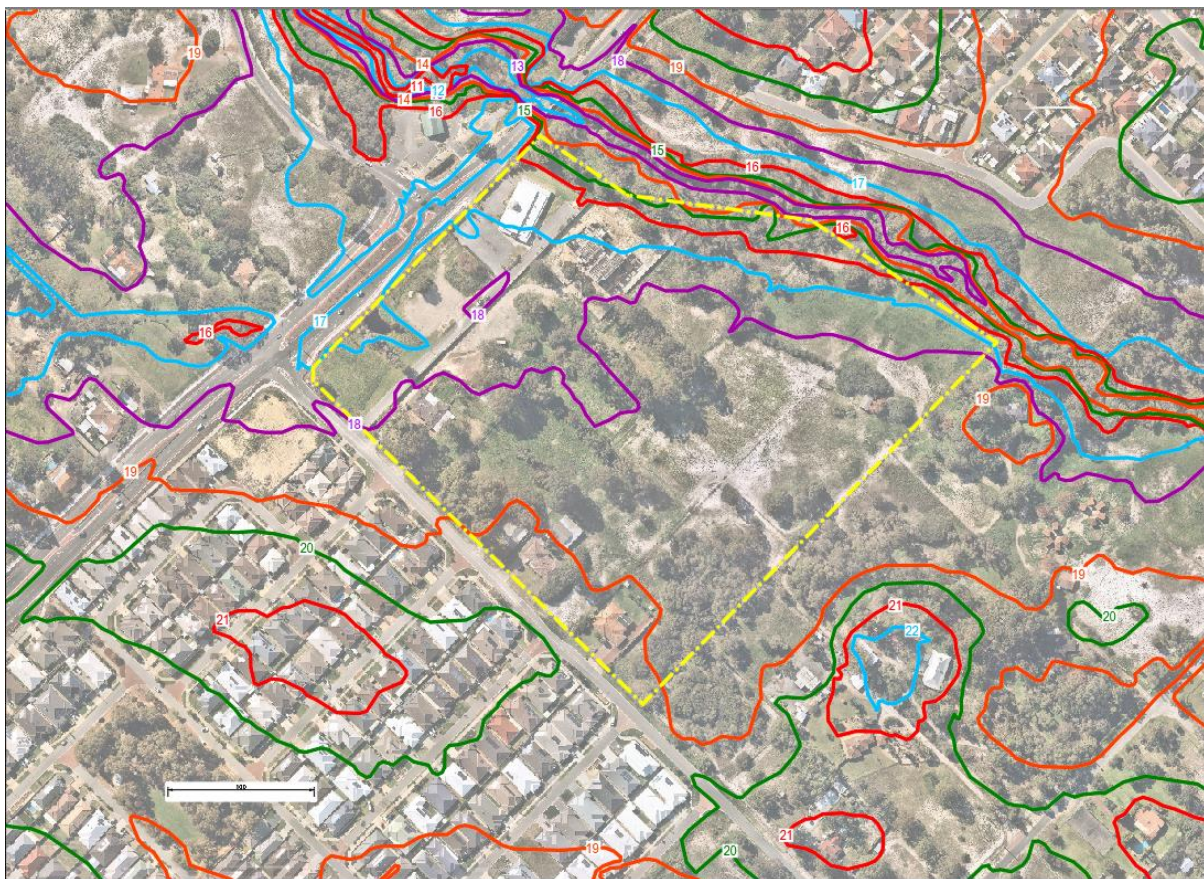


Figure 4 Approximate Site Contours

Subject to final development layout the land will require bulk earthworks to be completed to regrade the site to suit building footprint and to meet the stormwater, and site soil classification requirements. There may be some requirement for retaining walls to create a level building pad and to provide infrastructure servicing to the site.

2.2. SITE GEOLOGY

The subject site on the DMIRS 1:50,000 environmental geology map indicates that the majority of the subject site is underlain by S10 sand which is associated with S8 sand over various other units. A small portion of the southern section is underlain by S8 sand which is associated with white to pale grey at surface, yellow at depth, fine to medium-grained, moderately well sorted, subangular to subrounded quartz, of eolian origin. Around the vicinity of the Southern River to the north of site the ground surface geology is underlain by MS4 sand, which is associated with cream to pale brown alluvium, clayey in part, fine to medium-grained sand, of alluvial origin. See **Figure 5** Below for further details.



Figure 5 DMIRS Site 50000 Geology

A formal geotechnical investigation was undertaken for the subject site in 2010 by Bioscience Pty Ltd. The geotechnical investigation indicates that the subject site is generally consistent with the site surface geology, consisting typically of Bassendean sand over a layer of iron rich silty sand that is sometimes indurated (coffee rock) over sandy clay to depth.

Based on the geotechnical data available there could be significant costs involved with ensuring that the subject site soil is suitable for the proposed development. The subject site will require further investigation during specific development phases with due regard to the proposed development layout and drainage requirements.

2.3. GROUND WATER

Based on information from the Department of Water & Environmental Regulation (DWER), the maximum historical groundwater levels across the development site is approximately 18m AHD parallel to Leslie Street and down to 14m AHD at Southern River shown in **Figure 6** below. The natural ground levels of the site ranges from approximately 19 m AHD in the southern corner of the subject site down to 14 m AHD in the northern corner of the subject site. The depth to groundwater is estimated to vary between natural surface level and 1m AHD.

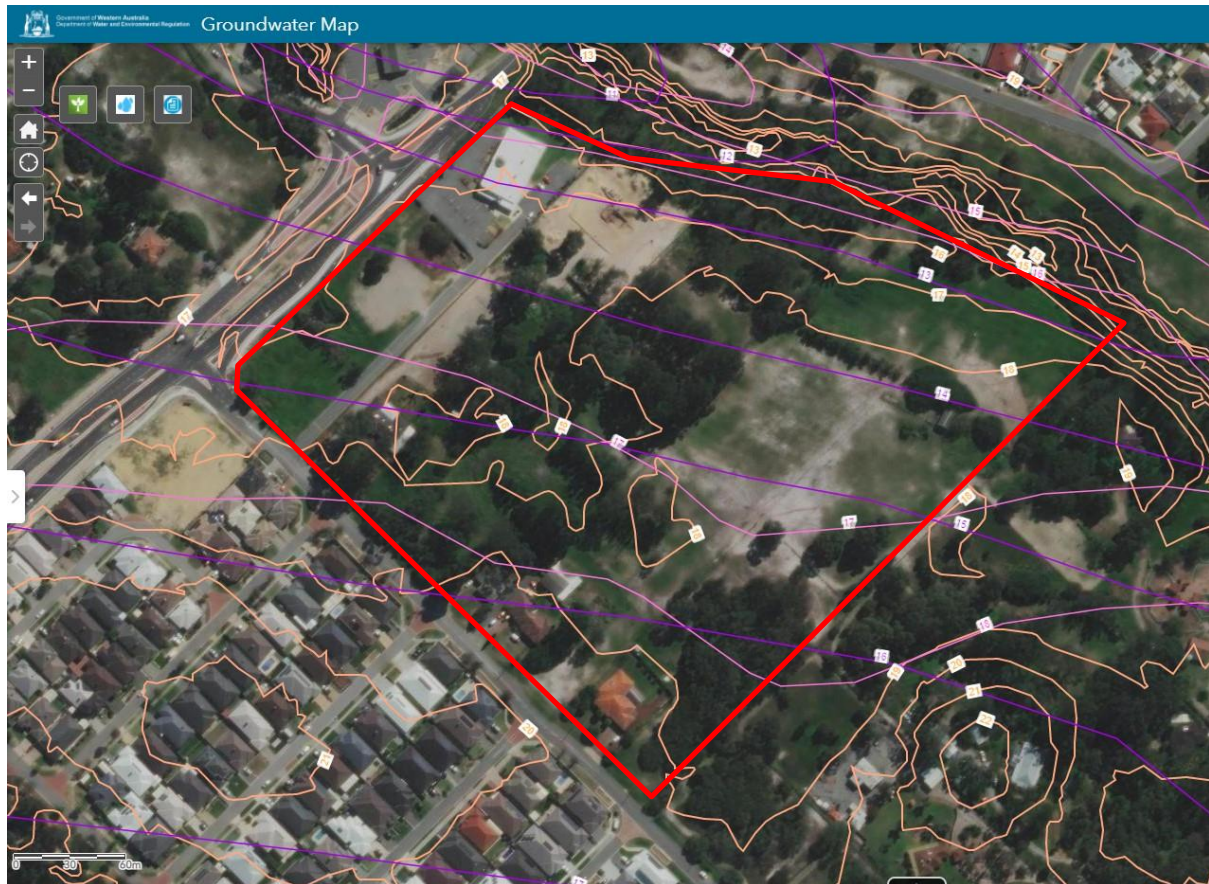


Figure 6 DWER Groundwater Map

Based on the information from DWER database and shown below in **Figure 7** there is a moderate Acid Sulfate Soils (ASS) risk for the majority of the subject site and a high risk around the Southern River. Groundwater salinity is between 500-1000mg/L.



Figure 7 DWER Groundwater Atlas Acid Sulfate Soil Risk

2.4. BUSHFIRE

The current online bushfire mapping listed on the Department of Fire & Emergency Services (DFES) website demonstrates that the subject site is within a Bushfire Prone Area as shown below in **Figure 8**. Additional planning and building requirements may apply to the proposed subdivisional development in accordance with Schedule 2 Part 10A of the Planning and Development (Local Planning Schemes) Regulations 2015, State Planning Policy 3.7, WA Guidelines for planning in Bushfire Prone Areas, and the Building Code of Australia.

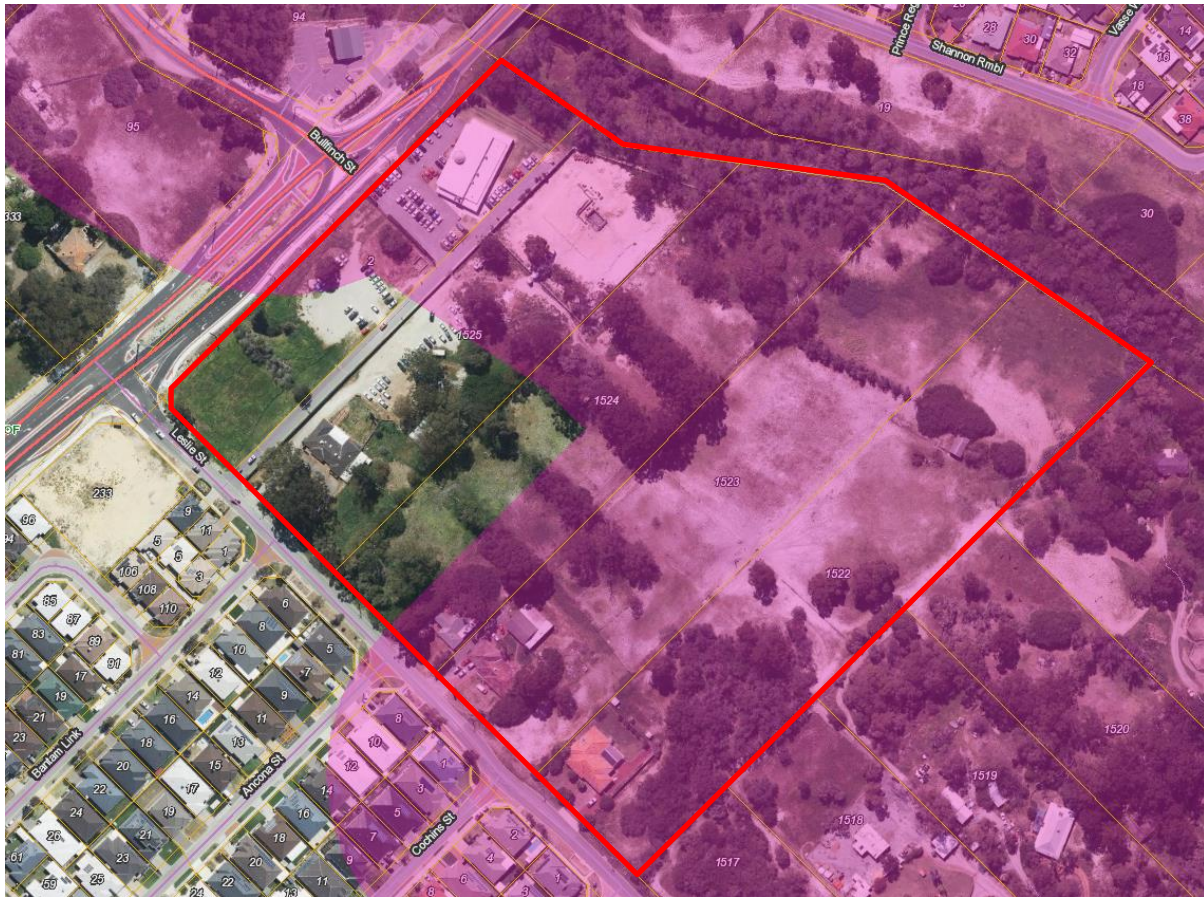


Figure 8 DFES Bushfire Prone Area

2.5. ENVIRONMENTAL AND CONTAMINATION

A contaminated land search on the DWER website indicates the site is not within known contaminated sites. No further actions from an environmental contamination perspective are required for the proposed development site.

2.6. FLOOD

The subject site northeast boundary is located along the edge of the Southern River. Preliminary information from DWER provides the following advice:

The Southern River – Wungong Brook Flood Study shows that the general area is affected by flooding during a 1 in 100 (1%) AEP flood event, with the estimated 1 in 100 year AEP flood level shown on the attached map (Appendix D).

Based on the floodplain development strategy for the area, proposed development on the Lots (ie, filling, building, etc) is considered acceptable with respect to major flooding. However, we recommend proposed minimum habitable floor levels of 0.5 metre above the appropriate 1 in 100 (1%) AEP flood level to ensure adequate flood protection.

2.7. SITE GRADING & BULK EARTHWORK

General Principles & Approach

The subject land generally has mild slopes with multiple existing trees predominantly around the centre of the subject site and along the Southern River.

Site grading and remodelling will be kept to minimum limits wherever possible and will generally be limited by adjacent roads, creation of the building pads for future development and associated works within the following parameters:

- Creation of the building pads for the proposed development.
- Regarding site at the location of vehicle access points.
- Contouring of land to suit landscaping and servicing requirements of the development.
- Filling of land to suit proposed development soil grading requirements and services design levels.

Site grading will generally be determined by the building pad design and the sewer design requirements to ensure a sustainable as well as economic development.

Peritas anticipate that the bulk earthwork operations will be partly completed using material available from the area. If importation of sand is required, it will be sourced from existing sand mining operations within the locality.

Preparatory works prior to earth working should be limited to the following:

- Removal of existing structures (exclusive of Masjid Ibrahim place of worship and residence currently under construction) and fencing and other improvements as necessary.
- Stripping and grubbing of areas to be earth worked to the depth 1500mm for stripping and 700mm below existing ground level for grubbing.
- Strip and disposal of topsoil.
- Cut to fill operations and imported fill to selected areas to suit building pad designs.
- Stabilisation of any areas to be landscaped or where topsoil has not been respread on verges and embankments.

Site levels shall be set in accordance with the following parameters:

- Geotechnical and soil parameters to ensure that the site is capable of the development.
- Fill levels to provide clearance to groundwater (AAMGL and as prescribed by authority approvals). Possibly an issue for this site due to the possibility of high ground water levels.
- Appropriate minimum clearances above sewer and water reticulation services.
- Finished transformer site pad levels are to be set at least 1.0m above 100 year flood event and building pads are to be at least 300mm above.

Upon completion of bulk earthworks, any disturbed areas shall be stabilised either by respreading the stockpiled topsoil from the bulk earthwork operations or via hydro mulching stabilisation as appropriate or in accordance with the requirements of the local authority.

Land Stabilisation & Dust Suppression

Prior to construction taking place, a construction water supply will be established to provide water for dust suppression, temporary sand stabilisation and irrigation during the construction phases. Water trucks and spray equipment will be on site throughout the construction programme to damp down exposed sand surfaces until the surface is physically stabilised. In the event that adjacent occupied homes or trafficked roads are affected by sand drift, a sand trapping fence will be constructed fronting the affected section of the development.

In the event of strong winds blowing towards adjacent properties that cause blown sand to reach those properties, earthworks, including the stripping or resspreading of topsoil, will be temporarily suspended and dust suppression measures immediately implemented.

Stabilisation of the soil surface will be carried out, as required, immediately following topsoil re-spreading and minor regrading.

Soil stabilisation will be maintained until such time as the building construction commences.

3. ROAD NETWORK & TRAFFIC CONSIDERATIONS

3.1. VEHICULAR AND PEDESTRIAN ACCESS

Currently the subject site obtains vehicular access from Southern River Road and Leslie Street.

Southern River Road is a dual access carriage way road with an approximate sealed width of 24m, and a landscaped island with a varying width. Each of the carriage ways has kerbing on both sides of the road, and a 2.4m width pedestrian access way.

Southampton Drive has an approximate 7.6m seal width with kerbing on both sides of the road, and a pedestrian access way shoulder with a width of 2.0m on one side of the road.

There is an existing driveway access point for access onto the proposed development from Leslie Street from each of the 5 lots, and an access point from Southern River Road as well.

There are two bus stop locations located in close proximity to the subject site. The approximate locations of the bus stops are shown below in **Figure 9** circled in red.

The proposed development will have site access from Southern River Road and Leslie Street.

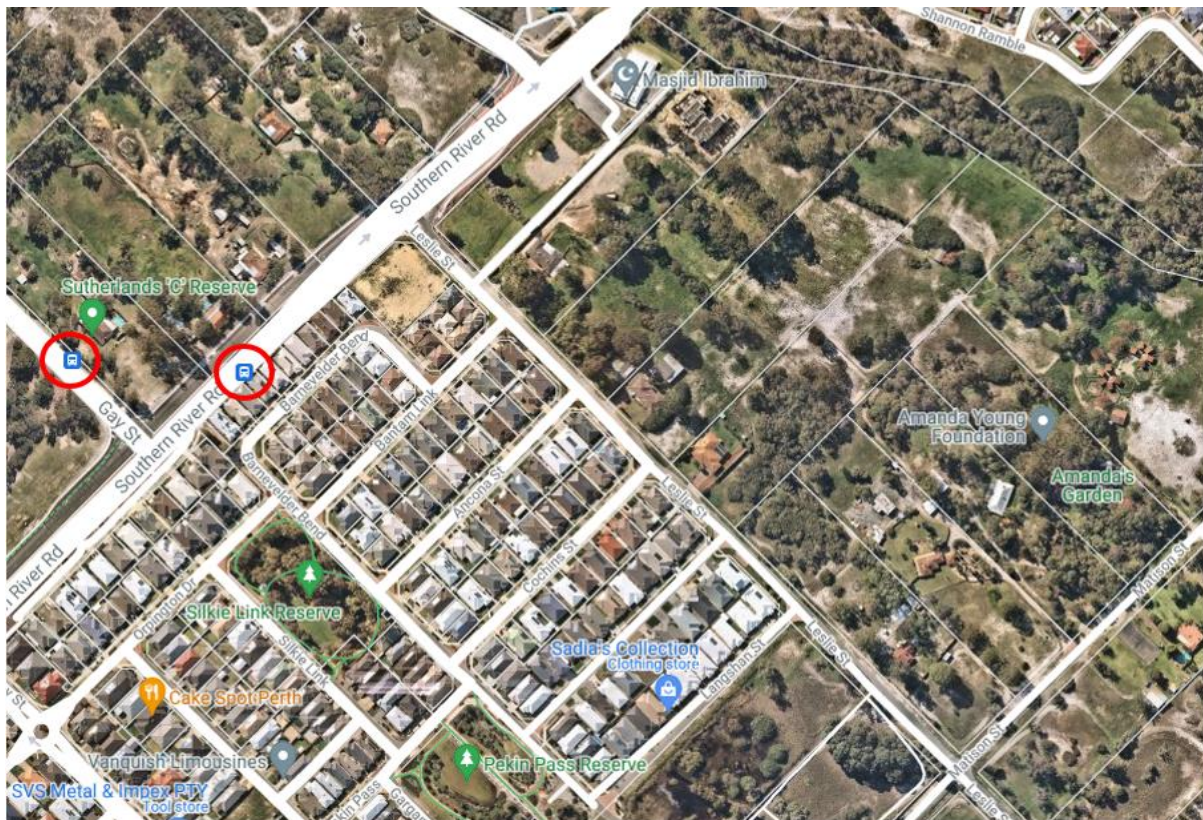


Figure 9 Existing Pedestrian and Public Transport Infrastructure

4. STORMWATER DRAINAGE

The existing stormwater drainage service information has been compiled from Dial Before You Dig information as shown below in **Figure 10**.

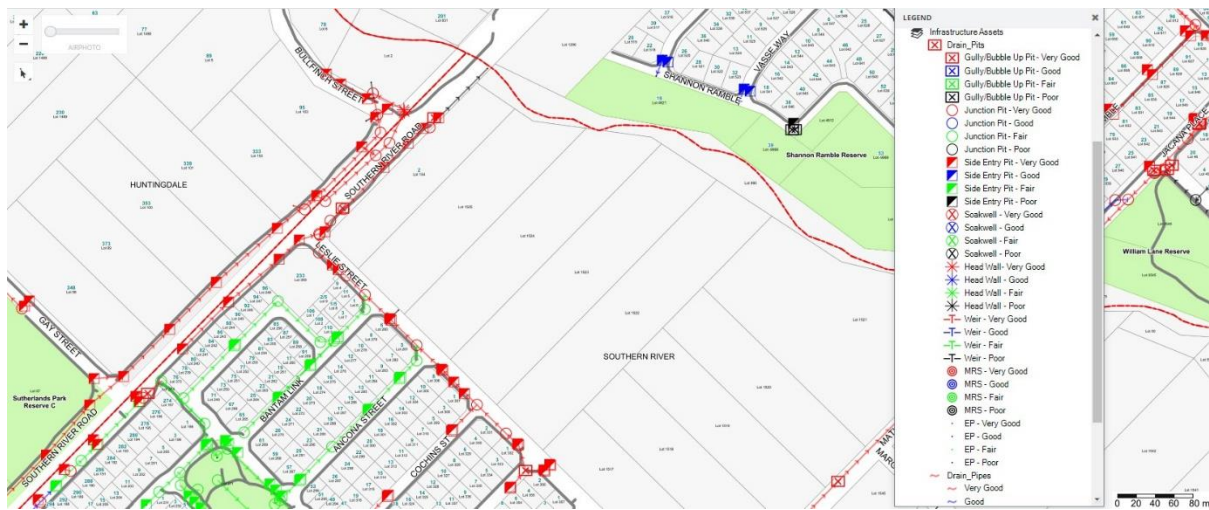


Figure 10 City of Gosnells Drainage Plan

The proposed Local Water Management Strategy prepared by Bioscience Pty Ltd is consistent with water sensitive urban design (WSUD) practices and addresses by the City of Gosnells and the Swan River Trust requirements as outlined below.

The proposed drainage conveyance and retention philosophy will follow the preceding outline:

- *Lots to cater for the critical 5 year ARI event via soakwells;*
- *Raingardens to be provided throughout the road reserve to cater for the 1 year 1 hour ARI for at-source treatment and infiltration;*
- *Provision will be made to pipe the 1 in 5 year ARI flows via a piped network. Specific details relating to the sizing and location of pits and pipes will be provided in subsequent UWMP(s);*
- *Stormwater exceeding the capacity of the piped network will be directed as overland flow within the road reserves to retention basins. This has been designed up to and including the 1 in 100 year ARI;*
- *Stormwater outflow to Southern River generated by Precinct 3B will be detained to pre-development levels utilising raingardens and retention basins located within Public Open Space areas; and*
- *External catchment flows will be allowed to pass through the development site unrestrained. This assumption works on the premise that adjacent stormwater flows passing through the site is either in its natural state or that development has limited flows to pre development levels. The overflow weir from Basin C2 will be sized to cater for these additional flows. This was explained in more detail within Section 4.9.3.*

Refer to LWMS prepared by Bioscience for further details for the stormwater management strategy within the subject land catchment and particularly outlining the 1 in 5 and 1 in 100 year ARI management strategies.

5. WASTEWATER DISPOSAL

Preliminary information from the WA Water Corporation indicates that there is a reticulated sewer service network in the area. A DN225 sewer main is located immediately outside the southern corner of the subject site in the northern verge of Leslie Street. There is a DN100 sewer main located in the southern verge of Leslie Street that connects to the existing development to the south of the proposed lot and also runs up Southern River Road.

Water Corporation has confirmed that the current existing wastewater infrastructure is sufficient to accommodate the proposed development without any required upgrades. Based on Water Corporation records the site has no existing sewer connections.

Peritas engaged in correspondence with Water Corporation to discuss the possibility of a private wastewater pump station (PPS) to discharge to the nearest approved receival sewers, however Water Corporation confirmed that it would not be an option since a gravity sewer option was already available and planned for (see **Figure 11** below)

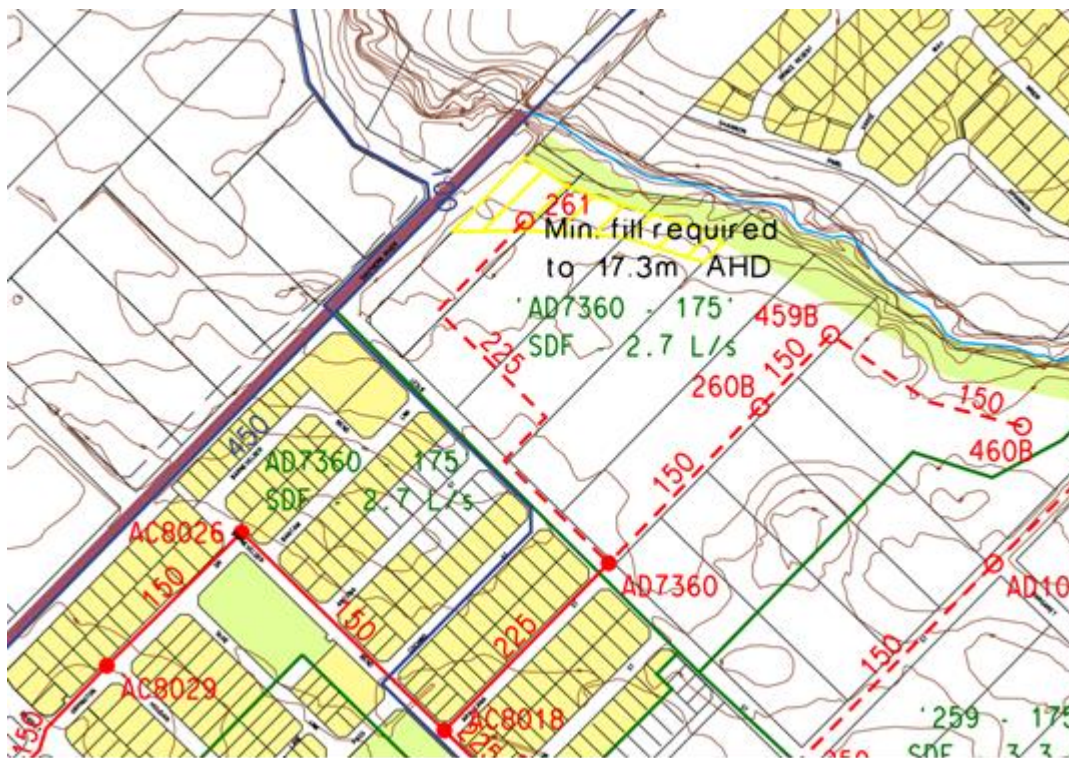


Figure 11 Water Corporation Sewer Scheme Plan

The current proposed option is for the sewer reticulation to connect to the existing DN225 gravity sewer reticulation to the south of the site on Leslie Street, circled in green in **Figure 12** below.



Figure 12 Water Corporation Wastewater Assets

All works in the vicinity of the existing sewer should be completed in accordance with Water Corporation Technical Guidelines for working near Water Corporation assets.

All developed lots would need to be served with a conventional gravity sewer system with the majority of the reticulation sewers located within road reserves. The internal sewer reticulation would be designed in accordance with the Water Corporation Sewerage Manual and connect to the existing network in Leslie Street as noted above.

Standard Water Corporation Headwork charges will apply to this development.

6. POTABLE WATER SUPPLY

Preliminary information from Water Corporation indicates that there is a potable water supply network in the area.

A DN100 CI potable water pipe is located immediately outside the subject site along the northern verge of the Leslie Street, a 200P-12 potable water pipe along the southern verge of Leslie Street, and a DN150 CI potable water pipe along the eastern verge of Southern River Road as shown below in **Figure 13**.



Figure 13 Water Corporation Potable Water Supply

Water Corporation has confirmed that the current existing water infrastructure is sufficient to accommodate the proposed development without any required upgrades. There are currently five potable water connections to the subject site, one to each of the lots.

The internal water reticulation shall be designed and constructed in accordance with standard Water Corporation requirements. Standard Water Corporation water headwork charges will apply to this development.

7. POWER, TELECOMMUNICATION & GAS

7.1. WESTERN POWER

The proposed development currently has underground HV and LV infrastructure in the vicinity, running in the verge of Leslie Street and Southern River Road, see **Appendix B** for further details. The proposed development also currently has overhead HV and LV infrastructure in the vicinity, running along the verge of Leslie Street and Southern River Road, see **Appendix C** for further details. Based on the expected requirements of the proposed development, the current electrical infrastructure will likely require upgrades to service the development.

7.2. TELECOMMUNICATION SERVICES

There is existing comms infrastructure along Leslie Street, Southern River Road and surrounding local streets. See **Appendix A** for further information.

The selected provider will install telecommunication facilities to the proposed development, subject to the developer paying connection fees.

Some additional cost may be applicable for relocation of existing pits and pipes subject to the development layout.

7.3. GAS SUPPLY

DBYD mapping indicates that reticulated gas services are available in the surrounding area. A DN155 PVC 70 kPa medium pressure gas main runs along the eastern verge of Southern River Road and the northern verge of Leslie Street as seen below in **Figure 14**.

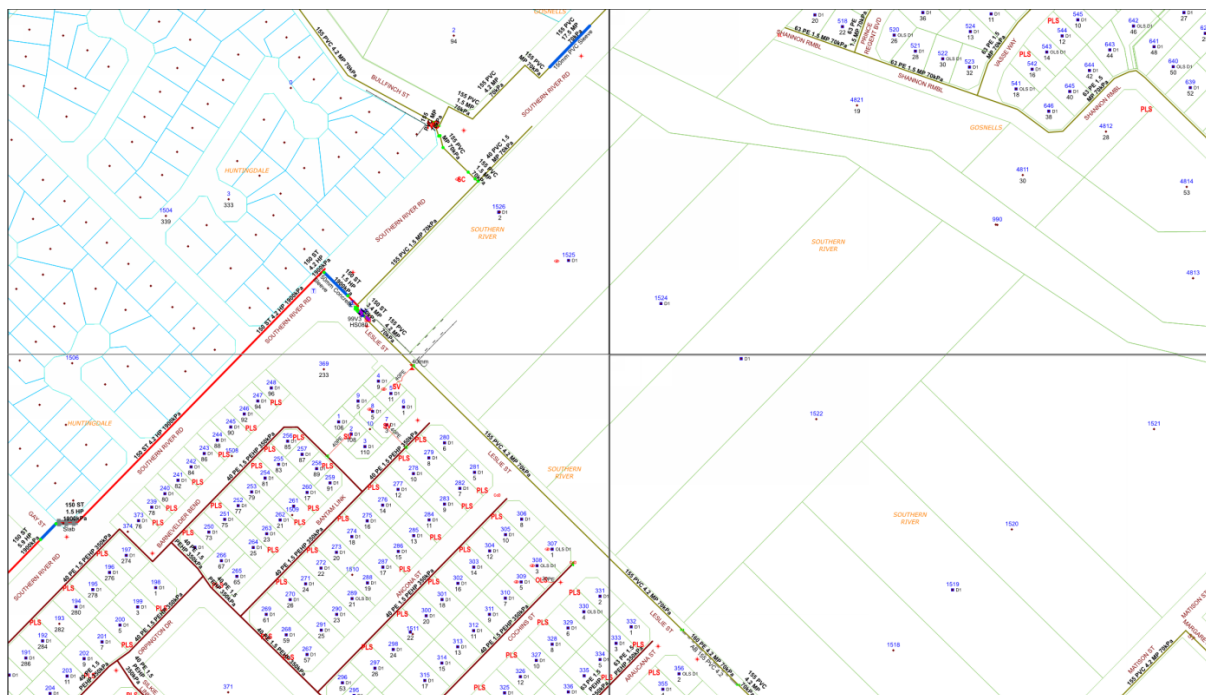


Figure 14 DBYD ATCO Gas Reticulation Map

Gas connection will be provided as on the application from the builder.

8. CONCLUSIONS & RECOMMENDATIONS

Peritas does not envisage any major servicing constraints for the proposed development and has allowed appropriate costs for major servicing infrastructure upgrades based on a stand-alone site development of the subject land.

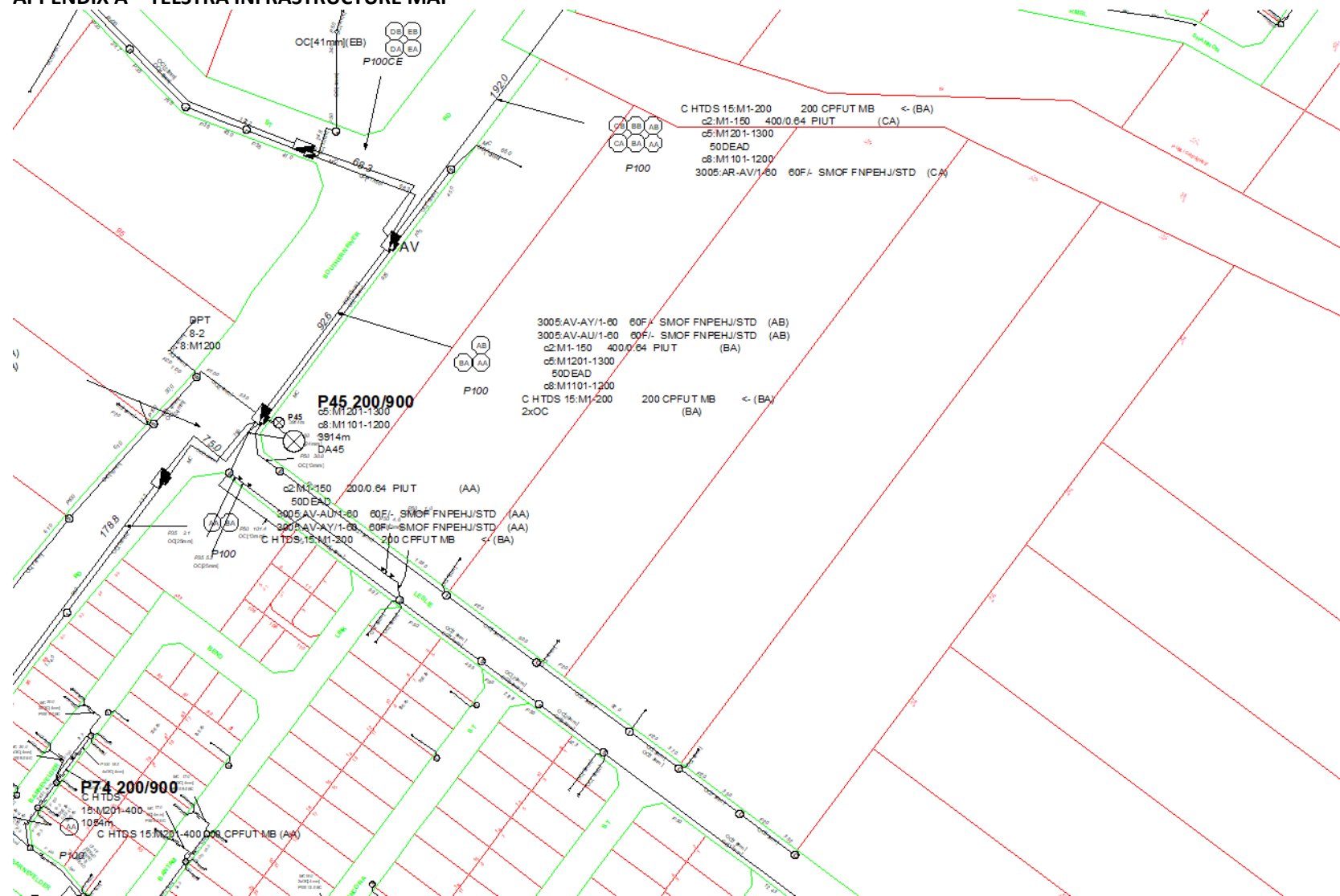
The site is capable of being serviced with all essential services, has no major identifiable problematic soil conditions based on preliminary inspection of the site and with careful considered design would result in a high-quality development.

It is recommended that additional detailed work be undertaken in conjunction with the regulatory authorities and service providers at development application stage to determine the land requirements associated with the necessary infrastructure changes as described in the report above. This would include the following:

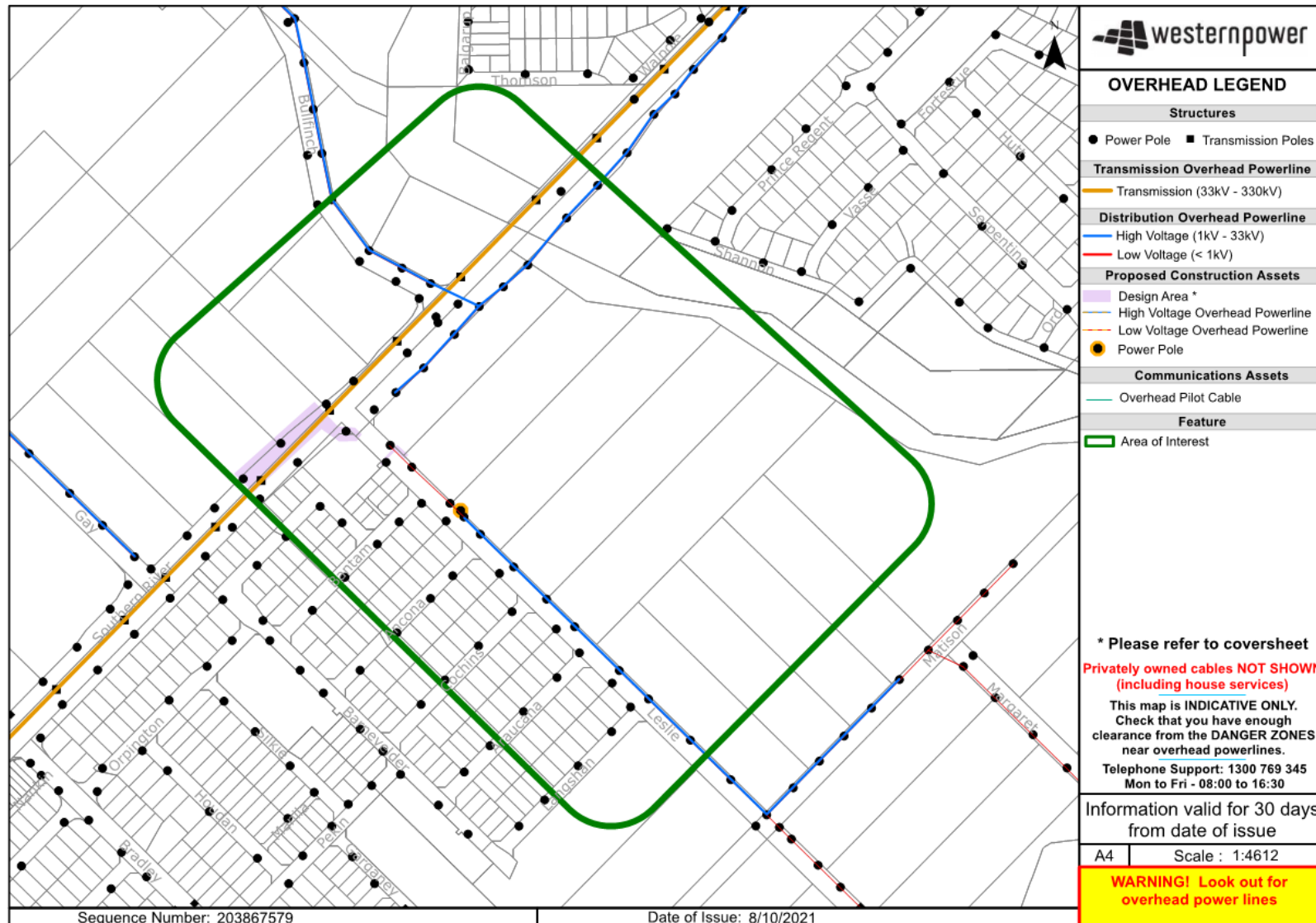
1. Undertake geotechnical site investigation to confirm permeability rates and depth of fill material, and depth to ground water level.
2. A survey be completed to confirm earthwork requirements.
3. Undertake traffic assessment report and confirm with City of Gosnells for access points.
4. Fill requirements for sewer and stormwater are recommended to be at a minimum FL of 17.25m AHD.
5. Liaise with Western Power and engage an Electrical Consultant to investigate whether the existing network capacity is sufficient to service the proposed development or if upgrades will be required.

Additionally, the major service authorities should be approached to formally confirm further details of any upgrade requirements so that the early planning major infrastructure can be undertaken, and forward work construction programmed.

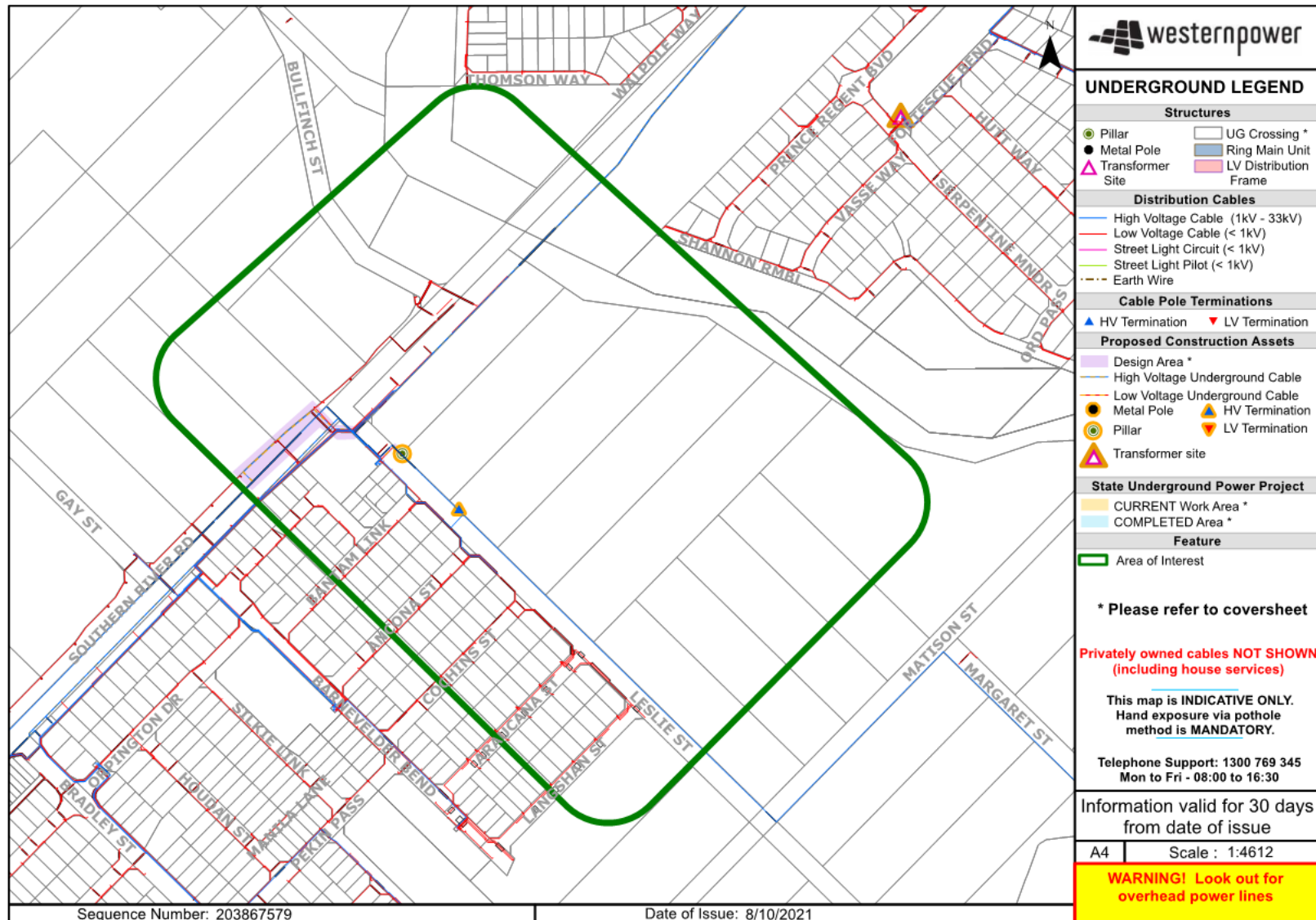
APPENDIX A – TELSTRA INFRASTRUCTURE MAP



APPENDIX B – WESTERN POWER OVERHEAD MAP



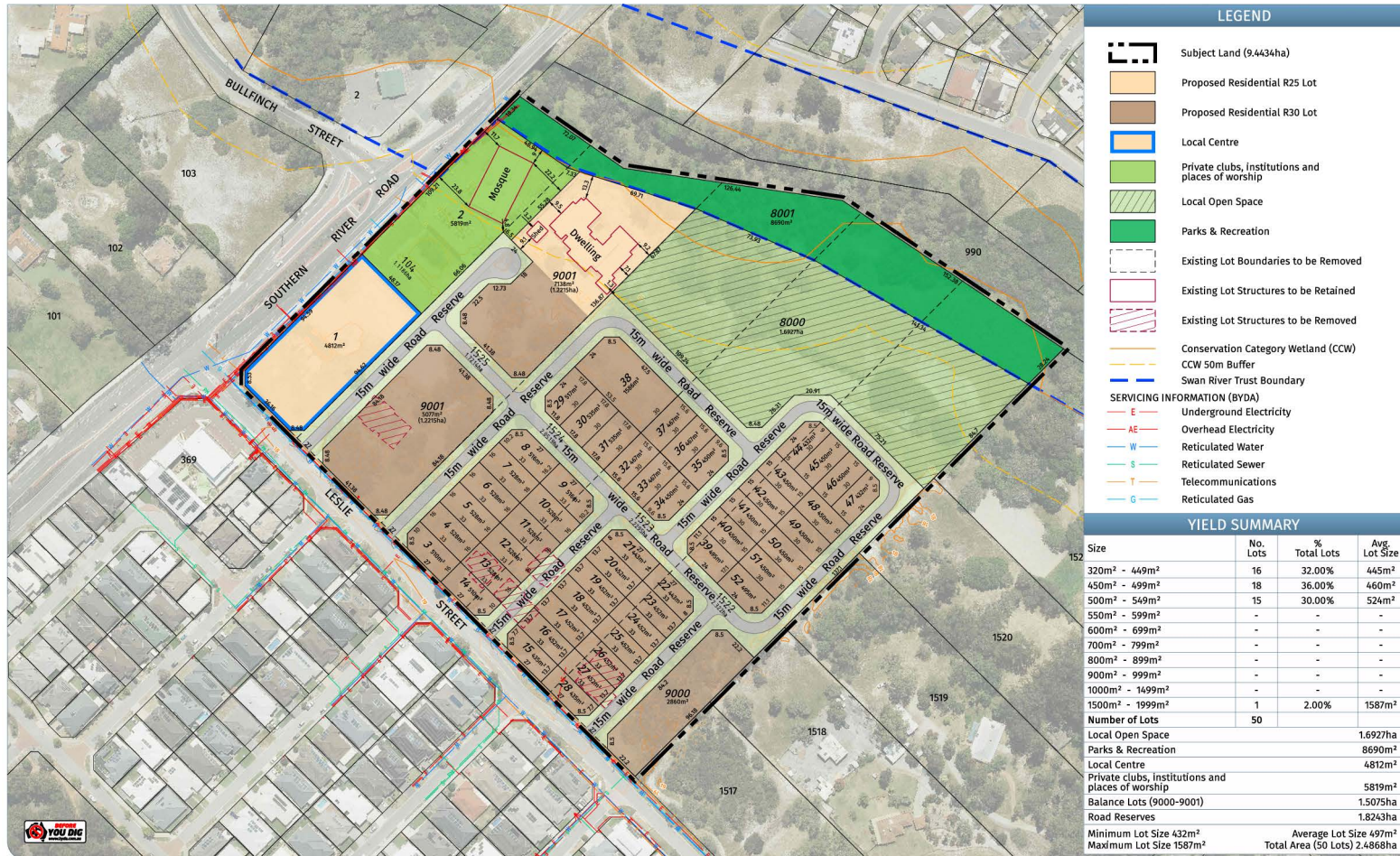
APPENDIX C – WESTERN POWER UNDERGROUND MAP



APPENDIX D – 100 YEAR FLOOD LEVELS



APPENDIX E – RESIDENTIAL LOT YIELD PLAN



FREEHOLD SUBDIVISION

Lots 104 (No. 2) and 1522-1525 Leslie Street,
SOUTHERN RIVER

Plan No. | 22377-07
Date | 04/08/25
Drawn | TJ
Checked | JS
Revision | H

PERTH & FORRESDALE:
SUB 1522 Forrestdale St
PERTH WA 6000
1522 Intersection Loop
FORRESDALE WA 6112
G. 08 9445 7942
E: metro@harleydykstra.com.au

ALBANY | BUNBURY | BUSSELTON | FORRESDALE | PERTH

Scale | 1:2000@A3

NOTE: This plan has been prepared for planning purposes. Areas, Contours and Dimensions shown are subject to survey.

Harley Dykstra
SURVEYING | TOWN PLANNING | PROJECT MANAGEMENT

APPENDIX I | LOT YIELD PLAN



LEGEND

Subject Land (9.4434ha)

Proposed Residential R25 Lot

Proposed Residential R30 Lot

Local Centre

Private clubs, institutions and places of worship

Local Open Space

Parks & Recreation

Existing Lot Boundaries to be Removed

Existing Lot Structures to be Retained

Existing Lot Structures to be Removed

Conservation Category Wetland (CCW)

CCW 50m Buffer

Swan River Trust Boundary

E

Underground Electricity

AE

Overhead Electricity

W

Reticulated Water

S

Reticulated Sewer

T

Telecommunications

G

Reticulated Gas

YIELD SUMMARY

Size	No. Lots	% Total Lots	Avg. Lot Size
320m² - 449m²	16	32.00%	445m²
450m² - 499m²	18	36.00%	460m²
500m² - 549m²	15	30.00%	524m²
550m² - 599m²	-	-	-
600m² - 699m²	-	-	-
700m² - 799m²	-	-	-
800m² - 899m²	-	-	-
900m² - 999m²	-	-	-
1000m² - 1499m²	-	-	-
1500m² - 1999m²	1	2.00%	1587m²
Number of Lots	50		
Local Open Space			1.6927ha
Parks & Recreation			8690m²
Local Centre			4812m²
Private clubs, institutions and places of worship			5819m²
Balance Lots (9000-9001)			1.5075ha
Road Reserves			1.8243ha
Minimum Lot Size 432m²			Average Lot Size 497m²
Maximum Lot Size 1587m²			Total Area (50 Lots) 2.4868ha

FREEHOLD SUBDIVISION

Lots 104 (No. 2) and 1522-1525 Leslie Street,
SOUTHERN RIVER

Plan No. | 22377-07

Date | 04/08/25

Drawn | TJ

Checked | JS

Revision | H

PERTH & FORRESTDALE:

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PERTH WA 6000

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ALBANY | BUNBURY | BUSSELTON | FORRESTDALE | PERTH

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Scale | 1:2000@A3

NOTE: This plan has been prepared for planning purposes. Areas, Contours and Dimensions shown are subject to survey

Harley Dykstra

SURVEYING | TOWN PLANNING | PROJECT MANAGEMENT

APPENDIX J | LANDSCAPING PLAN



SOUTHERN RIVER PRECINCT 3B1

LANDSCAPE MASTERPLAN

UDLA

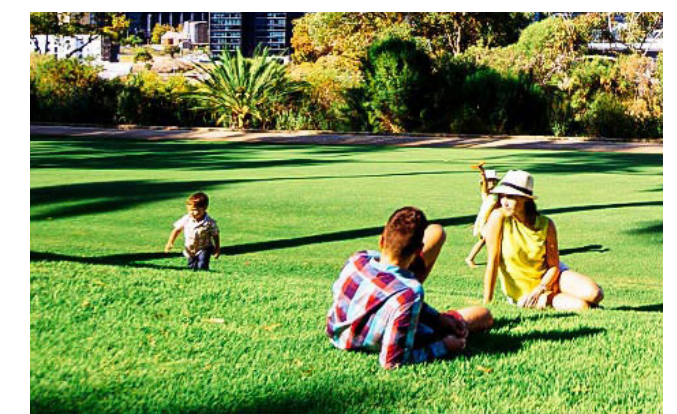


LEGEND

- Subject Area
- ① CCW / Bush Forever / Revegetation
- ② CCW Buffer / Revegetation
- ③ 2.0M Wide Dual Use Path (1040sqm total including shelter hardstands)
- ④ Shelter with Picnic Setting (3 No.)
- ⑤ Fitness Zone (2 No. at 45sqm total)
- ⑥ Open Turf Area (3,870sqm total)
- ⑦ Bioretention Basin (1,262sqm 1% AEP capture)
- ⑧ Bioretention Basin (800sqm 20% AEP capture)
- ⑨ Bioretention Basin Base (368sqm)
- ⑩ Parallel Parking Bays (10 No.)
- ⑪ CCW Fence Line
- Stormwater Overflow Discharge
- POS Irrigated area - approx. 5,420sqm
Garden Beds (1550sqm) / Turf (3870sqm) / Trees



④ Shelter with Picnic Setting



⑥ Open Turf Area



STREET TREE LEGEND



Agonis flexuosa
WA Weeping Peppermint
Height: 12m Width: 10m
Evergreen / Native



Eucalyptus sideroxylon Rosea
Red-flowering Ironbark
Height: 15m Width: 10m
Evergreen / Exotic



Melaleuca viridiflora
Red-flowering Paperbark
Height: 8m Width: 4m
Evergreen / Native



Prunus blireana
Cherry Blossom Plum
Height: 4m Width: 4m
Deciduous / Exotic



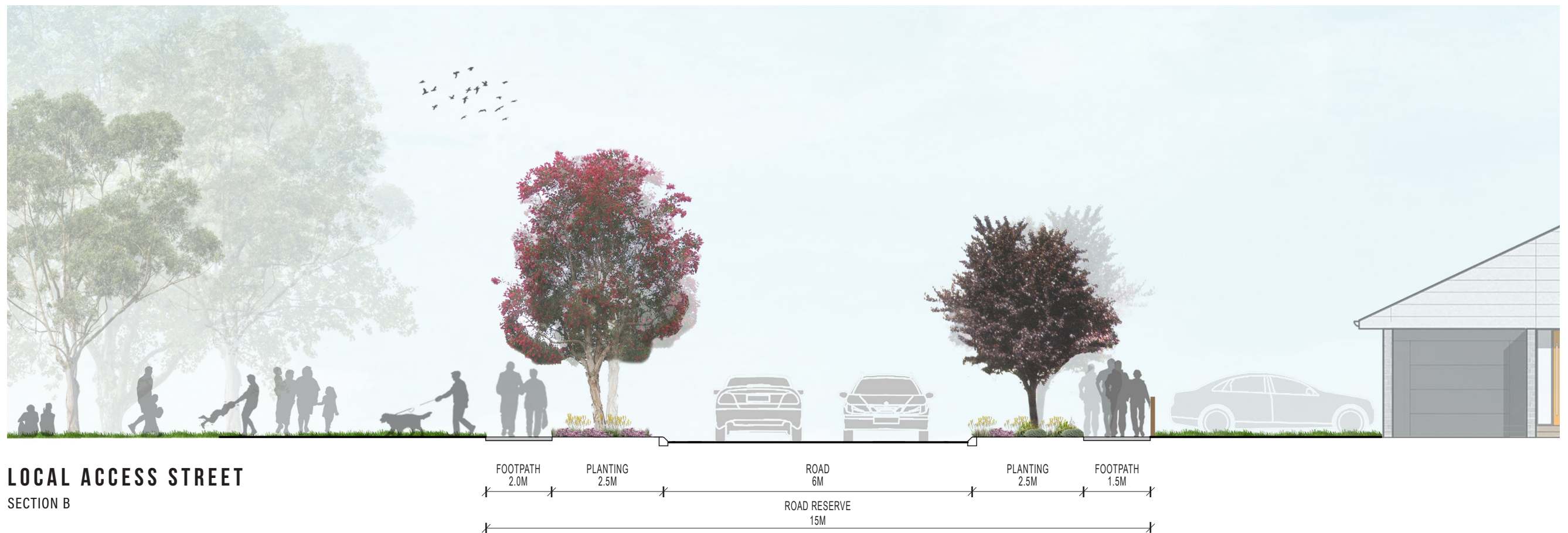
Prunus cerasifera nigra
Ornamental Flowering Plum
Height: 5m Width: 4m
Deciduous / Exotic

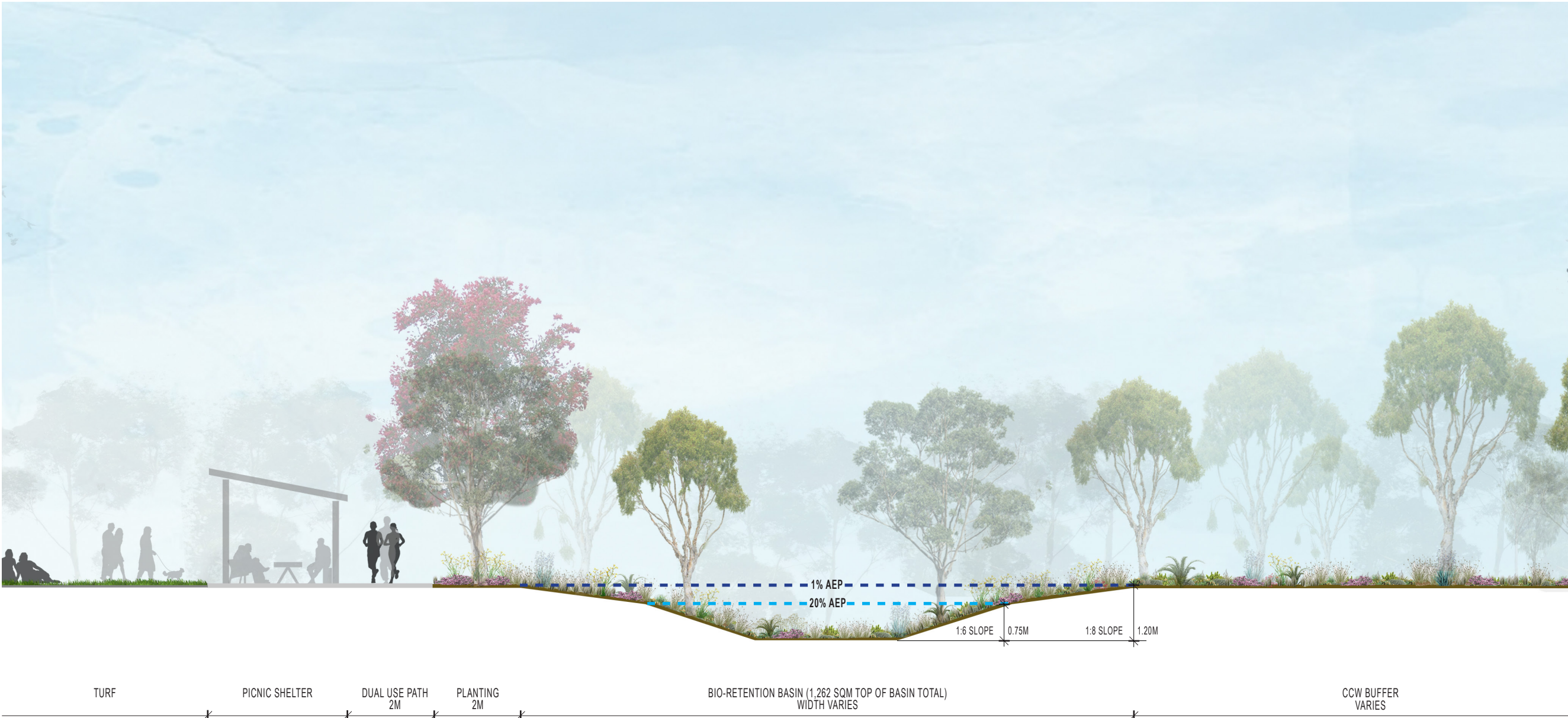


Pyrus calleryana
Ornamental Pear
Height: 11m Width: 3m
Deciduous / Exotic

Opportunity to increase tree canopy within the road reserve aims to improve the health of our communities and work towards developing an urban forest that has a greater potential to withstand the deleterious impacts of climate change. The City of Gosnells encourages the planting of at least one street tree per property frontage throughout the City. Additional trees may be planted if space permits.

The tree species selected are based on their suitability, the size of the planting space available, provide street identity, sense of place, and are within the suggested Street Tree Schedule as published by the City of Gosnells. This ensures the City is aware of the species and their specific maintenance needs.





POS / BIORETENTION BASIN / CCW BUFFER
SECTION C

SOUTHERN RIVER PRECINCT 3B1
BIORETENTION BASIN

CLIENT
Harley Dykstra

SCALE
1:100 @ A3



DRAWING
MP-05

ISSUE DATE
February 2025

REVISION
F

UDLA

PUBLIC OPEN SPACE TREE



Corymbia calophylla
MARRI
H: 20M X W: 10M



Corymbia ficifolia
RED FLOWERING GUM
H: 8M X W: 4M



Eucalyptus erythrocorys
RED CAP GUM
H: 5M X W: 3M



Eucalyptus luecoxylon
RED FLOWERING YELLOW GUM
H: 10M X W: 8M



Melaleuca leucadendra
WEeping PAPERBARK
H: 10M X W: 6M

WSUD TREE



Melaleuca raphiophylla
SWAMP PAPERBARK
H: 2-10M X W: 5M

PUBLIC OPEN SPACE SHRUB



Banksia blechnifolia
GROUND COVER BANKSIA
H:0.6M X W:0.9M



Conostylis setigera
BRISTLY COTTONHEAD
H:0.6M X W:0.9M



Dianella revoluta,
FLAX LILLY
HEIGHT: .5M X WIDTH: 1.5M



Eremophila glabra,
TAR BUSH
HEIGHT: 0.3M X WIDTH: 1M



Eremophila nivea
EMU BUSH
HEIGHT: 0.6M X WIDTH: .7M



Grevillea obtusifolia
GIN GIN GEM
HEIGHT: 0.3M X WIDTH: 1M



Lomandra longifolia
TANIKE
HEIGHT: .6M X WIDTH: .5M



Westringea fruticosa
NATIVE ROSEMARY
HEIGHT: .6M X WIDTH: .5M



Lepidosperma gladiatum
COASTAL SWORD SEDGE
HEIGHT: .6M X WIDTH: .5M



Leucophyta brownii
CUSHION BUSH
HEIGHT: .6M X WIDTH: .5M

WSUD SHRUB



Baumea juncea
BARE TWIGRUSH
H:0.6M X W:0.9M



Ficinia nodosa
KNOBBY CLUB-RUSH
H:1.0M X W:1.0M



Grevillea obtusifolia
GIN GIN GEM
H:0.4M X W:2.0M



Juncus Krausii
SEA RUSH
H:0.8M X W:1.2M



Lepidosperma calcicola
COASTAL SEDGE
H:0.6M X W:0.5M



Lepidosperma gladiatum
COASTAL SWORD-SEdge
H:0.6M X W:1.5M



Macrozamia riedlei
ZAMIA
H:1.6M X W:0.5M