



LOTS 109 & 110 WATTLEUP ROAD,
HAMMOND PARK

CITY OF COCKBURN

LOCAL STRUCTURE PLAN

Lots 109 and 110 Wattleup Road, Hammond Park

LOCAL STRUCTURE PLAN

Issue 3: November 2015

Prepared for: **Wattleup Road Property Development Pty Ltd and M & A Dropulic**

Prepared by: Burgess Design Group
101 Edward Street, Perth, 6000
PO Box 8779, Perth Business Centre, W.A., 6849
Telephone: (08) 9328 6411
Facsimile: (08) 9328 4062
Website: www.burgessdesigngroup.com.au
Email: reception@burgessdesigngroup.com.au

Project Planner: Jaclyn Drummond
Job code: OPE HAM / EGD WAT
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1.	03.12.2014	Jaclyn Ward	Mark Szabo
2.	21.01.2015	Zarina MacDonald	Jaclyn Ward
3.	13.11.2015		Jaclyn Ward

Project Team:

Planning and Urban Design - Burgess Design Group
Environmental Assessment – Emerge Associates
Local Water Management – Emerge Associates
Engineering Infrastructure and Services – Development Engineering Consultants (DEC)
Traffic and Transport – Transcore
Bushfire Hazard Assessment and Management – Emerge Associates
Landscaping – Emerge Associates

ENDORSEMENT PAGE

This structure plan is prepared under the provisions of the City of Cockburn Local Planning Scheme No. 3.

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

03 November 2015

In accordance with Schedule 2, Part 4, Clause 28 (2) and refer to Part 1, 2. (b) of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

Date of Expiry:

07 December 2027

**MODIFICATIONS TO PART ONE AND STRUCTURE PLAN MAP FOR LOTS 109 & 110
WATTLEUP ROAD, HAMMOND PARK**

TABLE 1 - TABLE OF VARIATION(S) TO STRUCTURE PLAN

[illegible]

EXECUTIVE SUMMARY

This Local Structure Plan (LSP) applies to Lots 109 & 110 Wattleup Road, Hammond Park. The subject land comprises a total land area of 8.0938ha and is bound by Wattleup Road along its southern boundary, the Harry Waring Regional Reserve to the north, and Urban zoned land to the east and west.

The subject land forms part of the Southern Suburbs District Structure Plan Stage 3 (SSDSP3) Hammond Park/Wattleup which identifies the majority site for medium density residential development.

A summary of all key statistics and planning outcomes of the Structure Plan is provided in Table 2 below.

TABLE 2 - STRUCTURE PLAN SUMMARY

Item	Data	Section number referenced within Part Two of the Structure Plan Report
Gross Structure Plan Area	8.094 hectares	Section 1.2.2
Area of each land use proposed: <u>Zones</u> Residential (R30, R50 and R60) <u>Reserves</u> Amount of Public Open Space Amount of restricted Public Open Space <i>as per Liveable Neighbourhoods</i>	4.8153 hectares (59.5% of gross area) 0.9068 hectares (11.2% of gross area) 0.1214 hectares (13.39 % of total POS)	Section 3.2 Section 3.4
Composition of Public Open Space - District Parks - Neighbourhood Parks - Local Park	0.0 hectares 0.0 hectares 0.8559 hectares 10.64 % (creditable)	Section 3.4 and Table 4
Estimated Lot Yield	152 lots	Section 3.3
Estimated Number of Dwellings	157 dwellings	Section 3.3
Estimated Residential Density - dwellings per gross hectare <i>As per Directions 2031</i> - dwellings per site hectare <i>As per Liveable Neighbourhoods</i>	19 dwellings per gross hectare 32 dwellings per site hectare	Section 1.3.3 Section 1.3.3 & Section 3.3
Estimated Population	439 people @ 2.8 people/household	Section 3.3
Number of Secondary Schools	Nil	-
Number of Primary Schools	Nil	-

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1. STRUCTURE PLAN AREA

This Structure Plan is identified as the 'Plan 1 Structure Plan Lots 109 & 110 Wattleup Road Hammond Park'.

The Structure Plan applies to Lots 109 and 110 Wattleup Road, Hammond Park, being the land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan Map (**Plan 1 – Structure Plan Map**).

2. STRUCTURE PLAN CONTENT

The Structure Plan comprises the following sections:

- (i) **Part One** – Statutory Section. This section includes the Structure Plan Map and any textual provisions, standards or requirements that require statutory effect.
- (ii) **Part Two** – Explanatory (Non-Statutory) Information. This section provides the planning context and justification for the Structure Plan Map and the textual provisions contained in Part One of the Structure Plan. Part Two is to be used as a reference to guide interpretation and implementation of Part One.
- (iii) **Appendices**, includes all specialist consultant reports and documentation used in the preparation of and to support the land use outcomes of the Structure Plan.

3. INTERPRETATION AND RELATIONSHIP WITH CITY OF COCKBURN TOWN PLANNING SCHEME NO.3

3.1	Terms and Interpretations	As per Clause 6.2.6.3 of the City of Cockburn Town Planning Scheme No.3.
3.2	Relationship of the Structure Plan with City of Cockburn Town Planning Scheme No.3	This Structure Plan has been prepared under Clause 6.2 of the City of Cockburn Town Planning Scheme No. 3 as the subject land is zoned 'Development' and contained within Development Area No. 27 which is shown on the Scheme Map and contained within Schedule No.11.
3.3	Provisions	Pursuant to Clause 6.2.6.3 and Clause 6.2.12.2 of the City of Cockburn Town Planning Scheme No.3.
3.4	Land Use Permissibility	As per Clause 4.3.2 of the City of Cockburn Town Planning Scheme No.3.

4. OPERATION

4.1	Operation Date	As per Clause 6.2.12 of the City of Cockburn Town Planning Scheme No. 3.
4.2	Variation to Structure Plan	As per Clause 6.2.14 and Clause 6.2.15 of the City of Cockburn Town Planning Scheme No.3.

5. LAND USE

5.1	Residential Density	Residential densities applicable to the Structure Plan area shall be those residential densities shown on the Structure Plan Map.
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6. SUBDIVISION / DEVELOPMENT

6.1	Notifications on Title	<p>In respect of applications for the subdivision of land the Council shall recommend to the Western Australian Planning Commission that a condition be imposed on the grant of subdivision approval for a notification to be placed on the Certificate(s) of Title(s) to advise of the following: -</p> <ol style="list-style-type: none"> 1. Land or lots deemed to be affected by a Bush Fire Hazard as identified in a Bushfire Management Plan as outlined within the Lots 109 & 110 Bushfire Management Plan contained within Appendix 3. 2. Building setbacks and construction standards required to achieve a Bushfire Attack Level (BAL-29) or lower in accordance with Australian Standards (AS3959-2009): Construction of buildings in bushfire prone areas.
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6.2	Local Development Plans (Local Development Plans)	<p>Local Development Plans (LDP's) are required to be prepared and implemented pursuant to Clause 6.2.15 of the City of Cockburn Town Planning Scheme No. 3 for lots with one or more of the following site attributes:</p> <ul style="list-style-type: none"> ▪ Lots with rear-loaded vehicle access; ▪ Lots with direct boundary frontage (primary or secondary) to an area of Public Open Space; ▪ Lots deemed to be affected by a recognised Bush Fire Hazard, as identified spatially in Appendix 3 of the accompanying Bushfire Management Plan, under Appendix 3; ▪ Lots adjoining the existing Wattleup Road with a density code of R50; ▪ Front loaded lots with an effective frontage of less than 12m.
6.3	Bushfire Management	<p>This Structure Plan is supported by a Bushfire Hazard Level Assessment (BFHA) and Bushfire Management Plan (BMP) (Appendix 3). Any land falling within 100 metres of a bushfire hazard identified in the BFHA/BMP is designated as a Bushfire Prone Area for the purpose of the Building Code of Australia.</p>

7. DEVELOPER CONTRIBUTIONS

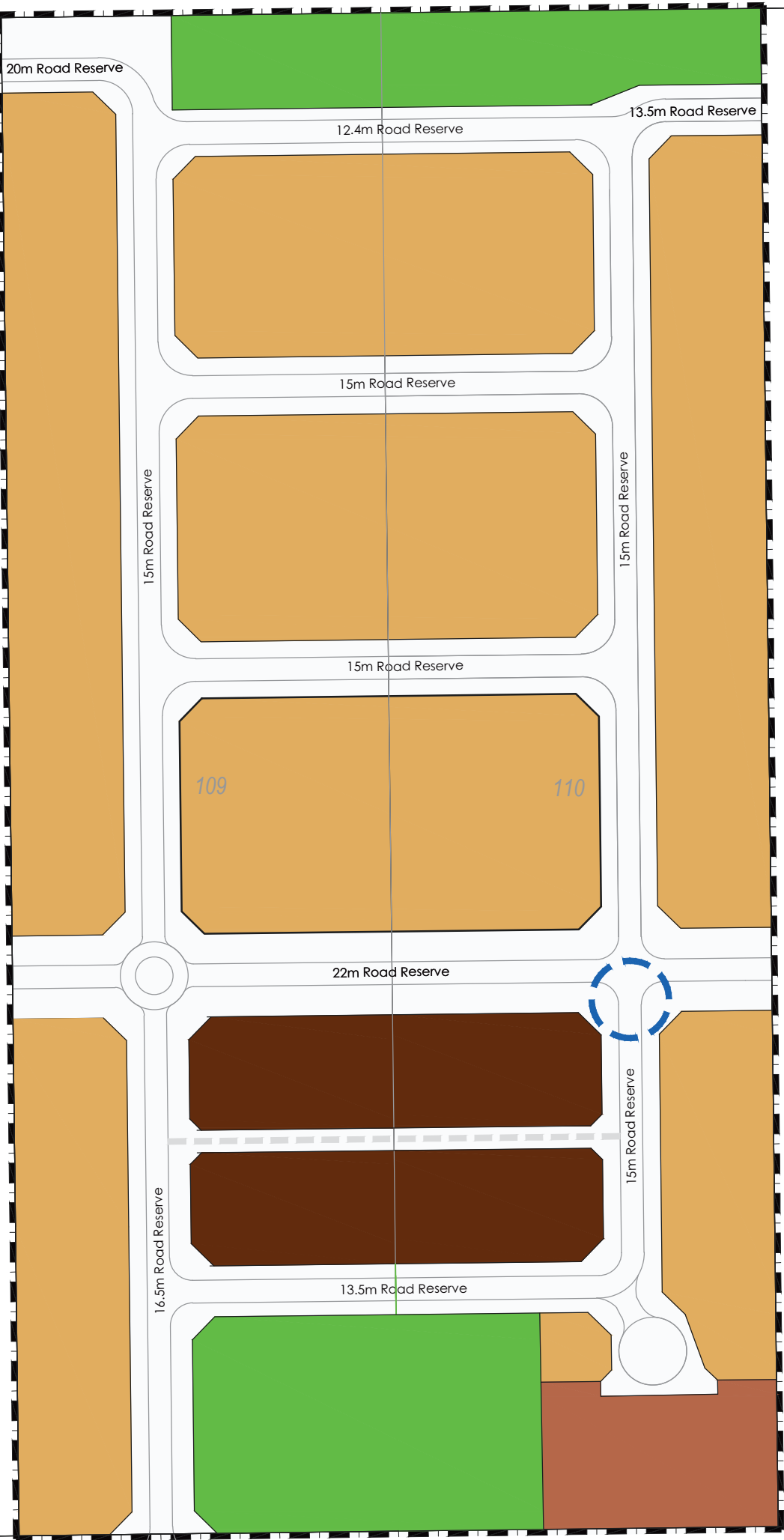
7.1	Development Contributions	<p>The subject land falls within a Special Control Area, being Development Contribution Area (DCA) 13, and DCA10.</p> <p>Development of the land is therefore subject to cost contributions in accordance with Development Contribution Plan (DCP) 10 and DCP13 as prescribed within Schedule 12 of TPS3.</p>
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108

109

110

111



LEGEND

Zones

- Residential R30
- Residential R50
- Residential R60

Local Scheme Reserves

- Parks & Recreation

Other

- Structure Plan Boundary
- Laneway
- Left in/Left out

All areas and dimensions are subject to survey, engineering and detailed design and may change without notice. © Copyright of Burgess Design Group.

PLAN 1



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PO Box 8779, Perth Business Centre 6849
www.burgessdesigngroup.com.au

P (08) 9328 6411
F (08) 9328 4062



0 10 20 30 40 50m
SCALE 1:1,500 (A3)

Plan No: OPE HAM 2-01h Client: OPE HAM/EGD WAT
Date: 27.01.15 Planner: JD/MB

LOCAL STRUCTURE PLAN
LOTS 109 & 110 WATTLEUP ROAD
HAMMOND PARK
CITY OF COCKBURN

1. PLANNING BACKGROUND

1.1 INTRODUCTION AND PURPOSE

This Local Structure Plan (LSP) has been prepared by Burgess Design Group on behalf of Wattleup Road Property Development Pty Ltd, as the contracted purchaser of Lot 109 Wattleup Road, and Mate & Anica Dropulic, being the registered landowners of Lot 110 Wattleup Road, Hammond Park (the subject site).

The *Lots 109 & 110 Wattleup Road LSP* further refines the land uses identified under the *Southern Suburbs District Structure Plan Stage 3 (SSDSP3)* in order to guide future subdivision and development. This structure plan also considers the adjoining proposed structure plan area, *Lots 1, 111 & 801 Wattleup Road LSP*, to create an integrated transition between the two structure plan areas.

This Local Structure Plan has been prepared in consultation with a number of sub-consultants and is informed by a suite of technical investigations and documentation (copies of which are included as the **appendices**) that includes: Environmental Assessment; Traffic Impact Assessment; Civil Engineering and Servicing Report; Local Water Management Strategy; Bushfire Management Plan; and Landscape Master Plan.

1.2 LAND DESCRIPTION

1.2.1 Location

The subject land is located in Hammond Park, approximately 25 kilometres south of the Perth CBD, 5.5 kilometres south west of Cockburn Central, within the municipality of the City of Cockburn.

The subject land is bound by Wattleup Road to the south, the Harry Waring Regional Reserve to the north and Urban zoned land to the east and west. The site is located on the western side of the proposed *Lots 1, 111 & 801 Wattleup Road Local Structure Plan* area. Existing access to the site is via Wattleup Road (Refer **Figure 1**).

1.2.2 Area and Land Use

The subject land incorporates Lots 109 & 110 Wattleup Road, Hammond Park, both with site areas of 4.0469ha. Both land parcels have a frontage of approximately 100.5m to Wattleup Road with a lot depth of approximately 402m. The subject site has a total area of 8.0938ha.

The subject land remains largely vegetated, consisting of large areas of Natural Vegetation, with the exception of an existing dwelling and outbuilding located on Lot 110 (refer to **Figure 2**).

1.2.3 Legal Description and Ownership

Certificates of Title are attached at **Appendix 1**. The subject land is legally described as:

- Lot 109 on Plan 8384 Volume: 1304 Folio: 683 (Registered Proprietor: Sail Holdings Pty Ltd)
- Lot 110 on Deposited Plan 8384 Volume: 1304 Folio: 684

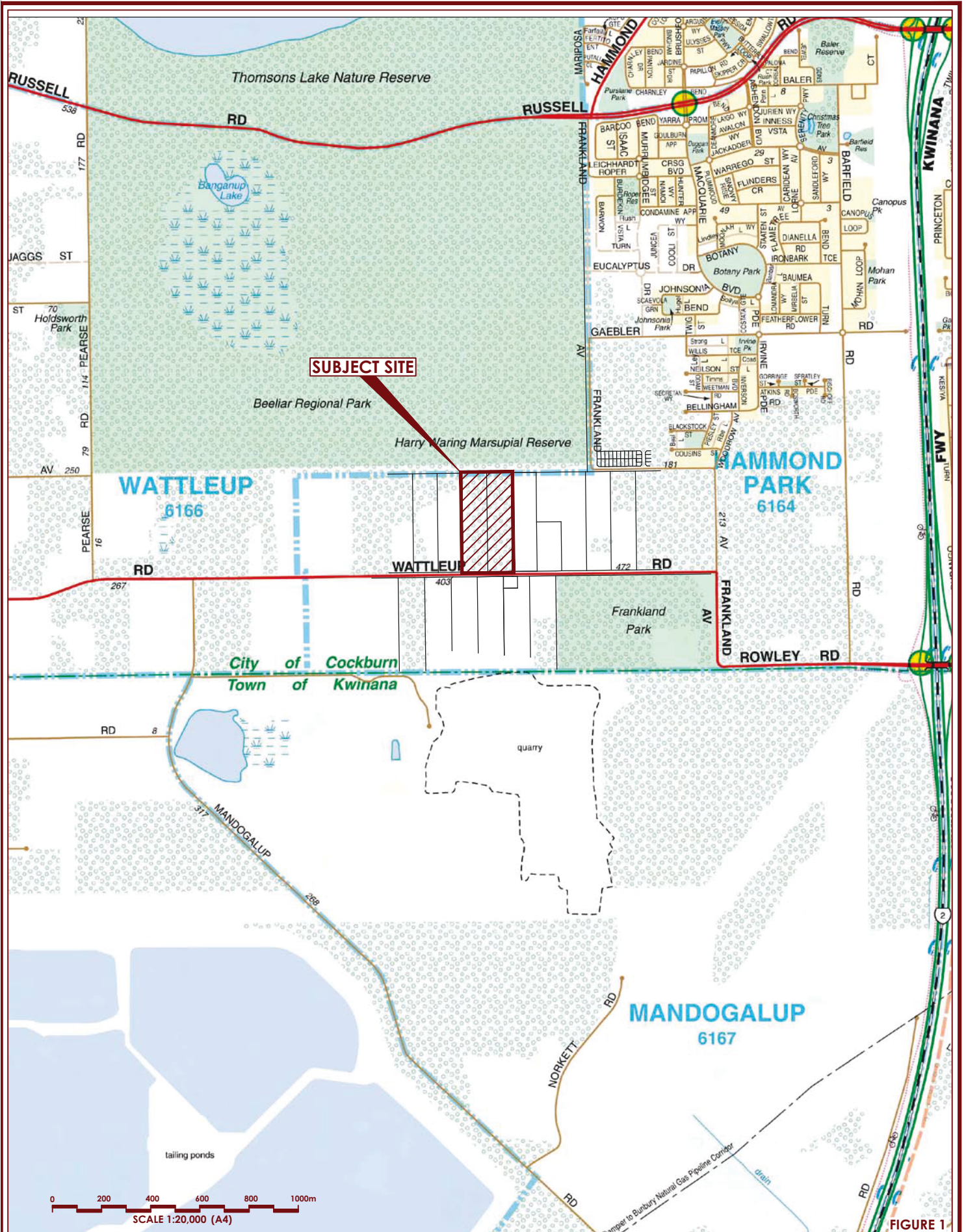


FIGURE 1



Planner: JD
Client: OPE HAM/EGD WAT

Date: 26.11.14
Plan No: OPE HAM 9-01

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LOCATION PLAN
LOTS 109 & 110 WATTLEUP ROAD
HAMMOND PARK
CITY OF COCKBURN



0 20 40 60 80 100m
SCALE 1:3,000 (A4)

FIGURE 2



Planner: JD Date: 26.11.14
Client: OPE HAM/EGD WAT Plan No: OPE HAM 9-01

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AERIAL PHOTOGRAPH
LOTS 109 & 110 WATTLEUP ROAD
HAMMOND PARK
CITY OF COCKBURN

1.3 PLANNING FRAMEWORK

1.3.1 Zoning and Reservations

The subject land is currently zoned 'Urban' under the Metropolitan Region Scheme and 'Development' under the City of Cockburn Town Planning Scheme No.3 (TPS3) (refer **Figure 3**).

The objectives of the 'Development' zone under TPS3 are *"to provide for future residential, industrial or commercial development in accordance with a comprehensive Structure Plan prepared under the Scheme."*

Pursuant to the above provision as specified in TPS3 (Clause 4.2.1), structure planning is required prior to subdivision and development of the land.

The subject land is further contained within a Special Control Area, being Development Contribution Area (DCA) 13, under TPS3. As such, development of the land is subject to cost contributions in accordance with Development Contribution Plan 13, as prescribed within Schedule 12 of TPS3.

1.3.2 Southern Suburbs District Structure Plan - Stage 3, Hammond Park

The LSP area is located within the *Southern Suburbs District Structure Plan - Stage 3, Hammond Park (SSDSP3)* area (refer **Figure 4**). The SSDSP3 generally applies to land west of Kwinana Freeway, from Gaebler Road to the north, through to Rowley Road to the south. The SSDSP3 has been adopted by the City of Cockburn as a guiding document only and therefore does not have the endorsement of the WAPC.

SSDSP3 identifies the need for a Local Structure Plan (LSP) to be prepared over the subject land in order to achieve an integrated and coordinated development outcome. The LSP has been designed to integrate with the adjoining proposed LSP, to ensure that the planning objectives for the area are not compromised.

The SSDSP3 designates medium density residential uses over the majority of the land, with a portion identified as Public Open Space (POS). The uses proposed herein reflect those identified under the SSDSP3 by providing a base residential density code of R30, with higher densities adjoining the POS. This LSP coordinates the provision of POS across the two subject landholdings to ensure the 10% POS requirement for each parent lot is achieved, as per the requirements of SSDSP3.

1.3.3 Planning Strategies

Directions 2031 – A Spatial Framework for Perth and Peel

Directions 2031 is a high-level strategic plan that establishes a spatial framework and vision for future growth of the Perth metropolitan and Peel region. It provides direction on the region's projected growing population and guides the detailed planning and delivery of housing, infrastructure and services, to ensure the region is able to respond sustainably to longer term growth pressures. Directions 2031 is a medium-term planning tool, anticipating a city of 3.5 million people by the year 2031.

The objectives of Directions 2031 are based on contemporary community, economic and environmental factors that will likely influence the growth of the Perth region and sets a range of strategic directions to guide decision-making. It provides an indication of how the planning system could accommodate the housing and land supply needs of a city of 3.5 million people by establishing a minimum target density of 15 dwellings per gross urban zoned hectare, for the outer metropolitan sub-regions.

This LSP responds to the goals set out in Directions 2031, providing *19 dwellings per gross hectare* of urban zoned land.

Outer Metropolitan Perth and Peel Sub-Regional Strategy

Sub-regional strategies provide a framework for delivering the objectives of Directions 2031. The draft Outer Metropolitan Perth and Peel Sub-Regional Strategy (OMPPSRS) addresses strategic planning issues in the outer sub-regions, such as long-term land supply, and guides the preparation and review of structure plans. The sub-regional strategy provides information about the level of expected population growth in each local government area and estimates the dwelling supply for each sub-region based on currently identified infill opportunities, existing urban and urban deferred zoned land, and potential urban expansion and investigation areas.

The SSDSP3 area (designated 'SOU1' under the OMPPSRS) has been identified as 'urban zoned undeveloped' under the sub-regional strategy, having the capacity to accommodate an additional 3,000+ dwellings. This LSP has therefore been prepared to meet the objective of achieving housing targets in the south-west sub-region.

1.3.4 Policies

State Planning Policy 3 (SPP3): Urban Growth and Settlement

SPP3 provides a set of principles and considerations which apply to planning for urban growth and settlement in Western Australia and aims to provide a consolidated and sustainable built form.

This Structure Plan has been prepared in accordance with SPP3, and can provide for a range of housing options on highly serviceable land, with good access to nearby activity centres.

Liveable Neighbourhoods

Liveable Neighbourhoods (LN) is a state-wide development control policy that facilitates the development of sustainable communities. It provides an integrated planning and assessment policy for the preparation of Structure Plans and subdivision designs and represents an alternative performance-based approach to conventional subdivision policies.

Liveable Neighbourhoods requires Local Structure Plans to express density targets as dwellings per site hectare and states that "*in most new urban areas, urban densities of at least 15 dwellings per urban hectare, and an average of 22 dwellings per site hectare, should be provided.*"

This Structure Plan meets the LN density target by providing an average of *32 dwellings per site hectare* of residential zoned land.

This Structure Plan further adopts the principles of LN policy and should be assessed against the objectives and requirements of each of the LN design elements, as outlined below:

1. Community design

The proposal will effectively create a sustainable, safe, vibrant, and efficient built form through a structure that is based on connectivity (with nearby local centres and schools) that supports walking and cycling, to promote a sense of community.

2. Movement network

The proposal provides a safe and efficient movement network that utilises the street design principles of LN. The road network is based upon integration with existing Wattleup Road that forms the perimeter of the subject land and opportunities to link the subject land with surrounding developments.

3. Lot layout

The lot pattern is generally based on a traditional grid to maximise the number of east/west or north/south lots for best opportunities for climate responsive design, whilst also facilitating a highly permeable and legible street layout. The LSP provides for a range of residential lot options, with densities concentrated around the area of POS to the south of site.

4. Public parkland

The POS comprises 10.64 % of the subdivisible area, features integrated drainage, and is effectively surveilled by surrounding development.

5. Urban water management

The proposal maximises local recharge of water by utilising integrated drainage basins incorporated within the POS and the co-location of flood storage areas with natural landforms and native remnant vegetation where possible, to ensure an integrated water management approach for site drainage.

6. Utilities

The proposal has been designed to accommodate all normal servicing infrastructure requirements.

7. Activity centres and employment

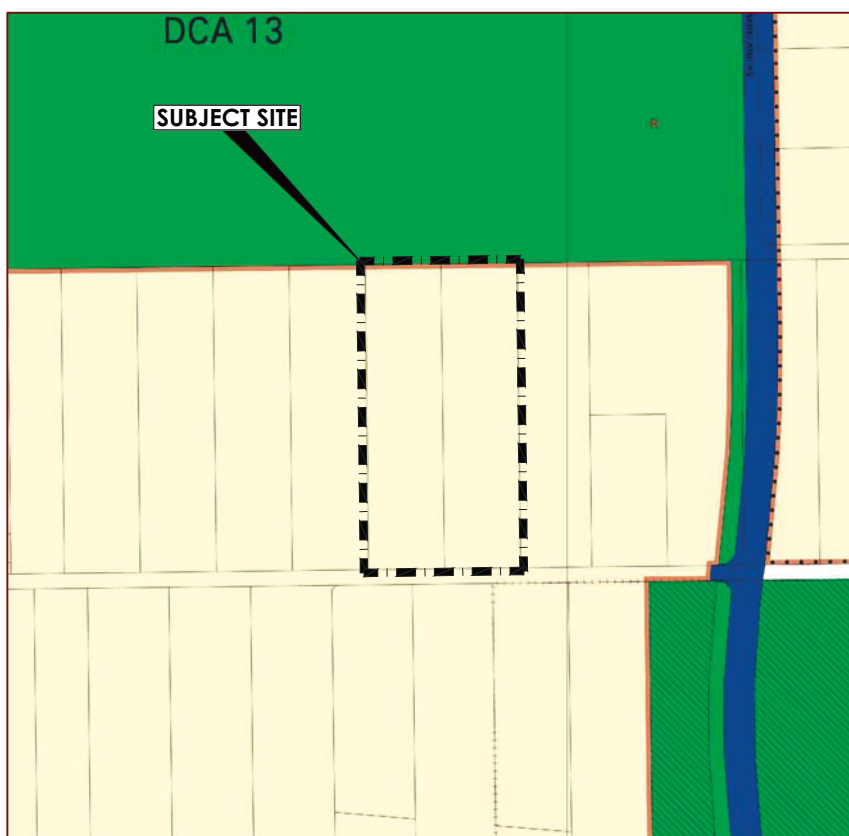
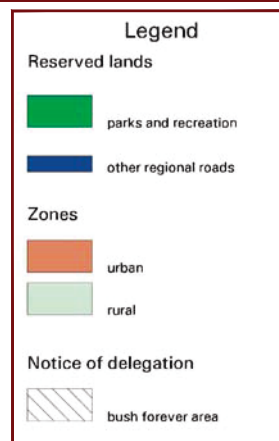
The subject site contains no activity or employment centres, but is located within 2km of two local centres. The residential densities prescribed herein have been designated with high level of serviceability in mind.

8. Schools

The subject site contains no school sites, but is located approximately 150m east of a public primary school site, and approximately 800m west of a private primary school and public high school site. This structure plan has been designed to provide an appropriate interface and connection with the nearby public primary school.



METROPOLITAN REGION SCHEME



CITY OF COCKBURN LOCAL PLANNING SCHEME



FIGURE 3



Planner: JD Date: 26.11.14
Client: OPE HAM/EGD Warrian No: OPE HAM 9-01

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ZONING
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PLAN NOTES

1. FUTURE RESIDENTIAL DEVELOPMENT SHALL NOT DIRECTLY ABUT ROWLEY ROAD. FUTURE LOCAL STRUCTURE PLANNING IS TO DEMONSTRATE A SUITABLE INTERFACE TREATMENT (E.G. ENLARGED SERVICE ROAD DESIGN WITH FRONTING RESIDENTIAL DEVELOPMENT AS A MINIMUM) BEING PROVIDED TO THE FUTURE ROWLEY ROAD FREIGHT ACCESS ROUTE.
2. FUTURE ACCESS ROAD TO BE PROVIDED AS A FULL INTERSECTION UNTIL ROWLEY ROAD IS UPGRADED AND CONSTRUCTED TO A REGIONAL ROAD AT WHICH TIME THE INTERSECTION WILL BE CONVERTED AND MAINTAINED AS LEFT IN/LEFT OUT ACCESS ONLY. (SUBJECT TO MAIN ROADS WA APPROVAL).
3. AS PART OF THE UPGRADE OF ROWLEY ROAD, GRADE SEPARATED PEDESTRIAN AND VEHICULAR ACCESS IS TO BE PROVIDED AS A CONTINUATION OF BARFIELD ROAD, IN ORDER TO MAINTAIN CONNECTIVITY BETWEEN FUTURE DEVELOPMENT TO THE SOUTH OF ROWLEY ROAD. THIS MAY BE FURTHER RATIONALISED THROUGH SUBSEQUENT LOCAL STRUCTURE PLANNING TO DETERMINE HOW THIS SPECIFIC ACCESS IS CREATED.
4. FUTURE STRUCTURE PLANNING OF THE CELL SOUTH OF WATTLEUP ROAD MUST PROVIDE AN APPROPRIATE INTERFACE WITH RESIDENTIAL DEVELOPMENT NORTH OF WATTLEUP ROAD. THIS IS TO HAVE PARTICULAR REGARD TO THE POSITION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION IN RESPECT OF ITS POSITION ON THE ACCEPTABILITY (OR OTHERWISE) OF RESIDENTIAL DEVELOPMENT SOUTH OF WATTLEUP ROAD, AND ALTERNATIVE (NON-RESIDENTIAL) LAND USES THAT MAY BE REQUIRED. ANY IMPACTS ASSOCIATED WITH THE FUTURE DEVELOPMENT OF NON-RESIDENTIAL LAND USES IN THE CELL SOUTH OF WATTLEUP ROAD MUST BE FULLY CONTAINED WITHIN THE CELL BOUNDARIES.
5. NEIGHBOURHOOD CENTRE - THE DESIGN AND FUNCTION OF THE PROPOSED NEIGHBOURHOOD CENTRE SHALL BE BASED ON 'MAIN STREET' PRINCIPLES AND RELEVANT PROVISIONS OF LIVEABLE NEIGHBOURHOODS. ANY ASSOCIATED LOCAL STRUCTURE PLAN MUST ADEQUATELY DEMONSTRATE THROUGH CONCEPT PLANS AND/OR DETAILED AREA PLANS THE MANNER IN WHICH THE CENTRE ADDRESSES THE REQUIREMENTS OF THE RELEVANT SECTIONS OF THE SOUTHERN SUBURBS DISTRICT STRUCTURE PLAN - STAGE 3 REPORT, AND PARTICULARLY THE NEIGHBOURHOOD CENTRE CONCEPT PLAN PROVIDED WITHIN THE REPORT DOCUMENT.
6. NEIGHBOURHOOD NODES - THE DESIGN AND FUNCTIONALITY OF THE NEIGHBOURHOOD NODES SHALL BE DISTINCTLY DIFFERENT TO THE PRIMACY OF THE NEIGHBOURHOOD CENTRE. THESE LOCATIONS ARE TO PROVIDE FOR A RANGE OF MORE LOCALLY FOCUSED ACTIVITIES AND FUNCTIONS. WHERE RETAIL IS PROPOSED, THESE ARE TO NOT EXCEED A MAXIMUM RETAIL FUNCTION OF 300SQM, WITH SUCH FUNCTION BASED UPON A 'CONVENIENCE STORE' TYPE USE.
7. CENTRAL PRECINCT - A COMPREHENSIVE LOCAL STRUCTURE PLAN WILL BE REQUIRED FOR THE CENTRAL NEIGHBOURHOOD CENTRE AND ADJACENT DEVELOPMENT. THE CITY WILL NOT CONSIDER INDIVIDUAL STRUCTURE PLANS IN THIS LOCATION DUE TO THE NEED TO ENSURE THE SUITABLE INTEGRATION OF DEVELOPMENT.

GENERAL NOTES

- A. ALL LOCAL STRUCTURE PLANS MUST INCLUDE AND BE INFORMED BY:
- i) DETAILED LWMS BASED UPON REGIONAL DRAINAGE STUDY.
 - ii) DETAILED NOISE MANAGEMENT STRATEGY WHERE LSP ADJOINS ROWLEY ROAD.
 - iii) FIRE MANAGEMENT PLAN WHERE LSP IS LOCATED NEAR ROS OR SIGNIFICANT POS.
 - iv) FLORA AND FAUNA MANAGEMENT PLAN.
 - v) TRAFFIC MANAGEMENT PLAN.
 - vi) CONTAMINATED SITES & ACID SULPHATE SOILS MANAGEMENT PLAN WHERE REQUIRED.
 - vii) HERITAGE STUDY WHERE LSP INCLUDES FORMER HISTORIC TRAMWAY.
 - viii) TRANSITION AND/OR INTERFACE STRATEGY IN RESPECT OF EXISTING RURAL USES.
 - ix) NEIGHBOURHOOD CENTRE CONCEPT PLAN AND DETAILED AREA PLAN WHERE INCLUDED WITHIN LSP AREA.
 - x) NEIGHBOURHOOD NODE CONCEPT PLAN AND DETAILED AREA PLAN.
- B. LOCAL STRUCTURE PLANS
SUBDIVISION AND DEVELOPMENT OF THE SUBJECT AREA IS TO BE IN ACCORDANCE WITH AN ENDORSED APPLICABLE LOCAL STRUCTURE PLAN.

C. PUBLIC OPEN SPACE AND DRAINAGE
PUBLIC OPEN SPACE AREAS ARE INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN AND MODELLING AT THE LOCAL STRUCTURE PLAN STAGE. ALL LOCAL STRUCTURE PLANS MUST ALSO INCORPORATE A LOCAL WATER MANAGEMENT STRATEGY TO DEMONSTRATE THE MANNER IN WHICH DRAINAGE CAN BE SELF CONTAINED WHILST TAKING INTO CONSIDERATION THE DISTRICT/REGIONAL DRAINAGE OBJECTIVES, AND ENSURING BEST PRACTICE WATER SENSITIVE URBAN DESIGN. THE FUNCTIONALITY OF OPEN SPACE FOR INFORMAL ACTIVE RECREATION MUST ALSO BE CONSIDERED AS PART OF FUTURE OPEN SPACE AND DRAINAGE CO-PLANNING.

D. RESIDENTIAL
i) USES WITHIN THE RESIDENTIAL AREAS ARE AS PER THE CITY OF COCKBURN'S TOWN PLANNING SCHEME NO.3 USE CLASS TABLE.
ii) RESIDENTIAL DENSITIES ARE INDICATIVE ONLY AND SHALL BE REFINED AT THE LOCAL STRUCTURE PLAN STAGE IN ACCORDANCE WITH THE LOCAL CRITERIA AS DEFINED WITHIN THE ASSOCIATED SOUTHERN SUBURBS DISTRICT STRUCTURE PLAN - STAGE 3 REPORT.
iii) THE BASE CODING/MINIMUM DENSITY APPLICABLE TO THE DISTRICT STRUCTURE PLAN AREA IS TO BE CONSISTENT WITH DIRECTIONS 2031 IN REQUIRING GENERALLY 15 DWELLINGS/HA AND 25 DWELLINGS/HA IN AREAS NEAR 'CENTRES' AND AREAS OF 'AMENITY'.

E. DEVELOPMENT CONTRIBUTIONS
DEVELOPMENT IN THIS AREA IS ALSO SUBJECT TO DEVELOPMENT CONTRIBUTIONS. SCHEDULE 12 OF TOWN PLANNING SCHEME NO. 3 DETAILS DEVELOPMENT CONTRIBUTION AREA PROVISIONS. PERSONS OR COMPANIES PROPOSING TO UNDERTAKE SUBDIVISION IN THIS AREA SHOULD REVIEW SCHEDULE 12 AND ALSO CONTACT THE CITY'S STRATEGIC PLANNING TEAM TO ASCERTAIN THERE ARE NO PENDING AMENDMENTS TO THIS SCHEDULE.

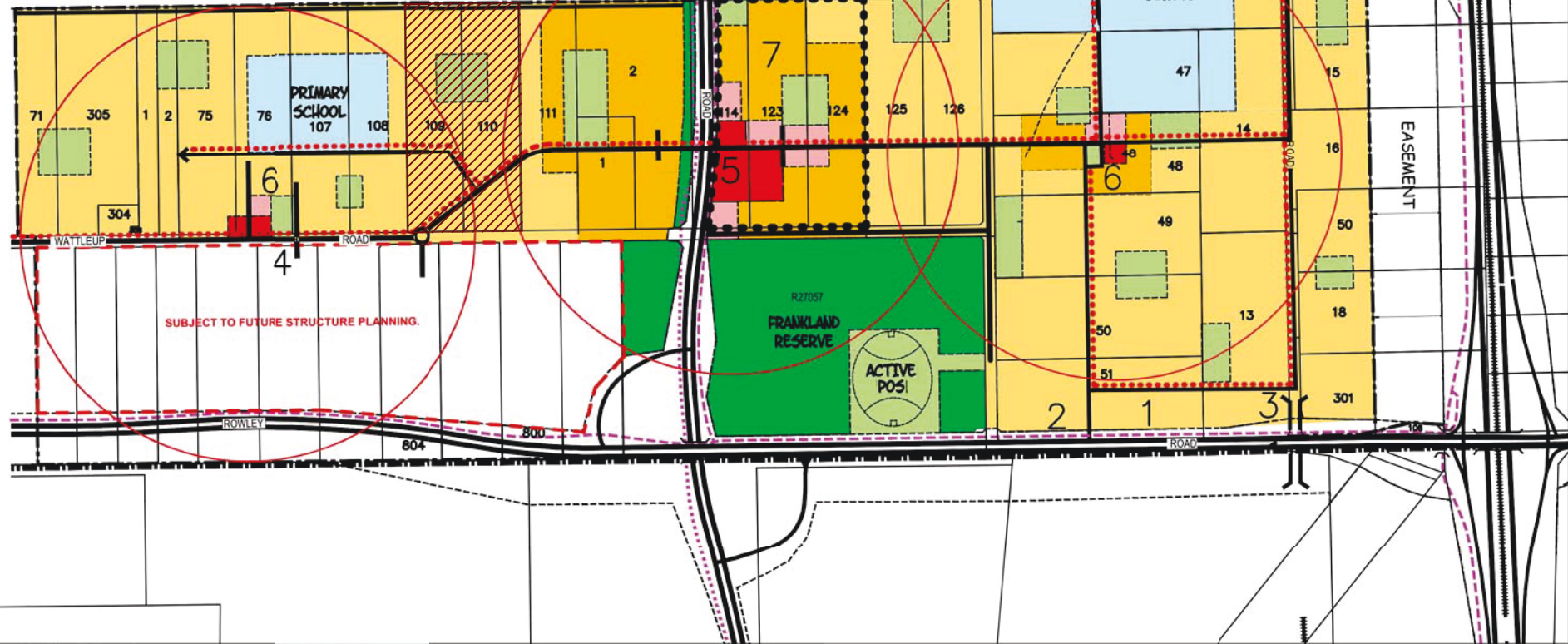


FIGURE 7



GNA 2/05

0 250m
SCALE 1:12,500

Residential Density
High
Medium

Local Centre (Pedestrian Based Retail)
Mixed Business / Commercial / Home Based Business
Community Facilities / Schools etc
Conservation Category
Wetland* * In accordance with DEC Geomorphic Wetlands Swan Coastal Plain dataset

Key Open Space Areas:
Public Open Space
Regional Open Space

Key Road Structure (Existing and Proposed)
Major Shared Path
Historic Baldivis Tramway Trail
400m Walkable Catchment
Central Precinct

SOUTHERN SUBURBS
DISTRICT STRUCTURE PLAN
- STAGE 3, HAMMOND PARK / WATTLEUP

All areas and dimensions are subject to survey, engineering and detailed design and may change without notice.
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FIGURE 4



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TOWN PLANNING + URBAN DESIGN

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www.burgessdesigngroup.com.au

P (08) 9328 6411
F (08) 9328 4062

LEGEND

SUBJECT LAND



NORTH
NOT TO SCALE

SOUTHERN SUBURBS DISTRICT STRUCTURE PLAN
LOTS 109 & 110 WATTLEUP ROAD
HAMMOND PARK
CITY OF COCKBURN

Planner: JD
Client: OPE HAM/EGD WAT

Date: 26.11.14
Plan No: OPE HAM 9-01

2. SITE CONDITIONS AND CONSTRAINTS

The following section provides a summary of the key site characters. A Context Plan (**Figure 5**) has also been prepared to illustrate the opportunities and constraints that drove the design response to the site and context analysis.

2.1 SITE HISTORY

Based on a review of historic aerial photography, the majority of the site has remained fully vegetated since at least 1953. There does not appear to be any historic evidence of on-site activities (e.g. market gardening) within the site that would raise considerations relating to potential soil and/or groundwater contamination.

A search of the Department of Environment Regulation's (DER) Contaminated Sites Database and Register (DER, 2013) found there to be no registered sites within or immediately adjacent to the site.

2.2 BIODIVERSITY AND NATURAL AREA ASSETS

A range of environmental investigations have been carried out by Emerge Associates to determine the biodiversity values and natural area assets within the LSP area. The environmental assessment (**Appendix 2**) provides information regarding the environmental attributes and values of the site. It is based on a range of information sources including local and regional reports, databases and publically available mapping, and where available, site specific surveys and investigations.

The environmental assessment has been supported by the following technical investigations:

- Groundwater level and quality monitoring;
- Flora and vegetation surveys (conducted over July and October 2014) and preparation of a *Level 2 Flora and Vegetation Report* (Emerge Associates 2014);
- Fauna survey (August 2014) and preparation of a *Fauna Assessment* (Greg Harewood 2014).

2.2.1 Vegetation

The site contains extensive remnant native vegetation (refer **Figure 2 – Aerial Photograph**), consisting mainly of low Banksia woodland. Vegetation condition ranges from 'Completely Degraded' to 'Excellent'. A Priority 1 Flora species *Eremaea asterocarpa* subsp. *Brachyclada* and a Priority 4 Flora species *Dodonaea hackettiana* was found within the site. These Priority Flora species are known from the local area with the Priority 4 flora species recorded in the adjoining Harry Waring Marsupial Reserve, immediately north of the site, and the Priority 1 flora species recorded east of the site in Wandii.

No Threatened Flora, Threatened Ecological Communities or Priority Ecological Communities were found within the site.

2.2.2 Fauna

Fauna habitat values over the site are relatively good, given the presence of largely intact remnant vegetation however, biodiversity values would have been reduced to a certain degree due to overall fragmentation of vegetation within the wider area by the establishment of market garden operations, residential development and road construction.

One threatened fauna species was observed at the site, being *Carnaby's Black-Cockatoo* and diggings attributed to the southern brown bandicoot (or *Quenda*), a Priority 5 species, was also observed. The habitat tree assessment identified only five trees of suitable size (Diameter at Breast Height >50 cm) to support the Black-Cockatoo, however none of these trees appeared to have hollows associated with Black-Cockatoos.

Given the presence of high value fauna habitat within the adjacent Harry Waring Marsupial Reserve, the removal of vegetation for development is not expected to have a significant impact on local fauna. However, due to the presence of foraging habitat for Carnaby's Black-Cockatoo, the proponent will need to consider their potential obligations pursuant to the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), prior to commencing development.

2.3 LANDFORM AND SOILS

The majority of the site is underlain by Tamala Limestone with Bassendean Sands in the north east corner of the site (Gozzard 1983) with soils consisting of highly permeable sands.

ASS risk mapping (Landgate 2014) indicates a small area of the north-east of the site as having a 'moderate to low risk' of ASS being present within 3 m of the natural surface. The rest of the site has no known risk of ASS being present within 3 m of the natural surface. It should be noted that any urban development must meet the requirements of the Western Australian Planning Commission's *Acid Sulphate Soils Planning Guidelines of September 2010*.

The current surface level of Lots 109 & 110 ranges from RL 48.0 m AHD in the south east, to RL 38.0 m AHD in the south west, to RL 28.0 m AHD in the north east, with the site reaching its highest elevation in the center of the south-west of Lot 109 at 48.0 m Australian height datum (AHD). Topography slopes away from this high point to the south-west and north-east. The lowest elevation is seen in the north-east corner of the site at 28.0 m AHD.

Development Engineering Consultants (DEC), the project engineers, have advised that based on preliminary earthwork planning, there is likely to be significant site level constraints with level differences between future lot levels and the existing Wattleup Road. The existing Wattleup Road is undulating and surface levels are somewhat fixed at approximately RL 44.0 m AHD adjacent to lot 110 and 38.0 m AHD adjacent to Lot 109, until further development proceeds south of Wattleup Road. This poses some difficulties in achieving acceptable access to the subject land from Lot 110, with access being restricted from Wattleup Road to future lots within Lot 110, until such time as changes are made to the Wattleup Road surface level. Vehicular access from Wattleup Road will therefore need to be provided initially via Lot 109, where the level of Wattleup Road is at RL 38.0 m AHD, making it the most practicable location to incorporate site access whilst also ensuring an acceptable contour to work with across the site.

2.4 GROUNDWATER AND SURFACE WATER

Department of Water (DoW) historical groundwater data recorded at DoW's long term monitoring bore, located 300m from the north-east corner of the site, recorded an historical Maximum Groundwater Level (MGL) of 20.1 m AHD (DoW 2014). Based on the existing topography of the site, depth to MGL therefore ranges from 7.9m to 27.9m below ground level (BGL). The significant depth to groundwater and lack of historical development of the site results in minimal risk to groundwater quality and therefore additional monitoring to support the LSP is not required (M. Hingston [DoW] 2014, pers. comm., 5th June) (refer **Appendix 5 - LWMS**).

The high permeability of the underlying sands and the vegetation coverage has resulted in no natural channels forming over the site and reinforces that the majority of surface runoff will infiltrate at source. There are also no defined streamlines or floodways within the site, with surface runoff from extreme rainfall events likely to be seen as sheet flow directed towards the north-east and south-west corners of the site, as dictated by the natural topography.

2.5 BUSHFIRE HAZARD

A key issue affecting the site is the interface with the adjoining Bush Forever Area to the north. In response to this concern, a bushfire hazard assessment has been carried out and a Bushfire Management Plan (BMP) prepared by Emerge Associates (refer **Appendix 3**).

The site is surrounded by Urban zoned land with the exception of Bush Forever Site No.392 immediately north of the subject land. A vegetation class map has been included as part of **Appendix 3** outlining the existing vegetation classifications on the study site and in the surrounding 100m assessment area. The vegetated Harry Waring Marsupial Reserve adjoining the site to the north (Bush Forever Site No.392), poses the majority of bushfire hazard.

Post-development vegetation mapping has also been prepared under **Appendix 3**, which outlines the dominant vegetation types that will remain within the site and surrounding area (within 100m) after development has been completed.

The Harry Waring Marsupial Reserve (Bush Forever Site No. 392) contains extensive woodland vegetation that will pose a long term bushfire hazard for residential development. Neighbouring vegetation to the west and east of the site will pose only a temporary hazard to development due to the temporary nature of the vegetation. These areas are subject to future urban development in accordance with the approved *SSDSP3*, and once vegetation is removed to accommodate development, the hazard will no longer apply.

2.6 CONTEXT AND OTHER LAND USE CONSTRAINTS

The opportunities and constraints associated with the LSP and surrounding land uses, as discussed in the above section, have been broadly defined in the Context Plan (**Figure 5**) and are summarised briefly in Table 3 below.

TABLE 3: OPPORTUNITIES AND CONSTRAINTS

Opportunities	Constraints
Site located within the 400m catchments of Local Centres under SSDSP3	Topography of subject land - Natural Surface Levels need to be reduced to support service provider requirements
Proximity of Primary School site under SSDSP3	Timing of Rowley Road extension and downgrade of Wattleup Road
Wattleup Road realignment as main east-west road link - internalised pedestrian based main street	Wattleup Road realignment as shown under SSDSP3
Interface with the Harry Waring Reserve (Bush Forever Site No. 392)	Interface with the Harry Waring Reserve (Bush Forever Site N. 392) to provide for both BPZ separation distances and increased construction standards as per AS3959-2009
Natural low point located adjacent to Harry Waring Reserve – drainage and POS interface	Servicing of the site is reliant on adjoining development to the east (extensions from eastern development)
Opportunity for increased density overlooking POS	Existing Wattleup Road level remains unchanged

The opportunities and constraints mapping (**Figure 5**) helps to illustrate the specific site characteristics that have been considered to determine the areas for traditional residential uses, higher density codes, feasible road connections and the location of public open space.

Three key issues were identified through the technical investigations. The first being servicing constraints associated with the topography of the site, the second being the design impact of the realignment of Wattleup Road as shown under the Southern Suburbs District Structure Plan, and the third being the interface with bushfire prone areas adjoining the site.



LEGEND - CONTEXT & OPPORTUNITIES

- ① 400m walkable catchment to Local Centre.
- ② Primary School Site as per SSDSP.
- ③ Linkage to Wattleup Road.
- ④ Wattleup Road realigned as per SSDSP 3.
- ⑤ Hammond Road (Other Regional Road) linkage to regional road network.

- ⑥ Controlled intersection at Hammond and (realigned) Wattleup Roads.
- ⑦ Wattleup Road to be downgraded & terminated.
- ⑧ Submission made on adjoining LSP - laneway to be removed.
- ⑨ Bush Forever Site 392 - bush fire prone area.
- ⑩ Access onto Wattleup Road restricted.

- [] Structure Plan Boundary
- Laneway
- Restricted Access
- Left in/Left out
- Shared Path
- Wattleup Road Downgrade & Termination (long term)
- Wattleup Road Realignment (SSDSP 3)
- Other Regional Road

- 400m Walkable Catchment
- Bushfire Prone Area
- Road Connectivity
- 38.0 Proposed reduced level
- 39.0 Existing road level
- H High Point
- L Low Point

Land Use

- Residential
- Local Centre
- Mixed Use
- Development Zone (TPS 3)

Local Scheme Reserves

- Public Open Space
- Parks & Recreation (MRS)
- Community Facilities/Schools

FIGURE 5



All areas and dimensions are subject to survey, engineering and detailed design and may change without notice. © Copyright of Burgess Design Group.

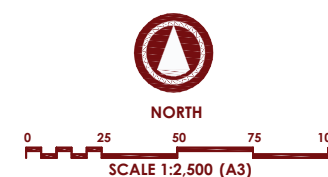
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PO Box 8779, Perth Business Centre 6849
www.burgessdesigngroup.com.au

P (08) 9328 6411
F (08) 9328 4062

Planner: JD
Client: OPE HAM/EGD WAT

Date: 26.11.14
Plan No: OPE HAM 9-01



CONTEXT PLAN
LOTS 109 & 110 WATTLEUP ROAD
HAMMOND PARK
CITY OF COCKBURN

3. LOCAL STRUCTURE PLAN

3.1 DESIGN PHILOSOPHY

The *Lots 109 & 110 Local Structure Plan* has been guided by the development principles contained within the *Southern Suburbs District Structure Plan Stage 3 - Hammond Park* (SSDSP3). Ultimately, this LSP will establish a variety of accommodation types, giving future residents a range of housing options regardless of their age or housing preference, thereby providing a varied population and creating a greater sense of community.

The detailed environmental, engineering, traffic, water management and fire management studies have been prepared for the subject site and can be found as the appendices. These technical reports should be read in conjunction with this structure plan to better understand the site characteristics that have influenced and shaped the LSP design.

3.2 LAND USE

The land uses proposed under this Local Structure Plan are in accordance with those outlined in the SSDSP3, with land intended primarily for medium density residential development, including two areas of Public Open Space.

The LSP is based on a logical and permeable network of streets that will combine to create a pleasant walking/cycling environment. Higher residential densities are envisaged in those areas with higher amenity, especially where future lots will overlook an area of Public Open Space.

The LSP showing the proposed land uses can be found in **Plan 1** (statutory) and **Figure 6** (non-statutory).

3.3 RESIDENTIAL

In accordance with the SSDSP3, this LSP comprises of a range of medium residential densities ranging from Residential R30 through to Residential R60.

The LSP aims to accommodate approximately 152 residential lots, including up to five duplex sized lots within an R50 zone in the south-east corner of the site. A total of 157 dwellings are expected achieving an overall residential site density of approximately **32 dwellings units per site hectare**.

It should be noted that estimated dwelling yields have been based on the assumption that there is potential for the R50 site to be further subdivided following the lowering of Wattleup Road. The structure plan should therefore ultimately accommodate approximately 439 residents, if fully developed. Population is based on the latest ABS data for household size which indicates an average of 2.8 people per dwelling within the municipality of Cockburn.

The target housing yield set by the SSDSP3 and LN will be achieved, even if the R50 site is not further subdivided.

3.3.1 Density

The application of densities are as prescribed under section 5.4.1 'Housing Principles' of the SSDSP3 report, and the locational criteria set out below:

Locational Criteria - Medium Density - Residential R30

1. Residential R30 will be the minimum base coding over the SSDSP3 area. The R30 density allows for the provision of traditional front-loaded single dwelling lots, ranging upwards from 260m².

Locational Criteria - Medium Density - Residential R50 and R60

1. Generally surrounding areas of high amenity, such as open space;
2. Located so as to maximise access to and use of services and facilities such as public open space, activity nodes and public transport routes; and
3. Located to enhance passive surveillance of public spaces.

Owing to the active area of POS in the south, the proposed increased density of adjoining lots to R60 (laneway) and R50 (homestead site) is in accordance with the criteria for varying the R30 base coding. This POS area provides a betterment function to smaller housing products, which, in return, enhances passive surveillance.

The densities proposed under Plan 1 indicate a good range of housing products will be made available.

3.3.2 Lot Layout

The proposed lot pattern is generally based on a traditional grid to maximise the number of east/west and north/south facing lots, for best attempts at climate responsive design, whilst also facilitating a highly permeable and legible street layout.

The layout has been orientated such that it can provide effective surveillance of (and achieve an effective relationship with) the public domain such as the streets, future bus routes and the local and regional open spaces. The proposed street pattern has been influenced by the need to achieve effective solar orientation for dwellings whilst considering the topography of the site and interface with and layout of the adjoining LSP area to the east.

3.4 PUBLIC OPEN SPACE

A Public Open Space (POS) schedule, in accordance with *Liveable Neighbourhoods* (LN) requirements, is provided at Table 4 below, and should be read in conjunction with the associated Landscape Master Plan (**Appendix 7**) prepared by Emerge Associates. The Landscape Master Plan is an indicative plan to illustrate the general principles and intent of the Public Open Space areas.

Whilst the proposed POS areas within the LSP modifies that originally proposed under the adopted SSDSP3, it maintains the original SSDSP3 objective of ensuring an equal 10% provision of open space across all landowners. POS within the LSP area comprises two (2) Public Open Space (POS) areas, one north and one south, totalling 0.8559 hectares (ha). The northern POS area is 3,700m² in size and the southern POS area is 5,368m² (refer to **Figure 6**).

The functionality of the POS areas evolved as a greater understanding of the site's topographical and land use constraints emerged. The SSDSP3 also provides scope for further rationalisation of the distribution of POS. The location of POS prescribed herein is considered appropriate as it:

- Allows for a cohesive and integrated approach to the provision of POS between the subject LSP and the proposed LSP over the adjoining *Lot 111 Wattleup Road*;;
- Accommodates drainage, as dictated by the natural topography, within a usable landscaped area to create amenity for residents;
- Encourages maximum surveillance of POS and bushland areas to discourage opportunities for criminal activities;
- Provides a green interface between residential uses and the adjacent Harry Waring Reserve;
- Reduces the impact of bushfire hazards associated with Harry Waring Reserve by providing a managed landscape buffer between the hazard and future assets; *and*
- Manages the interface with the existing Wattleup Road and the changes in surface levels across the site.

The total POS area meets the minimum 10% provision for each landowner as outlined in the SSDSP3 and Element 4 of Liveable Neighbourhoods. The proposed LSP provides a total of 10.64% creditable POS (refer Table 4).

The City of Cockburn will manage the long term maintenance of the parkland and reserves that fall within POS areas.

TABLE 4: PUBLIC OPEN SPACE SCHEDULE

Lots 109 & 110 Wattleup Road POS Schedule			
		ha	ha
A	Gross Area		
	Lot 109 Wattleup Road	4.0469	
	Lot 110 Wattleup Road	4.0469	
	TOTAL		8.0938
	Less Environmental/Ecological Considerations		
	Non Creditable open area's (1:1 drainage)	0.0509	

B	TOTAL	0.0509
C	NET SITE AREA (A-B=C)	8.0429
Non-Residential Deductions		
D	Nil	Nil
	TOTAL	0.0000
E	Net Subdivisible Area (C-D=E)	8.0429
F	10% Requirement (10% of E = F)	0.8043
POS Requirement		
G	Minimum 80% Unrestricted Open Space (80% of F=G)	0.6434
H	Maximum 20% Restricted Open Space (20% of F=H)	0.1609
POS Provided		
U	Total Unrestricted Open Space (T)	0.7234
V	Total Restricted Open Space (S)	0.1214
W	Creditable Restricted Open Space (to a max H)	0.1214
X	Total Unrestricted + Creditable Restricted POS Provided (U+W)	0.8448
Y	Total Unrestricted POS + Creditable POS (X/E)	10.50%
Z	Surplus POS Area (X-F)	0.0405

3.5 MOVEMENT NETWORK

A Transport Assessment Report has been prepared by Transcore over Lots 109 & 110 Wattleup Road, to estimate the generation and distribution of traffic associated with future development (refer to **Appendix 4**). Importantly, the proposed LSP area will gain access from the existing Wattleup Road in the short term. The LSP will later have connections to the broader network via adjacent landholdings to the east and west, which is subject to separate LSP approval, through an east-west spine road.

A summary of the key transport findings is included below.

3.5.1 Existing Road Network

The current road network comprises only Wattleup Road, forming the southern boundary of the subject site. The broader regional road network comprises Rowley Road to the south,

Rockingham Road to the west, Frankland Avenue to the east and the Kwinana Freeway further east.

Wattleup Road is classified as a District Distributor A Road in the Main Roads WA Functional Road Hierarchy document and is currently constructed as a rural standard single carriageway road. Wattleup Road provides the only existing access to the subject area, linking the site to the broader regional road network.

Rowley Road is classified as a District Distributor A Road in the Main Roads WA Functional Road Hierarchy document and is currently constructed as a rural standard single carriageway road. Rowley Road provides an east-west connection linking South Western Highway (via Eleventh Avenue in Armadale), Tonkin Highway, Kwinana Freeway and Rockingham Road in Wattleup (via Wattleup Road).

Frankland Avenue is classified as an Access Road in the Main Roads WA Functional Road Hierarchy document and is currently constructed as a rural standard single carriageway road. Frankland Avenue connects Rowley Road to Russell Road.

Kwinana Freeway is classified as a Primary Distributor and is reserved as a Primary Regional Road in the MRS. It is currently constructed as four lanes divided carriageway in this area and has a posted speed limit of 100km/h. The closest freeway interchange is at Rowley Road.

3.5.2 Future Road Network

The proposed road network within the LSP area conforms to a grid-street layout and will be integrated with neighbouring developments to the east and west, as part of the broader SSDSP3, to provide an interconnected and permeable road network. The future road network will consist of the following:

Wattleup Road (realigned)

Wattleup Road transects the site in an east/west direction and is designated as a 'Neighbourhood Connector A' road. Within the SSDSP3 area, this road extends almost the full breadth of the area. As per the SSDSP3, this road is realigned from its existing location and intersects with the extended Hammond Road to the east in the adjoining LSP area.

In future, when Hammond Road is extended further south and connected to Rowley Road through a grade separated intersection, the existing Wattleup Road will be downgraded and will terminate at Hammond Road. The proposed main east-west spine road will become the realigned Wattleup Road.

Rowley Road

Rowley Road has been identified as the future primary freight road to the Naval Base and Kwinana Beach industrial areas. Planning for the area includes the extension of Rowley Road west to Rockingham Road.

Hammond Road

The proposed extension of Hammond Road to the south is not expected in the interim, thus access to the LSP area in the south will be via the existing Wattleup Road alignment until

Hammond Road is upgraded and extended, and following urbanisation of the SSDSP3 development front, west of Hammond Road. Hammond Road will be the key road linking the subject site to the broader regional road network, via the realigned Wattleup Road.

3.5.3 Road Hierarchy

The proposed road hierarchy is based on projected traffic volumes and the classification of roads as per *Liveable Neighbourhoods*. It should be noted that the proposed road reserve widths and treatments under the traffic report are indicative only and will be subject to further adjustment and design during the detailed subdivision planning phases, in consultation with the City of Cockburn and WAPC.

Neighbourhood Connector A

The road network of the LSP area is proposed to connect to the neighbouring landholdings to the east and west through the main east-west spine road, improving the subject sites permeability and connectivity. This east-west spine road is the Wattleup Road realignment and is proposed to connect to Hammond Road through a roundabout intersection. This Road is estimated to carry about 3,000vpd to 4,000vpd through the LSP area. The traffic report proposes a 22m road reserve for the main east-west spine road including on-road cycle lanes and embayed parking bays.

Access Street D

The majority of proposed internal roads widths are 15 metres. All the internal roads are expected to carry less than 1,000vpd and are therefore classified Access Street D in accordance with LN.

Laneway

The proposed width for laneways is 6 metres. Visitor Car parking is to be constructed within the road reserve adjacent to those lots serviced by rear laneways.

3.5.4 Intersection Treatments

In the interim, the LSP area will gain access from the existing Wattleup Road through a priority controlled T-intersection. The entrance road will connect with the realigned Wattleup Road via a 4-way intersection within the western side of the LSP area, which is recommended to be constructed as a roundabout. A left in/ left out intersection treatment is also proposed for the 4-way intersection within the eastern side of the LSP area.

3.5.5 Public Transport

Existing public transport services in the area are limited with the closest bus route 525 and 526 terminating north of Gaebler Road.

It is anticipated that future bus routes 535 and 536 will service the area west of the Kwinana Freeway, including the possibility of future bus stops within 400m of the subject land. The

Public Transport Authority (PTA) has advised that these routes are likely to be operational in 2016, subject to continued development and available funding.

3.5.6 Pedestrian and Bike Network

Pedestrian and cyclist facilities are required along the realigned Wattleup Road in accordance with the *SSDSP3*. As such, a shared path is proposed on one side of the main east-west 'Neighbourhood Connector A' spine road, with a footpath on the other side. Footpaths are also required on at least one side of all other streets.

3.6 BUSH FIRE MANAGEMENT

All areas within 100 metres of the LSP boundary have been assessed for vegetation classification and bushfire hazard rating levels by Emerge Associates, in consultation with Bushfire Safety Consulting (refer **Appendix 3**). It has been determined that all proposed future dwellings will fall within an acceptable level of bushfire risk. Temporary and permanent Building Protection Zone (BPZ) requirements, as well as the predicted Bushfire Attack Levels (BALs), have been assessed and are shown in the Bushfire Management Plan (**Appendix 3 - BMP**).

A portion of the LSP area has been identified as being exposed to a long term bushfire hazard as a result of the adjoining Harry Waring Marsupial Reserve (Bush Forever Site 392) to the north. The appropriate design response to bushfire threat has been to ensure that no residential lots directly abut the Harry Waring Reserve and, as a minimum, residential land uses are to be separated from the reserve by a perimeter road. The road interface further provides access for emergency vehicles, hydrant locations and will act as a strategic fire break.

Neighbouring vegetation to the west and east of the site will pose only a temporary hazard to the development due to the temporary nature of the vegetation. These areas are subject to future urban development in accordance with the approved *SSDSP3*, and once vegetation is removed to accommodate development, the hazard will no longer apply. The lot neighbouring the subject site to the west holds one residential dwelling and a market garden/greenhouse operation. The majority of this lot has been historically cleared to make way for residential and agricultural land uses however, a patch of remnant native woodland vegetation occurs in the north of this lot, adjacent to the north-west corner of the subject site. The landholding immediately east of the site contains relatively intact native regrowth consisting of open woodland.

The mitigation of hazards within areas proposed as Public Open Space (POS) will be largely addressed through the detailed landscaping design and the selection of suitable species. All POS areas will be managed to maintain low fuel levels and therefore pose a low threat status, based on AS 3959 and Planning for Bush Fire Protection Guidelines (WAPC and FESA 2010). The Department Fire and Emergency Service WA (DFES) policy further promotes the placement of reticulated areas, such as public open space areas, adjacent to bush land areas. Given the relatively narrow urban corridor (in the case of this Structure Plan), the placement of open space areas at the edge of the urban corridor can be accommodated without greatly impacting on accessibility.

Areas of 'Moderate' and 'Extreme' bushfire hazard located within 100m of the site have an appropriate setback distance to ensure that the maximum BAL predicted for the site is BAL-19.

The majority of proposed dwellings will be rated BAL-Low, followed by BAL-12.5, BAL-19 and BAL-29. BAL-29 is not exceeded. The exposed dwellings that are located in the bushfire prone areas, as outlined in the BMP (**Appendix 3**), will have the threat mitigated by ensuring those dwellings are compliant with *Australian Standard 3959 Construction of Buildings in Bushfire Prone Areas* (AS 3959).

3.7 WATER MANAGEMENT

The overall water management objective for residential development is to maintain the existing hydrological regime and minimise pollution. The Local Water Management Strategy (LWMS) (**Appendix 5**) design objectives seek to deliver best practice outcomes using a Water Sensitive Urban Design (WSUD) approach, including management approaches for:

- Water conservation;
- Groundwater management;
- Flood mitigation;
- Stormwater quality management.

The key principles of integrated water cycle management that have guided the water management approach for the development include:

- Considering all water sources, including wastewater, stormwater and groundwater;
- Integrating water and land use planning;
- Allocating and using water sustainably and equitably;
- Integrating water use with natural water processes;
- Adopting a whole of catchment integration of natural resource use and management.

The LWMS provides a comprehensive summary of the existing environmental values of the site, that are based on site-specific studies undertaken and review of publicly available data. The characteristics and environmental values of the site, along with National and State policies and guidelines relevant to urban water management, have guided the water management design criteria and propose a contemporary best practice approach to achieving the design objectives for water management.

The Water Sensitive Urban Design (WSUD) approach and measures that are proposed for the development include:

- Maintaining existing flow regimes by retaining all runoff within the site;
- Runoff retention as high in the catchment as possible;
- Treatment of surface runoff prior to infiltration to groundwater;
- Bio-retention areas incorporated into POS areas;
- Major event flood storage requirements addressed within POS areas;
- Co-location of flood storage areas with natural landforms and native remnant vegetation where possible;
- Adopting appropriate non-structural best management practices;
- Adopting a fit-for-purpose water use approach;
- Minimising use of both scheme and non-potable water.

The LWMS demonstrates that the design approach for the development is consistent with a best practice WSUD approach, that the water management objectives for the site can be

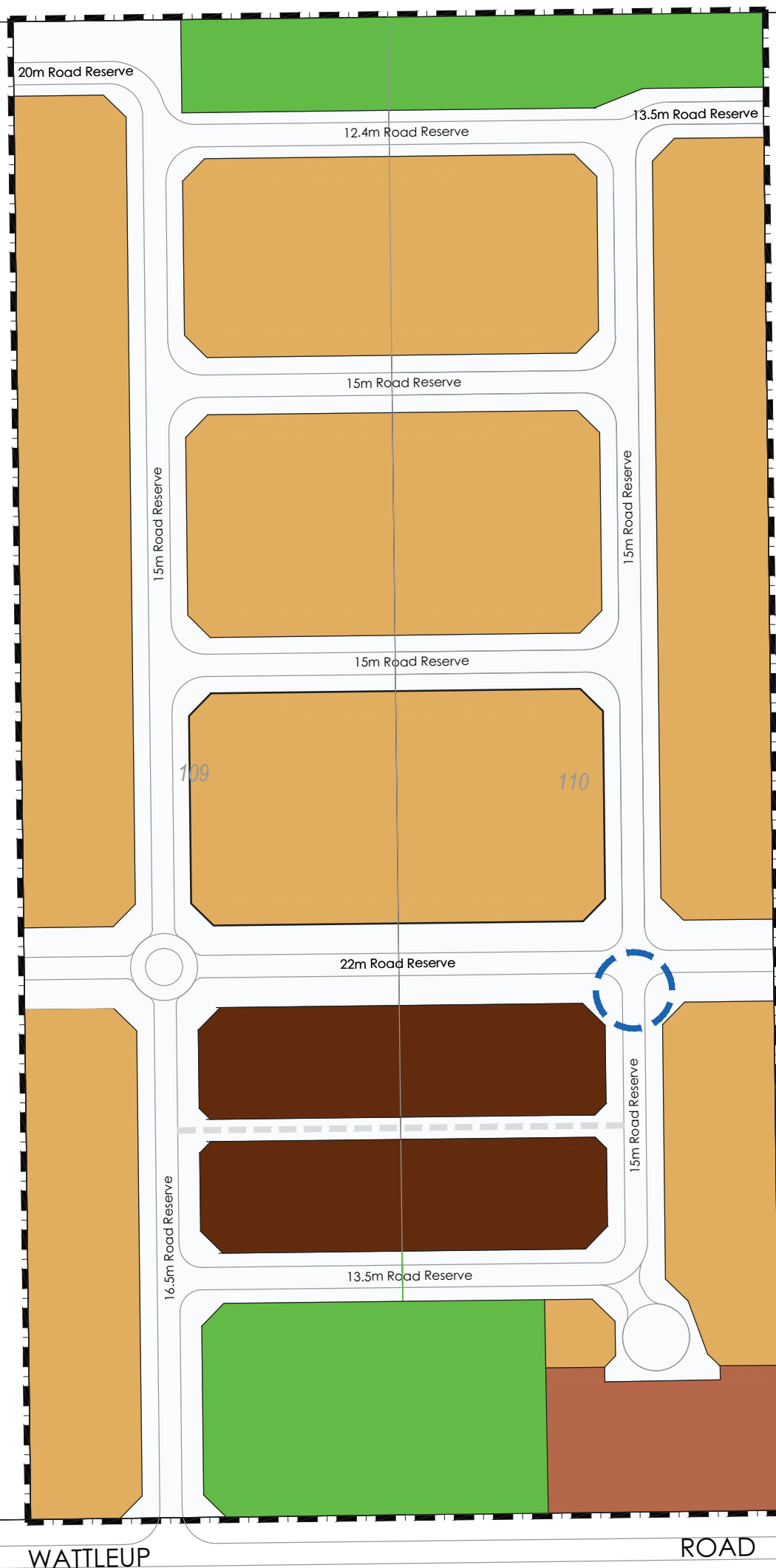
achieved within the spatial allocation of the LSP, and that the requirements of the relevant State and local government policies and guidelines will be satisfied.

3.8 ACTIVITY CENTRES AND EMPLOYMENT

No activity centres are proposed within the LSP area.

The subject site is, however, located adjacent to the 'Central Precinct' as identified by the *SSDSP3*. The precinct contains a 'Local Centre' located approximately 350 metres east of the subject site. This centre is intended to take the form of a 'main street' style development, comprising some 5,000m² of retail and commercial floor space. Additionally, a smaller localised centre is located approximately 200 metres east of the subject site. Both of these sites will provide vital commercial opportunities for the subject site.

111



LEGEND

Zones

-  Residential R30
-  Residential R50
-  Residential R60

Local Scheme Reserves

- Parks & Recreation

Other

- Structure Plan Boundary
- Laneway
- Left in/Left out

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NORTH



SCALE 1:1,500 (A3)

**LOCAL STRUCTURE PLAN
LOTS 109 & 110 WATTLEUP ROAD
HAMMOND PARK
CITY OF COCKBURN**

burgess design group
TOWN PLANNING + URBAN DESIGN

PO Box 8779, Perth Business Centre 6849
www.burgessdesigngroup.com.au

Plan No: OPE HAM 2-01h Client: OPE HAM/EGD WAT
Date: 27.01.15 Planner: JD/MB

CITY OF COCKBURN

FIGURE 6

4. INFRASTRUCTURE COORDINATION AND SERVICING

Development Engineering Consultants (DEC) were engaged to prepare an infrastructure and servicing report over the LSP area (refer **Appendix 6**). This report found no significant issues that would prevent urban development however, given the level differences between our client's landholding, adjoining land parcels and with the existing Wattleup Road, interface treatments and subdivisional earthworks needs to be managed effectively.

It is expected that the majority of servicing infrastructure will be extended to the site through the adjoining development of Lots 111, 1 & 801 Wattleup Road.

A summary of the main points of the servicing report can be found below.

4.1 EARTHWORKS

Due to undulating topography of the structure plan area, earthworks will be required to provide level building blocks, thus necessitating extensive low to medium height retaining walls. Substantial earthworks will be required because the land has to be cut down to RL 38.0m AHD in order to service the development with Water Corporation reticulated water. The R50 site will require substantial retaining to achieve a graded separation from the existing Wattleup Road.

Retaining walls along the eastern boundary will be coordinated with the adjoining developer to ensure compatibility with the adjoining site. Earthworks on site will entail removal of topsoil, cut and fill, with no imported fill, but rather export of sand to other sites.

4.2 ROADS

All roads in the structure plan area are to be constructed to the City of Cockburn standards and approval, including kerbing and piped drainage plus provision of footpaths as required.

4.3 DRAINAGE

The site will be self-contained as far as storm water drainage is concerned. The soil characteristics of the site will allow site soakage, based on the geology and the depth to groundwater. The site is contained within one overall drainage catchment. All residential lots will dispose of site generated stormwater into soakwells.

The proposed swale storage basins will be located at the low point of the site to contain the 1 in 100 year storm runoff from roads. These drainage basins will be located along the northern boundary of the site within an area of POS, and will achieve a minimum clearance to the water table of some 10 metres.

4.4 POWER

Sufficient power supplies currently exist in the surrounding areas. A 22kVA high voltage plus low voltage aerial power line is located along the southern verge of Wattleup Rd, connecting to Frankland Avenue to the east of the site.

Connections to the existing power serviced will be constructed at the cost of the developer, and will be subject to approval from Western Power and detailed design at the subdivision stage.

4.5 WATER SUPPLY

At present there is no reticulated water supply connection to the site. The Water Corporation advises that sufficient supply exists to service the site from mains located in Frankland Ave east of the site. Extension from this main will be brought to the site via the adjoining development over Lots 111, 1 & 801 Wattleup Road.

Water Corporation has advised it can only supply a water service to RL 38.0m AHD, and therefore the high land adjacent to Wattleup Road will need to be earthworked down to this level, cutting the natural surface level of Lot 110 (RL 48.0AHD) by up to 10m, creating a significant level difference between the existing Wattleup Road (RL 44.0AHD) and future development (RL 38.0 AHD). Some augmentation of this supply in the way of a 600mm feeder main is planned by the Water Corporation to ensure supply to the RL 38.0 metre AHD level.

4.6 SEWER

The subject site currently does not have any sewer connections, however falls within the Bibra Main Sewer catchment. Development will require the extension of a 225mm gravity sewer from the corner of Frankland Ave and Hammond Rd extension through the adjoining development to the east. This sewer extension will require some fill to maintain minimum cover to the sewer through the adjoining land.

It is planned to extend the 225mm sewer through the development to Wattleup Rd so as to act as a discharge point for a future Waste Water Pump Station (WWPS) to be located west of the subject site.

4.7 TELECOMMUNICATIONS

Telstra services currently exist along Wattleup Road and Frankland Avenue, and are likely to be extended, and upgraded if required, to service the development.

In accordance with recent requirements, the developer will likely be required to install NBN “pipe and pit” to allow for future installation of cables for the NBN. The design of the “pipe and pit” is the responsibility of the developer, and will be designed in conjunction with the underground power network, and installed during the construction phase of the development.

4.8 GAS

Gas mains are available in this area. The nearest ATCO gas main is located in Frankland Avenue to the east of the subject site. Gas can be extended to this development by ATCO in the normal way, with trenching and is the responsibility of the developer.

5. IMPLEMENTATION

The implementation of the planning framework through LSP design, subdivision and development, will ensure the objectives of the EPA and the WAPC can be met in accordance with the below guidelines, policies and standards:

- EPA *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (EPA 2008).
- EPA *Environmental Assessment Guideline No. 8 Environmental factors and objectives* (EPA 2013).
- *State Planning Policy (SPP) 2.9 Water Resources* (WAPC 2006).
- WAPC's *Better Urban Water Management Guidelines* (WAPC 2008).
- *Planning for Bushfire Protection* (WAPC 2010).
- *AS3959 Construction of Buildings in Bushfire Prone Areas* (Standards Australia 2009)

5.1 STAGING

Indicative staging of development in the LSP area generally indicates subdivision construction occurring in a north to south pattern, on the basis of service extensions from the adjoining development over Lots 111, 1 & 801 Wattleup Road.

Final stages of development across the boundaries of the subject site are dependent on:

- a) Removal of temporary bush fire hazards within adjoining development sites; and
- b) Achieving suitable levels to provide efficient interface with adjoining landholdings.

The existing homestead on Lot 110 is intended to be retained until the final stages of development. When the Homestead lot is developed, larger sized lots will be created to enable retaining within the southern portions of these lots. Following development south of Wattleup Road, and a reduced Wattleup Road level, these R50 lots could then be further subdivided once access to Wattleup Road can be achieved.

5.2 LOCAL DEVELOPMENT PLANS (LDP)

As discussed, in order to achieve a range of lot sizes to facilitate a variety of housing choice and to address built form outcomes stipulated in the LSP, Local Development Plans (LDP) will likely be required to guide further development. Local Development Plans are required to be prepared and implemented pursuant to Clause 6.2.15 of the TPS3 for lots with one or more of the following site attributes:

- Lots with rear-loaded vehicle access;
- Lots with direct boundary frontage (primary or secondary) to an area of Public Open Space;
- Lots deemed to be affected by a recognised Bush Fire Hazard, as identified spatially in Appendix 3 of the accompanying Bushfire Management Plan, under Appendix 3;
- Lots adjoining the existing Wattleup Road with a density code of R50;
- Front loaded lots with an effective frontage of less than 12m.

The need for a LDP will be determined by the local government when a subdivision application is lodged.

5.3 LANDSCAPE PLAN

Landscaping treatments have been identified through the Landscape Master Plan (**Appendix 7**) which accompanies this LSP report as well as the indicative cross sections for drainage basins and swales (**Appendix 5 – LWMS**). Whilst the plan and cross sections are provided to illustrate potential development outcomes, further discussion and detail design is required through the preparation of Landscape Management Plans to finalise proposed treatments and maintenance.

The submission of a suitable landscape plan will be required at the subdivision stage. This landscape plan will cover the POS areas within the LSP and will have due regard for the requirements of the *SSDSP3*; this is primarily in regards to the functionality of open space for informal active recreation, the incorporation of drainage, and the utilisation of water sensitive urban design.

6. CONCLUSION

This LSP report, accompanying plans, and appendices, relating to Lot 109 and 110 Wattleup Road, Hammond Park satisfy the planning frameworks adopted by the City of Cockburn and the Western Australian Planning Commission. In summary, the LSP proposes approximately 152 residential lots at densities ranging from R30 to R60, facilitating lot sizes between 225m² and 505m², with an average lot area of 316m².

The proposed structure plan design is based on recommendations from detailed investigations that support development of the land, including flora and vegetation assessments, wetland assessments, transport assessment, planning framework review, servicing analysis, bush fire hazard assessment and local water management plan.

In light of the above, this Local Structure Plan as submitted represents a logical, well planned and timely addition to the ongoing development of the City of Cockburn's Southern Suburbs Growth Corridor and the next stage of implementing the SSDSP3.

Once endorsed, this Local Structure Plan will dictate the zoning or reservation and the Residential Design Code, where applicable, to individual land holdings and will form the framework for landowners to proceed towards subdivision and development in a well-planned and logical manner. This LSP will also enable the relevant government agencies to assess such future proposals in a coordinated fashion.

TABLE 5: PRE-LODGEMENT CONSULTATION

Agency	Date of Consultation	Method of Consultation	Summary of Outcome
Land owners within and adjacent to the structure plan area	March 2014	Email correspondence/ Telephone discussion/ Meeting	Concept Plan adjacent to Plan 1 Structure plan Lots 109 &110 Wattleup Road, Hammond Park
Relevant community groups in the area	Nil – not required	-	-
Local government (City of Cockburn)	July 2014 December 2014	Meeting and Email correspondence/ Telephone discussion Meeting with Planning Staff	City's preliminary comments on concept plan Resolution of proposed Wattleup Road re-alignment, POS position and design, proposed density. Submission of LSP
Department of Planning	Nil	-	-
Department of Water	Nil – not required	-	-
Department of Environment and Conservation	Date unknown	By sub-consultant Emerge Associates	No issues
Department of Education	Nil – not required	-	-
Department of Indigenous Affairs	Date unknown	By sub-consultant Emerge Associates	No issues
Main Roads Western Australia	Date unknown	By sub-consultant Transcore	No issues
Heritage Council	Nil – not required	-	-
Department of Transport	Nil	-	-
Department of Health	Nil – not required	-	-
Public Transport Authority	Nil	-	-
Environmental Protection Authority	Nil	-	-
Western Power	Date unknown	By sub-consultant Development	No issues

		Engineering Consultants(DEC)	
Alinta Gas	Date unknown	By sub-consultant DEC	No issues
Water Corporation	Date unknown	By sub-consultant DEC	No reticulated water supply connection to the site – extension required.
Telstra	Date unknown	By sub-consultant DEC	No issues
Non-government school providers	Nil – not required	-	-
Department for Community Development	Nil – not required	-	-
Department of Sports and Recreation	Nil – not required	-	-
Department of Agriculture and Food Western Australia	Nil – not required	-	-
Fire and Emergency Services Authority	Date unknown	By sub-consultant Emerge Associates	No issues
Any other relevant government agency as required	Nil	-	-

APPENDIX 1
Certificate of Title

WESTERN



AUSTRALIA

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

REGISTER NUMBER 109/P8384	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

VOLUME
1304FOLIO
683

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.

REGISTRAR OF TITLES

**LAND DESCRIPTION:**

LOT 109 ON PLAN 8384

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

SAIL HOLDINGS PTY LTD OF 5 TARONGO WAY, CITY BEACH
(T F974148) REGISTERED 6 SEPTEMBER 1995

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.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
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: 1304-683 (109/P8384).
PREVIOUS TITLE: 1302-365.
PROPERTY STREET ADDRESS: LOT 109 WATTLEUP RD, HAMMOND PARK.
LOCAL GOVERNMENT AREA: CITY OF COCKBURN.

WESTERN



AUSTRALIA

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

REGISTER NUMBER 110/P8384	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

VOLUME
1304FOLIO
684

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.

REGISTRAR OF TITLES

**LAND DESCRIPTION:**

LOT 110 ON PLAN 8384

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

MATE DROPULIC
ANICA DROPULIC
BOTH OF 14 VLAMING RISE, COOGEE
AS JOINT TENANTS

(T H209755) REGISTERED 31 AUGUST 1999

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

1. H209756 MORTGAGE TO NATIONAL AUSTRALIA BANK LTD REGISTERED 31.8.1999.

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.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
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: 1304-684 (110/P8384).
PREVIOUS TITLE: 1302-365.
PROPERTY STREET ADDRESS: 424 WATTLEUP RD, HAMMOND PARK.
LOCAL GOVERNMENT AREA: CITY OF COCKBURN.

APPENDIX 2

Environmental Assessment

ENVIRONMENTAL ASSESSMENT AND MANAGEMENT STRATEGY

LOTS 109 & 110 WATTLEUP ROAD - LOCAL
STRUCTURE PLAN

Project Number EP14-021

**Prepared for Wattleup Road Property Developments Pty Ltd
and M & A Dropulic
December 2014**



ENVIRONMENTAL ASSESSMENT AND MANAGEMENT STRATEGY
 LOTS 109 & 110 WATTLEUP ROAD - LOCAL STRUCTURE PLAN

Document Control

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		Vanessa Keating	VMK		
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	Updated after comment from client.				
B	December 2014	Vanessa Keating	VMK	Chrystal King	CKK
	Final version for release.				
C					
D					

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ENVIRONMENTAL ASSESSMENT AND MANAGEMENT STRATEGY

LOTS 109 & 110 WATTLEUP ROAD - LOCAL STRUCTURE PLAN

Executive Summary

Emerge Associates were engaged by Wattleup Road Property Developments Pty Ltd and M & A Dropulic (the proponent) to provide environmental consulting services to support the design and documentation of a Local Structure Plan (LSP) for Lots 109 and 110 Wattleup Road, Hammond Park (herein referred to as “the site”). The site is within the City of Cockburn, located approximately 24 kms south of the Perth Central Business District and forms part of the Southern Suburbs District Structure Plan. The site is zoned “Urban” under the Metropolitan Region Scheme (MRS) and “Development” under the City of Cockburn’s Town Planning Scheme (TPS) No. 3.

This Environmental Assessment and Management Strategy has been prepared to address the requirements of the Western Australian Planning Commission’s (WAPC) *Structure Plan Preparation Guidelines* (WAPC 2012) to support the LSP design and implementation.

This report provides a synthesis of information from a range of sources regarding the environmental features, attributes and values of the site. This includes existing information, plus site specific assessments and reporting that have been undertaken over the site including:

- *Level 2 Flora and Vegetation Report* (Emerge Associates 2014a)
- *Local Water Management Strategy* (Emerge Associates 2014b)
- *Fire Management Plan* (Emerge Associates and Bushfire Safety Consulting 2014)

Based on the above information, the environmental attributes and values identified within the site have been outlined in **Section 2** and include:

- The topography of the site is gently undulating, ranging from 43 metres Australian Height Datum (mAHD) in south-west of the site to 29 mAHD in north-east of the site.
- The majority of the site has been classified as having a ‘no known risk’ of ASS occurring within three metres of the natural soil surface, while the north-east corner has a ‘Moderate to Low’ risk of ASS occurring within three metres of the natural soil surface.
- The site contains extensive remnant native vegetation. Vegetation condition ranges from ‘Completely Degraded’ to ‘Excellent’.
- A Priority 1 Flora species and a Priority 4 Flora species was found within the site.
- Bush Forever Site No. 392 occurs immediately adjacent to the north of the site, associated with the Harry Waring Marsupial Reserve.
- The buffer of Regional Ecological Linkage 50 extends into the north of the site.
- Groundwater levels ranges from 17.5 mAHD in the south-east corner to 18.5 mAHD in the north-east corner.
- Vegetation within the Harry Waring Marsupial Reserve presents a permanent “Extreme” bushfire risk to the development.

The LSP has responded to the environmental values and attributes of the site and outlines an environmental management framework that will be progressed through the relevant stages of the planning process and development of the site.

Specifically the LSP has responded to the environmental values and attributes of the site through:

- Preparation of a *Local Water Management Strategy* (Emerge Associates 2014b) in accordance with *Better Urban Water Management* (BUWM) (WAPC 2010) (model subdivision condition D8).

ENVIRONMENTAL ASSESSMENT AND MANAGEMENT STRATEGY
LOTS 109 & 110 WATTLEUP ROAD - LOCAL STRUCTURE PLAN

- Preparation of a *Fire Management Plan* (Emerge Associates and Bushfire Safety Consulting 2014) and placement of POS along northern boundary to accommodate a 20 m BPZ required to manage bushfire threats (model subdivision conditions F2 and F3).

These responses are discussed further in **Section 4** of this document. Overall, the environmental attributes and values of the site can be accommodated within the LSP design, or can be managed appropriately through the subdivision and development stages in line with the relevant federal, state and local government legislation, policies and guidelines and best management practices. As such, the proposed future development of the site will not significantly impact on the environmental values and attributes of the site.

ENVIRONMENTAL ASSESSMENT AND MANAGEMENT STRATEGY
LOTS 109 & 110 WATTLEUP ROAD - LOCAL STRUCTURE PLAN

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LOTS 109 & 110 WATTLEUP ROAD - LOCAL STRUCTURE PLAN

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Appendices

Appendix A

Local Structure Plan (Burgess Design Group 2014)

Appendix B

Level 2 Flora and Vegetation Report (Emerge 2014)

Appendix C

Fauna Assessment (Greg Harewood 2014)

ENVIRONMENTAL ASSESSMENT AND MANAGEMENT STRATEGY
LOTS 109 & 110 WATTLEUP ROAD - LOCAL STRUCTURE PLAN

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1 Introduction

1.1 Background

Burgess Design Group, on behalf of the proponent, have prepared a Local Structure Plan (LSP) (**Appendix A**) for the residential development of Lots 109 and 110 Wattleup Road within the Southern Suburbs District Structure Plan (DSP) (City of Cockburn 2012), in the City of Cockburn.

The site is approximately 8 hectares (ha) in size, located in Hammond Park approximately 24 kilometres (kms) south of the Perth Central Business District (CBD) and is bound by Wattleup Road to the south, Harry Waring Marsupial Reserve to the north and urban lots to the east and west. The location of the site is shown in **Figure 1**. The site is zoned "Urban" under the Metropolitan Region Scheme (MRS) and "Development" under the City of Cockburn's Town Planning Scheme No. 3 (TPS No. 3).

1.2 Purpose of Report

This report provides a synthesis of information regarding the environmental attributes and values of the site. It is based on a range of information sources including local and regional reports, databases and publically available mapping, and where existing, site specific surveys and investigations. Together, this information has been used to inform the layout of the LSP and the preparation of the LSP supporting documentation for the site.

The primary purpose of this report is to present the information that was used to inform the preparation and design of the LSP, assess the potential environmental impacts that could arise from implementation of the plan, outline the responses in the LSP to accommodate the environmental values and attributes and specify an environmental management framework for the future subdivision and development process.

1.3 Scope of Work

Emerge have been engaged to provide a suite of environmental services to support future urban development within the site. This has included numerous investigations to identify and assess the environmental attributes and values present within the site, utilizing a range of information sources including local and regional reports, databases and mapping.

To date, services provided include:

- Groundwater level and quality monitoring.
- Flora and vegetation surveys and preparation of a *Level 2 Flora and Vegetation Report* (Emerge Associates 2014a) (see **Appendix B**).
- Preparation of a *Fauna Assessment* (Greg Harewood 2014) (see **Appendix C**).
- Preparation of a *Local Water Management Strategy* (LWMS) (Emerge Associates 2014b).
- Bushfire hazard assessment and preparation of a *Fire Management Plan* in collaboration with Bushfire Safety Consulting Pty Ltd (Emerge Associates and Bushfire Safety Consulting 2014).

1.4 Environmental and site specific investigations

There has been a significant amount of work undertaken to understand the environmental attributes and values to support development across the district, and work to date over the site and local area has included:

- *Level 1 flora and vegetation survey* (Lot 109) (Bayley Environmental Services 2012)
- *Southern Suburbs District Structure Planning Area: Russell Road Arterial Drain Scheme* (David Wills and Associates 2003)
- *Southern Suburbs District Structure Plan Stage 3:Infrastructure Servicing Advice* (SKM 2004)

In addition to the above investigations, Emerge have undertaken site specific investigations and prepared documentation to support urban development within the site. Other than this document, these investigations include the following:

- *Level 2 flora and vegetation report* (Emerge Associates 2014a) (see **Appendix B**).
- *Level 1 fauna and fauna habitat survey* (Greg Harewood 2014) (see **Appendix C**).
- *Fire Management Plan* (Emerge Associates and Bushfire Safety Consulting 2014).
- *Local Water Management Strategy* (Emerge Associates 2014b).

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2 Existing Environment and Site Specific Investigations

2.1 Local Context

The site is approximately 8 ha in size and is bound by Wattleup Road to the south, Harry Waring Marsupial Reserve to the north, and “Urban” zoned lots to the east and west.

The site is zoned “Urban” under the Metropolitan Region Scheme (MRS) and “Development” under the City of Cockburn Town Planning Scheme (TPS). The site forms part of the larger Southern Suburbs District Structure Plan developed by the City of Cockburn to guide residential development in the area.

Current MRS zoning is shown in **Figure 2**.

2.2 Climate

The climate of the site (which applies to the wider Perth metropolitan region) is described as Mediterranean, with hot, dry summers and moderately wet, mild winters.

The majority of rainfall within the region occurs between May and October each year, and on average is between 600 to 1000 mm per year. However, in the last 40 years there has been a marked decrease in rainfall (between 10 to 15 % decrease), with a noticeable shift to a drier climate across the south-west of Western Australia.

The closest weather station to the site which records rainfall and temperature is the Medina Research Centre, located approximately 7 km south of the site. Average monthly rainfall and minimum and maximum temperatures (1983 - April 2014) are summarised in **Table 1** below.

Table 1: Rainfall and temperature averages for the Medina Research Centre weather station (1983 – April 2014) (BoM 2014)

STATISTICS	J	F	M	A	M	J	J	A	S	O	N	D
Maximum Temperature	30.6	31.5	29.4	25.6	22.1	19.3	18.3	18.8	20.3	22.6	25.9	28.1
Minimum Temperature	17.0	17.6	15.9	13.3	10.5	9.1	8.2	8.0	9.1	10.3	13.3	15.1
Rainfall (mm)	12.1	19.6	19.5	39.9	98.7	145.2	147.5	114.7	78.6	40.1	31.8	11.8

2.3 Landform and soils

2.3.1 Topography

The topography of the site is undulating, with a north-eastern aspect. Contour information available for the site indicates that the site ranges from its lowest elevation of approximately 29 m AHD in north-east corner to its highest elevation of 43 metres Australian Height Datum (mAHD) in south-west. The available contour information for the site is shown in **Figure 3**.

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2.3.2 Regional geomorphology

The site is located in the central part of the Swan Coastal Plain, which forms the central portion of the Perth Basin. The Perth Basin extends from the Darling Fault in the east to the continental slope west of Rottnest Island, and from the Murchison River in the north to the Southern Ocean in the south. The Perth Basin is sedimentary in origin and is marginal to the west of the Australian Shield (Seddon 2004).

The Swan Coastal Plain is composed of two wide belts of sediment that differ in origin, with one formed from alluvial deposits (water-laid) and the other formed from aeolian origins (wind-laid). It is approximately 20 to 30 kilometres wide, consisting of a series of geomorphic entities that run parallel to the coastline with the alluvial deposits in the east and the aeolian deposits in the west. The youngest and western most geomorphic entity of aeolian origin is the Quindalup Dunes, followed by the Spearwood Dunes and the Bassendean Dunes (Beard 1990, Seddon 2004). The Pinjarra Plain follows the Bassendean Dunes and is alluvial in origin, which then joins the Ridge Hill Shelf at the eastern most edge of the Swan Coastal Plain.

The site is located within the Bassendean Dune System, which is described as low relief, leached grey, siliceous Pleistocene sand dunes with well drained grey sands intervening sandy and clayey swamps and gently undulating plains.

2.3.3 Landform and soils

Landform and soil mapping undertaken by Churchward and McArthur (1980) indicates that the site is within the Bassendean soil association, described as sand plains with low dunes and occasional swamps; iron or humus podzols; areas of complex steep dunes (**Figure 4**).

The *Perth Metropolitan Region 1: 50,000 Environmental Geology Series, Perth (Fremantle Part Sheets 2033 I and 2033 IV)* (Gozzard 1983) shows the site is comprised of "Sand" (S7 for the majority of the site and S8 in the north-east corner). The general descriptions of these are provided in **Table 2** below and in **Figure 5**.

Table 2: Environmental Geology Series Map Unit Descriptions

MAP UNIT	DESCRIPTION
S7	SAND - white to pale yellowish brown and olive-yellow, medium- to coarse-grained, sub-angular quartz with some trace of feldspar, moderately sorted, of residual origin
S8	SAND - white to pale grey at surface, yellow at depth, fine to medium-grained, moderately well sorted, subangular to subrounded quartz, of eolian origin

2.3.4 Acid Sulfate Soils

Acid Sulfate Soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state ASS are generally present in waterlogged anoxic conditions and do not present any risk to the environment. When oxidised, ASS produce sulphuric acid, which can pose risks to the surrounding environment, infrastructure and human health.

Available information (Department of Environment and Conservation 2010) indicated that the majority of the site has been classified as having a 'no known risk' of ASS occurring within three metres of the

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natural soil surface, while the north-east corner has a 'Moderate to Low' risk of ASS occurring within three metres of the natural soil surface, as shown in **Figure 6**.

2.4 Biodiversity and Natural Assets

2.4.1 Flora and Vegetation

2.4.1.1 Extent and condition of remnant vegetation

A Level 2 flora and vegetation survey (Emerge Associates 2014a) was conducted for the site in July and October 2014. This survey found that the site consisted almost entirely of *Banksia attenuata* (- *B. menziesii* - *Eucalyptus marginata* - *Allocasuarina fraseriana* - *Jacksonia sternbergiana*) open low forest to low woodland over *Hibbertia hypericoides* - mixed species open low heath. A copy of the Level 2 Flora and Vegetation Report has been attached in **Appendix B**.

The condition of the vegetation based on the Keighery condition scale (1994) ranges from 'Completely Degraded' to 'Excellent', with some areas of localized disturbance and weed invasion. The survey also found there to be two patches of densely planted *Melaleuca hamulosa*, though the centre of Lot 110. Occasional native species were noted to emerge through the canopy of *Melaleuca hamulosa*, but these areas were in 'Completely Degraded' condition.

2.4.1.2 Regional vegetation context

The site occurs within the Southwest Province natural region of Western Australia as defined by Beard (1990). Much of the Southwest Province occupies the ancient Western Shield. The Interim Biogeographic Regionalisation of Australia (IBRA) further divides the Southwest Province into smaller areas (Environment Australia 2000) and the site is contained within the Drummond Subregion which occurs along the south-western coast of Western Australia. The Drummond Subregion is characterised as containing mainly *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; woodland of tuart (*Eucalyptus gomphocephala*), jarrah (*E. marginata*) and marri (*Corymbia calophylla*) on less leached soils (Beard 1990).

At a local level, the site is mapped as containing the Bassendean Complex - Central and South complex which is described as "woodland of *E. marginata* - *C. fraseriana* - *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This area includes the transition of *E. marginata* to *E. todtiana* in the vicinity of Perth" (Heddl et al. 1986). Vegetation Complex mapping is shown in **Figure 7**.

Prior to European settlement and the extensive land clearing that followed, the Bassendean Complex - Central and South covered 87,393 ha of the Swan Coastal Plain. In 2013, 24,206 ha (27.7%) of this complex was estimated to remain on the Swan Coastal Plain (LBP 2013). Of its pre-European extent 7,479 ha (or 8.56%) is under some form of protection (for example, within Department of Parks and Wildlife (DPAW) conservation estate, Bush Forever on DPAW managed lands or Bush Forever in Regional Parks) (Local Biodiversity Project 2013).

2.4.1.3 Significant Flora

Species of flora acquire Declared Rare Flora (DRF) or Priority Flora (PF) conservation status where populations are restricted geographically or threatened by local processes. The Department of Parks and Wildlife (DPAW) recognises these threats and subsequently applies regulations towards population protection and species conservation. The DPAW enforces regulations under the *Wildlife*

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Conservation Act 1950 (WC Act) to conserve DRF species and protect significant populations. PF are described as potentially rare or threatened species and are classified in order of threat.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) promotes the conservation of biodiversity by providing statutory protection for plants at a species level. Some DRF species listed under the WC Act are also listed at a Federal level. Section 178 and 179 of the EPBC Act provides for the lists and categories of threatened species under the Act.

Based on the detailed Level 2 flora and vegetation survey (Emerge Associates 2014a) undertaken for the site, one Priority 1 Flora species and one Priority 4 Flora species occurs within the site.

Priority 1 flora species *Eremaea asterocarpa* subsp. *brachyclada* was recorded at two survey locations in the centre of Lot 109. This species is a low growing shrub up to 0.7 m high. The species is known from two populations, one in Wandi, south-east of the site, and one in Armadale closer to the Darling Scarp.

One specimen of the Priority 4 Flora species *Dodonaea hackettiana* was recorded in the south eastern portion of Lot 110. *D. hackettiana* is an erect shrub or tree reaching up to five metres in height. It is known to occur in a number of locations to the north of the site within the Harry Waring Nature Reserve. Despite not being observed at any other location within the site during the course of the survey, it is possible that the species occupies a wider area within the site.

The consideration of significant flora is discussed further in **Section 4**.

2.4.1.4 Plant communities

Based on the Level 2 flora and vegetation survey undertaken for the site (Emerge Associates 2014a) the following vegetation communities (shown in **Figure 8**) were observed within the site:

- **EmBaBm** – Emergent isolated *Eucalyptus marginata* trees over low woodland of *Banksia* spp. and *Allocasuarina fraseriana* over shrubland of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Hypocalymma robustum* over sedgeland of *Mesomelaena pseudostygia* and *Lepidosperma* spp., forbland of *Burchardia congesta*, *Conostylis* spp., *Dasypogon bromeliifolius*, *Drosera* spp., *Scaevola canescens* and **Gladiolus caryophyllaceus* and grassland of *Amphipogon turbinatus*, **Ehrharta calycina* and **Briza maxima* on grey sand. This plant community is shown in **Plate 1** below.
- **SiJs** – Isolated trees to low open woodland of *Banksia attenuata* and *Banksia menziesii* over shrubland to closed shrubland of *Scholtzia involucrata* and *Jacksonia sternbergiana* over low open shrubland of *Hypocalymma robustum* and *Stirlingia latifolia* over open forbland of *Conostylis aculeata*, **Ursinia anthemoides* and *Anigozanthos manglesii* and grassland of **Ehrharta calycina* and **Briza maxima* on grey sand. This plant community is shown in **Plate 2** below.
- **Mh** – Emergent *Banksia* spp. over tall closed shrubland of planted **Melaleuca hamulosa* over sparse shrubland to open shrubland of *Hibbertia hypericoides*, *Scholtzia involucrata* and *Hypocalymma robustum* over open forbland of *Stylidium repens*, *Desmocladius flexuosus*, *Conostylis aculeata* and *Drosera erythrorhiza* on grey sand. This plant community is shown in **Plate 3** below.
- **Parkland Cleared** – Isolated native species over closed grassland of **Ehrharta calycina* and **Briza maxima* on grey sand. Parkland Cleared vegetation is shown in **Plate 4** below.

Three of the communities listed above (**Mh**, **SiJs** and **'Parkland Cleared'**) are considered likely to be the product of historical disturbance and clearing of vegetation within the site leading to an altered

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flora species composition. Plant community **EmBaBm** is likely to represent the plant community that would have occurred over the entire site originally (Emerge Associates 2014a).

Vegetation across the site ranges from 'Completely Degraded' to 'Excellent' condition. 'Completely Degraded' areas occur within the numerous tracks located within the site, areas of **Parkland Cleared** vegetation and planted community **Mh**. 'Degraded' areas exist as patches of relatively disturbed areas within the remnant vegetation in the southern portion of the site. Vegetation in 'Good' condition occurs at the southern extent of the site and along the eastern boundary, due to increased weed invasion and historical disturbance. 'Very Good' condition areas of the site are located throughout the majority of Lot 109 and relatively undisturbed portions of Lot 110 and are associated with relatively minor weed invasion and some disturbance to individual species (i.e. numerous dead *Banksia* spp. present). Smaller areas of 'Excellent' condition vegetation were noted at the northern extent of Lot 110 and in the centre of Lot 109 due to the presence of fewer weeds and disturbances to individual species noted (i.e. fewer dead *Banksia* spp. than observed in areas of 'Very Good' condition). Vegetation condition within the site is shown in **Figure 9**.



Plate 1: Plant Community **EmBaBm**.



Plate 2: Plant Community **SiJs**.



Plate 3: Plant Community **Mh**.



Plate 4: **Parkland Cleared** vegetation.

Further details are outlined in the Level 2 Flora and Vegetation Report attached in **Appendix B**.

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2.4.1.5 Threatened and/or Priority Ecological Communities

In Western Australia, TECs are defined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. Generally these can be described as vegetation communities that are assemblages of species that occur together in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole provide many of the processes which support a specific ecosystem. TECs are recognised as specific ecological communities that are rare or under threat.

TECs are not afforded direct statutory protection at a State level but their significance is acknowledged through other State environmental approval processes (i.e. environmental impact assessment pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act)). Under the State process the DPaW has been identifying and listing TECs since 1994, using a range of definitions to indicate the level of threat to the TEC in question. Specific TECs are also protected under the EPBC Act.

In addition to listing as a TEC, a community may be listed as a Priority Ecological Community (PEC). This is an ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined.

No TECs or PECs occur within the site.

2.4.2 Bush Forever and conservation reserves

The Government of Western Australia's *Bush Forever Policy* is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of Bush Forever is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10 % of each vegetation complex for protection (Government of Western Australia 2000). Bush Forever Sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

There are no Bush Forever Sites within the site, however Bush Forever Site No. 392 lies directly north of the site, associated with the Harry Waring Marsupial Reserve. Bush Forever Sites in the vicinity of the site are shown in **Figure 10**.

2.4.3 Ecological Linkages

The Perth Biodiversity Project's (PBP) *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* (2004) identifies Regional Ecological Linkages for the Perth Metropolitan Region. These indicative 500 m corridors intend to provide a planning framework link protected natural areas with other areas of native vegetation within the Perth Metropolitan Region and in conjunction with the *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* (PBP 2004) are intended to provide best practice guidance for local government biodiversity planning.

Ecological linkages provide a corridor or linkage between larger patches of vegetation so as to allow movement of flora and fauna and their genetic material through the landscape, helping to maintain metapopulations. Linkages can prevent isolation of flora and fauna and ultimately extinctions. Ecological linkages can either be continuous or near continuous, the more fractured the linkage is, the less efficient the flora and fauna move along that corridor. Within built up areas, these linkages are more fractured.

PBP Regional Ecological Linkage 50 runs across the north of the site before cutting south-east across Wattleup Road, connecting Bush Forever Site No. 392 north of the site to other Bush Forever Sites to

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the south. This biodiversity linkage is shown on **Figure 10**. The connectivity of this linkage will be maintained through the long term retention of vegetation within Bush Forever Site No. 392 north of the site and other City of Cockburn local parks and recreation reserves south-east of the site. Any areas of vegetation retained in POS within the site will contribute to this linkage, however the integrity of the connection is not dependent on the vegetation within the site. No further consideration is required within the LSP.

2.4.4 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems. Within an ESA exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply and the presence of an ESA would indicate that the site is likely to support significant environmental values. However, exemptions under Schedule 6 of the *Environmental Protection Act 1986* still apply, including any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the *Environmental Protection Act 1986*).

There are no ESAs recorded within the site. The extents of declared ESAs in close proximity to the site are shown in **Figure 10**.

2.4.5 Terrestrial Fauna

The conservation status of fauna species in Western Australia is assessed under the state administered WC Act. The WC Act utilises a set of schedules and DPaW also produces a list of priority fauna species which while not considered threatened under the WC Act, there is some concern over their long-term survival. As well as those species protected under the WC Act, the Federal government also maintains a list of protected species under the EPBC Act.

Based on a fauna survey undertaken by Greg Harewood (2014), fauna habitat values of remaining native vegetation within the site would appear to be relatively good despite some disturbance in the form of tree deaths, felling of live and dead trees for firewood collection and common invasive weeds.

It is, however, likely that the fauna habitat values within the site would have been reduced from pre-European levels due to the overall fragmentation of vegetation in the wider area (primarily from market gardens, residential developments and road construction), along with the likelihood of more frequent fires and the likely presence of feral predators such as cats and foxes. The site and area of vegetation present is relatively small and is therefore unlikely to have the capacity to support, in isolation, populations of most fauna species. Fauna are more likely to utilise the large area of vegetation reserved in Bush Forever Site No. 392 Harry Waring Marsupial Reserve immediately north of the site.

The site was surveyed for potential Black Cockatoo habitat. Hollows identified within a small number of suitable habitat trees were found to be unsuitable and unlikely to be utilised by the black cockatoo species (Greg Harewood 2014).

Further details are outlined in the Fauna Assessment report attached in **Appendix C**.

2.5 Hydrology

2.5.1 Groundwater

According to the *Perth Groundwater Atlas* (Department of Water (DoW) 2014a), the minimum groundwater levels beneath the site range from approximately 17.5 m AHD in the south-east corner of the site through to 18.5 m AHD in the north-east corner (**Figure 11**).

Further groundwater information is outlined in the *Local Water Management Strategy* (Emerge Associates 2014b) prepared for the site.

2.5.2 Surface Water

The site is largely undeveloped and there are no existing drainage channels present. The high permeability of the underlying sands and the vegetation coverage has resulted in no natural channels forming over the site (Emerge Associates 2014b).

2.5.3 Wetlands and waterways

The *Geomorphic Wetlands of the Swan Coastal Plain dataset* (DEC 1992) indicates that there are no wetlands within the site. There exists a Conservation Category Wetland (CCW) (UFI 14104), situated approximately 550 m to the north-east of the site.

2.5.4 Public Drinking Water Sources

Public Drinking Water Source Areas (PDWSAs) are surface water catchments or groundwater recharge areas that have been identified as drinking water sources, and proclaimed as water reserves by the Department of Water (DoW) (DoW 2009), and protected by government legislation. PDWSAs provide the majority of Western Australia's drinking water supplies and can be vulnerable to contamination from a range of land uses and water based activities (DoW 2009) therefore consideration needs to be given to the intended land use and associated activities to ensure that they are appropriate in meeting the water protection quality objectives of the area.

The site is not located within any proclaimed or proposed PDWSA.

2.6 Heritage

2.6.1 Indigenous Heritage

Based on a review of the Department of Aboriginal Affairs 'Aboriginal Heritage Inquiry System' online database (DAA 2014), there are no registered Indigenous heritage sites within or immediately adjacent to the site.

2.6.2 Non-indigenous Heritage

A desktop search of the State Heritage Office database (Heritage Council 2012) and the Australian Heritage Database (Department of Environment 2013) indicated there are no registered heritage sites within or in close proximity to the site.

2.7 Land Use Considerations

2.7.1 Historical land uses and potential contamination

A search of the Department of Environment Regulation's (DER) Contaminated Sites Database and Register (DER, 2013) found there to be no registered sites within or immediately adjacent to the site.

Based on a review of historic aerial photography, the majority of the site has remained fully vegetated since prior to 1953. The central portion of Lot 110 was cleared of vegetation between 1981 and 1985 and two small plantations of *Melaleuca sp.* were established which remain today. The existing residence in the south of Lot 110 was constructed in 2003.

There does not appear to be any historic evidence of any activities (e.g. market gardening) within the site that would raise considerations in relation to potential soil and/or groundwater contamination.

Based on the historic land uses within the site and the generally available information, there is not expected to be any significant risk of soil and/or groundwater contamination within the site.

2.7.2 Basic Raw Materials

Basic raw materials are described as sand (including silica sand), clay, hard rock, limestone (including metallurgical limestone) and gravel and other construction and road building materials, which are generally important to land development. *State Planning Policy No. 2.4 Basic Raw Materials* provides for the protection of the basic raw materials, with the intention of this policy to ensure these resources can be fully utilised, through appropriate land uses and timeframes for development that may otherwise conflict with this intention.

The site is not located within a designated extraction area or resource location according to mapping provided in *State Planning Policy No. 2.4 Basic Raw Materials* (WAPC, 2000) therefore there are no associated constraints on the timing of the proposed future urban development within the LSP area. There are, however, two designated sand resource 'Extraction Areas' located approximately 400 m south of the site, operated by WA Limestone and Frankland Sand Supplies.

EPA Guidance Statement No. 3 *Separation Distances between Industrial and Sensitive Land Uses* (EPA, 2005) recommends a generic separation distance of 300 to 500 m between limestone/sand extraction activities and sensitive land uses. In this case, the Southern Suburbs DSP considers the existing separation distance (in this case 400 m) to be acceptable given the nature of the extraction activities and the separation created by the wide reserve for Rowley Road (City of Cockburn 2012a).

2.8 Natural Hazards

2.8.1 Bushfire Hazard

Areas of bushland within and surrounding the site have the potential to carry an extreme fire risk. The significant bushfire hazard features which are relevant for the site include vegetation with Bush Forever Site No. 392 Harry Waring Marsupial Reserve immediately north of the site, and areas of remnant vegetation surrounding the site to the south, east, and west. Fire management is a requirement in accordance with the WAPC's *Planning for Bush Fire Protection Guidelines* (WAPC 2010) and has been considered as part of the LSP design.

3 Local Structure Plan and Planning Approval Framework

3.1 Historical Planning and Environmental Assessment Context

The site forms part of the City of Cockburn's Southern Suburbs DSP which was adopted by the Council in 2005. The Southern Suburbs DSP was prepared with the intention of providing a broad land use framework and basis for coordinating and considering LSP's prepared by landowners in the area.

Prior to the preparation and endorsement of the Southern Suburbs DSP the site was predominantly zoned "Urban Deferred" under the MRS and "Development" under the TPS. In 2008, pursuant to the endorsement of the Southern Suburbs DSP the deferment was lifted by the WAPC and the site subsequently became zoned "Urban" under the MRS.

3.2 Local Structure Plan

A Local Structure Plan has been prepared for the site by Burgess Design Group and is provided in **Appendix A**. The LSP design incorporates the inputs from a multi-disciplinary project team, the outcomes from various technical studies and the requirements of the Southern Suburbs DSP. The LSP area includes a total land area of 8.1 ha and the proposed land uses include:

- Residential Lots
- Road Reserves
- Public Open Space

The Southern Suburbs DSP requires that all local structure plans must include and be informed by a:

- Detailed LWMS based upon regional drainage study.
- Detailed noise management strategy where LSP adjoins Rowley Road (not relevant to the site).
- Fire Management Plan where the LSP is located near Regional Open Space or significant POS.
- Flora and Fauna Management Plan (not relevant to site, see **Section 4**).
- Traffic Management Plan
- Contaminated Sites and Acid Sulfate Soils Management Plan, where required.
- Heritage study where LSP includes former historic tramway (not relevant to the site).
- Transition and/or interface strategy in respect of existing rural uses (not relevant to the site).
- Neighbourhood centre concept plan and detailed area plan where included within LSP area (not relevant to the site).
- Neighbourhood node concept plan and detailed area plan (not relevant to the site).

This EAMS has been prepared to provide a summary of the environmental values and attributes found within the site and specifically address the proposed development of the site as defined by the LSP. It is the key supporting document for the LSP process, facilitating the consideration of any environmental issues by the various state agencies and the City of Cockburn.

The EAMS is consistent with the EPA's current *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (EPA 2008) and the WAPC's *Structure Plan Preparation Guidelines* (WAPC 2012a) and includes:

- Identification of significant environmental features.
- Management strategies specific to each environmental feature within the LSP area.

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- Opportunities for enhancement of the environmental features and issues to address at later stages of development.

3.3 Future Planning Approval Process

The LSP will be submitted to the City of Cockburn for consideration, with final approval to be given by the City of Cockburn and Western Australian Planning Commission. Following LSP approval, subdivision and development of areas generally in accordance with the LSP will be progressed. It is usual for this process to involve the imposition of subdivision conditions, in accordance with the WAPC's *Model Subdivision Conditions Schedule 2012* (WAPC 2012b), and these generally cover the following relevant areas:

- Amenity.
- Buildings and use.
- Drainage and site works.
- Electricity and gas pipelines.
- Environmental conditions.
- Fire and emergency.
- Heritage (indigenous, state, local, etc.).
- Lot design.
- Reserves.
- Transport roads and access.
- Water and sewers.

This condition framework provides a future environmental management framework for the site and is discussed further in **Section 4**.

3.4 Relevant Environmental Factors and Considerations

Table 3 lists the environmental factors that have been investigated for the site, and summarises those that require further specific attention in **Section 4**.

Table 3: Relevant environmental factors and considerations for LSP

ENVIRONMENTAL FACTOR	RELEVANT CONSIDERATIONS
Climate	No issues posed and therefore no further consideration is required.
Topography	No issues posed and therefore no further consideration is required.
Geology	No issues posed and therefore no further consideration is required.
Landform and soils	No issues posed and therefore no further consideration is required.
Acid Sulfate Soils	North-east corner of site has "moderate to low" risk of ASS occurring within 3 m of the natural soil surface. This may become an issue when excavation is required for services e.g. sewers. This is addressed further in Section 4 .
Flora and Vegetation	The site contains intact remnant vegetation. The majority of this vegetation is unable to be retained as part of the LSP due to necessary earthworks, however where possible, vegetation will be retained within areas of public open space. This is addressed further in Section 4 .
Bush Forever	Bush Forever Site No. 392 occurs directly adjacent to the northern boundary of the

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ENVIRONMENTAL FACTOR	RELEVANT CONSIDERATIONS
	site. This interface with the proposed development required consideration, and is addressed further in Section 4 .
Ecological Linkages	No issues posed and therefore no further consideration is required.
Environmentally Sensitive Areas (ESAs)	No ESAs are located within the site and therefore no further consideration is required.
Local Natural Areas (LNAs)	No LNAs are identified within the site under the City of Cockburn's Natural Area Management Strategy (City of Cockburn 2012) and therefore no further consideration is required.
Terrestrial Fauna	The site contains intact remnant vegetation which may provide habitat for a range of fauna species, including those of conservation significance. This is addressed further in Section 4 .
Groundwater	Pre-development groundwater levels and quality will need to be maintained post-development. This is addressed further in Section 4 .
Surface Water	No surface water features are located within the site and therefore no further consideration is required.
Wetlands	No wetlands are located within the site and therefore no further consideration is required.
Public Drinking Water Sources Areas (PDWSAs)	No PDWSAs are located within the site and therefore no further consideration is required.
Indigenous Heritage	No Indigenous heritage values are located within the site and therefore no further consideration is required.
Non-Indigenous Heritage	No non-Indigenous heritage values are located within the site and therefore no further consideration is required.
Historic Land Uses	No issues posed and therefore no further consideration is required.
Surrounding Land Uses	No issues posed and therefore no further consideration is required.
Bushfire Hazard	Classified vegetation within Harry Waring Marsupial Reserve to the north of the site poses an extreme bushfire threat. This is addressed further in Section 4 .

4 Environmental Assessment and Management

This section discusses in detail the spatial response of the LSP to the environmental values and attributes associated with the site, and also outlines future environmental management considerations that will be required for certain environmental factors as part of future subdivision and development within the LSP area. This section discusses only those environmental values and attributes that required specific consideration based on their presence within the site, and/or applicable legislation and policy requirements, which were addressed in **Section 3**.

4.1 Landform and Soils - Acid Sulfate Soils

4.1.1 Policy Framework and Management Objective

The Department of Environment Regulation (DER), through the WAPC, ensures Acid Sulfate Soils (ASS) are adequately managed during the subdivision process.

The objective of the DER's ASS policy framework is to manage ASS appropriately to prevent the release of metals, nutrients and acidity into the soil and groundwater system that may adversely affect the natural and built environment and human health.

4.1.2 LSP Considerations for Acid Sulfate Soils

Acid Sulfate Soils management does not require any spatial consideration within the LSP.

4.1.3 Future Acid Sulfate Soil Management Requirements

The WAPC includes a standard condition on all subdivision applications (model subdivision condition EN8, WAPC 2012b) which states:

An acid sulphate soils self-assessment form and, if require as a result of the self-assessment an acid sulphate soils report and an acid sulphate soils management plan shall be submitted to and approved by the Department of Environment and Conservation before any subdivision works are commenced. Where an acid sulphate soils management plan is required to be submitted, all subdivision works shall be carried out in accordance with the approved management plan (Department of Environment and Conservation) (now DER).

For the portion of the site with an ASS risk rating of “*moderate to low risk*”, ASS investigations and management considerations for the site will be required at subdivision for the installation of sub-soil drains and deep sewer facilities. Should ASS be found to occur within the site an ASS Management Plan will be prepared according to DER's policy framework.

4.1.4 Predicted Environmental Outcomes

Any future ASS considerations will be identified and managed during the subdivision process according to DER's standards and policy framework.

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4.2 Biodiversity and Natural Assets – Flora and Vegetation

4.2.1 Policy Framework and Management Objective

The Environmental Protection Authority's *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (EPA 2008) states their broad objective for flora and vegetation biodiversity conservation as: “to maintain the abundance, diversity, geographic distribution and productivity of flora at the species and ecosystem levels through the avoidance or management of adverse impacts and through improvement in knowledge.”

4.2.2 LSP Considerations for Flora and Vegetation

Two occurrences of the Priority 1 Flora species *Eremaea asterocarpa* subsp. *brachyclada*, and one specimen of the Priority 4 Flora species *Dodonaea hackettiana* was found within the site during the Level 2 flora and vegetation survey (Emerge Associates 2014a). The Priority 4 Flora species is known to occur within Bush Forever Site No. 392 north of the site. Given that the population within the Harry Waring Marsupial Reserve (Bush Forever Site No. 392) is highly likely to remain in perpetuity, and the species is represented by a single individual within the site, the occurrence within the site is not considered to be highly significant.

The DPaW Threatened and Priority Flora dataset indicates that the Priority 1 Flora species (*Eremaea asterocarpa* subsp. *brachyclada*) is known to occur in a cluster of populations ranging in size from one to 85 individuals located approximately four kilometres to the east of the site in Wandi. One additional population is known to occur further to the east in Armadale. The Wandi populations are located within land zoned ‘Rural – Water Protection’ under the MRS, which is defined as “rural land over public groundwater areas, where land use is controlled to avoid contamination” (WAPC 2012). This area is also declared as a Priority 2 Public Drinking Water Source Area (PDWSA) under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* and also within the policy area for the *State Planning Policy 2.3 Jandakot Groundwater Protection Policy* (SPP 2.3)(WAPC 2003). This area also supports at least two other Threatened Flora species based on Department of Parks and Wildlife (DPaW) datasets.

Priority 2 PDWSAs have been identified to ensure there is no increased risk of pollution to the water source, and are declared over land where low intensity development (such as rural) already exists. The policy stipulates further intensification of land use may result in contamination of the public drinking water source and therefore urban development is not considered appropriate within a Priority 2 area. This suggests that the rural zoning in this area is likely to persist into the longer term.

The Wandi Priority 1 flora species population is located within the Town of Kwinana and is zoned ‘Special Rural 2’ under their Town Planning Scheme No. 2 (TPS No. 2). This area is known to contain a number of state and federally listed flora species based on DPaW datasets. ‘Special Rural 2’ zoning under TPS No. 2 has key provisions which restrict the current and future land use in the area, including (but not limited to) the following:

- No lot shall be less than two hectares.
- The size and location of building envelopes must be approved by the Council prior to the approval of a Deposited Plan.
- The lot owner must prepare and undertake a tree planting program to encompass all land outside the building envelope at the instruction of the Council.
- Where a survey of the property for significant flora values has not been previously undertaken as a condition of subdivision, a spring survey shall be undertaken to the satisfaction of the

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Department of Environment Regulation (DER) prior to the commencement of development and Council may, on the advice of the DER require the development to be modified in order to preserve the identified flora.

- No development shall commence within or outside of the defined building envelope without the prior written approval of Council.
- The removal of any vegetation either within or outside of the building envelope requires written approval from the Council.
- No development, including earthworks, shall occur outside of the approved building envelope.
- Building envelopes may be altered to preserve significant flora values to the satisfaction of Council.
- Land within and outside of the building envelope is to be managed in such a manner as to avoid the land being laid bare in vegetation resulting in loose, wind erodible conditions.
- No further clearing is to be undertaken outside of the building envelope save for the maintenance of firebreaks and access ways.

The restriction on land uses and clearing within this area (where significant populations of this Priority Flora species occurs) provides some certainty to the long term retention of native vegetation and the Priority Flora species within the area. Further to this, it is possible that the Priority Flora species is also present within the Harry Waring Marsupial Reserve (Bush Forever Site No. 392) north of the site given the similarity of the vegetation type. It is understood that only limited survey has been conducted within Bush Forever Site No. 392, and the species characteristics are such that it may have been located within the reserve but incorrectly identified.

Based on the proposed LSP design the majority of vegetation within the site will be cleared to allow for residential development. While the clearing of the site will remove significant flora values from within the site, the relevant species are represented in areas of remnant vegetation with some form of planning control (Bush Forever and/or restricted land uses associated with regional and local land zoning and Priority 2 PDWSAs) that will ensure the ongoing retention of regional vegetation values outside of the site.

4.2.3 Future Flora and Vegetation Management Requirements

Landscaping of POS and road reserves will involve the use of native flora species representative of the diversity of flora species found in the surrounding area.

4.2.4 Predicted Environmental Outcomes

Remnant native trees will be retained within POS where possible. Areas of POS and road reserves will be planted with flora species native to the local area, addressing the EPA's policy objective.

4.3 Biodiversity and Natural Assets – Bush Forever

4.3.1 Policy framework and management objective

The Government of Western Australia's *Bush Forever Site Implementation Guidelines Practice Note 5: Bushland-sensitive Criteria for Urban Development* (2000) provides measures to assist in the protection of Bush Forever Sites from the adverse effects of adjacent urban development. Management measures include:

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- Creating a hard edge between the bushland and the development in the form of a road or access track.
- Retaining stormwater within the development to protect the adjacent bushland from potential pollutants and excessive nutrients.
- Providing conservation style fencing along the boundaries of the Bush Forever Site to control unauthorised access.

4.3.2 LSP Considerations for Bush Forever

The LSP has provided for a public interface with Bush Forever Site No. 392 through the inclusion of POS along the northern boundary of the site, immediately adjacent to the Bush Forever Site. This public interface will provide a clear distinction between private land and public space and allow for passive surveillance of the Bush Forever Site in order to assist in preventing unauthorised access and illegal rubbish dumping.

In addition, the POS and adjacent road reserve will create a 20-35 m separation between the development and the bushfire threat posed by the vegetation within Bush Forever Site No. 392. This is discussed further in **Section 4.7** and in the Fire Management Plan (Emerge Associates and Bushfire Safety Consulting 2014) prepared for the site.

4.3.3 Future Bush Forever management requirements

Further detail relating to the interface with Bush Forever Site No. 392 will be determined and implemented through discussions with DPaW and input into detailed landscape designs. Through recent discussions, DPaW have indicated that they will require the existing fence, and its function, surrounding Bush Forever Site No. 392 to be retained. The purpose of the fence is to restrict predators such as cats, foxes and dogs, from entering the Bush Forever Site. On this basis, no trees or structures should be placed next to the fence which may assist feral predators in accessing the Bush Forever Site over the fence.

Furthermore any landscaping within POS area adjacent to Bush Forever Site No. 392 should use native species or provide a hard barrier to prevent non-native species becoming established in the Bush Forever site.

4.3.4 Predicted Environmental Outcomes

Management measures implemented through the planning process will ensure that there is no change in the values associated with Bush Forever Site No. 392.

4.4 Biodiversity and Natural Assets – Terrestrial Fauna**4.4.1 Policy Framework and Management Objective**

The EPA's *Environmental Assessment Guideline No. 8 Environmental factors and objectives* states their objective for terrestrial fauna conservation in the development process, which is: *"to maintain representation, diversity, viability and ecological function at the species, population and assemblage level."*

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4.4.2 LSP Considerations for Terrestrial Fauna

There will be no opportunity to retain vegetation within the site, due to the ground level changes required to support residential development. Planting /landscaping within areas of POS or roadside areas will be undertaken using native species to provide some opportunistic fauna habitat values, and connectivity to the Harry Waring Marsupial Reserve north of the site.

4.4.3 Future Terrestrial Fauna Management Requirements

There will be no future management requirements for terrestrial fauna and fauna habitat within the site and as such no Fauna Management Plan will be required. High value fauna habitat is located within Harry Waring Marsupial Reserve, directly adjacent to the northern boundary of the site, and mobile fauna species potentially using the site will be able to use these areas in the long term.

The site contains suitable foraging habitat and potential breeding trees for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo, however due to the relatively small size of the site and the large area of intact habitat vegetation reserved in Bush Forever Site No. 392 north of the site, it is unlikely that the site supports any significant foraging and/or breeding activities. Notwithstanding this, these species are protected under the EPBC Act and given the structure plan does not provide for the retention of this habitat, the proponent will need to consider their potential obligations pursuant to this Act prior to development.

Landscaping of POS and road reserves within the site will use native species which may provide fauna habitat.

4.4.4 Predicted Environmental Outcomes

Areas of POS and road reserves will be planted with native flora species, addressing the EPA's policy objective.

4.5 Hydrology - Groundwater

4.5.1 Policy Framework and Management Objective

The EPA's *Environmental Assessment Guideline No. 8 Environmental factors and objectives* (EPA 2013) outlines the following key objectives for the management of groundwater:

- To maintain the hydrological regimes of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.
- To maintain the quality of groundwater, sediment and biota so that the environmental values, both ecological and social, are protected.

State Planning Policy 2.9 Water Resources (WAPC 2006) outlines the following key policy objectives:

- Protect, conserve and enhance water resources that are identified as having significant economic, social, cultural and/or environmental values;
- Assist in ensuring the availability of suitable water resources to maintain essential requirements for human and all other biological life with attention to maintaining or improving the quality and quantity of water resources; and
- Promote and assist in the management and sustainable use of water resources.

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4.5.2 LSP Considerations for Groundwater

The groundwater management strategy for the site is documented within the LWMS (Emerge Associates 2014b).

The main objective for groundwater level management is to ensure the final lot levels are at least 1.2 m above the Maximum Groundwater Level (MGL), and the earthworks strategy will see all habitable floor levels being greater than 1.2 m above the MGL.

The main objective for the management of the groundwater quality is to maintain or improve the existing groundwater quality. This can be achieved by reducing the total nutrient load into the groundwater that originates from the development. Improving groundwater quality can be achieved by the treatment of surface runoff prior to infiltrating to groundwater and this will be undertaken through the development of the site as described in the LWMS (Emerge Associates 2014b).

4.5.3 Future Groundwater Management Requirements

An Urban Water Management Plan (UWMP) will be prepared at subdivision stage, in order to address the WAPC's standard model subdivision condition D2 (WAPC 2012b) which states:

Prior to the commencement of subdivisional works, an urban water management plan is to be prepared and approved, in consultation with the Department of Water, consistent with any approved Local Water Management Strategy. (Local Government).

The UWMP will provide information on the groundwater controls proposed and the implementation of the LWMS through detailed civil design.

4.5.4 Predicted Environmental Outcomes

The LWMS provides the framework for the LSP to manage groundwater levels and quality in accordance with the WAPC and EPA guidelines and policy frameworks. The preparation of a UWMP utilising Better Urban Water Management practices to support subdivision will ensure the sustainable use of groundwater resources.

4.6 Natural Hazards - Bushfire Management

4.6.1 Policy Framework and Management Objective

The *Bush Fires Act 1954* sets out provisions to reduce the dangers resulting from bushfires; prevent, control and extinguish bushfires; and for other purposes. The Act addresses various matters including prohibited burning times, enabling Local Government to require landowners and/or occupiers to plough or clear fire breaks, to control and extinguish bushfires and establish and maintain Bush Fire Brigades.

Planning for Bush Fire Protection (WAPC 2010) is a bushfire hazard management guideline used for various stages of the planning process to avoid inappropriately located or designed land uses, subdivision and development on land where a bush fire risk is identified, and to ensure that an appropriate level of protection to life and property from bushfires is provided.

Vegetation within and surrounding the site has been classified according to *AS3959 Construction of Buildings in Bushfire-prone Areas* (Standards Australia, 2009). Vegetation that is to be permanently retained surrounding the site will pose permanent bushfire hazard considerations. In the same way,

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vegetation that is to be cleared for future urban purposes in the short to medium term will pose only temporary bushfire management considerations. Remnant vegetation within the site is intended to be largely cleared for urban development, and any areas retained within POS will be managed parkland and therefore will not pose a bushfire hazard to the site.

4.6.2 LSP Considerations for Bushfire Management

A *Fire Management Plan* (2014) has been prepared by Emerge Associates and Bushfire Safety Consulting Pty Ltd, in line with the WAPC's *Planning for Bush Fire Protection* (WAPC 2010), *Draft Planning for Bushfire Risk Management Guidelines* (WAPC 2014) and the Australian Standard AS3959-2009 *Construction of buildings in bushfire prone areas* (AS3959) (Standards Australia 2009). The Fire Management Plan (FMP) aims to address bushfire management issues within the LSP and, through this, reduce the occurrence of and minimise the impact of bushfires within and surrounding the site, thereby reducing the threat to life, property and the environment.

As outlined in the FMP (Emerge Associates and Bushfire Safety Consulting 2014), the only permanent bushfire hazard posed for the site is associated with the woodland vegetation within Bush Forever Site No. 392 Harry Waring Marsupial Reserve immediately north boundary of the site. This area has an "Extreme" bushfire hazard rating, requiring a 20 m Building Protection Zone (BPZ) separating residential dwellings from vegetation. The northern POS and road interface provided within the LSP, as shown in **Appendix A**, provides a setback of 20-35 m along the entire northern edge of the site and will be maintained following the standards outlined in the FMP to ensure a low bushfire threat. Vegetated areas adjacent to the east, west and south-west of the site will pose only a temporary bushfire hazard to the development as these areas are subject to future urban development in accordance with the approved Southern Suburbs DSP, and once vegetation is removed to accommodate development, the hazard will no longer apply.

In addition to BPZ requirements, surrounding vegetation is likely to present increased Bushfire Attack Levels (BALs) which influences building standards for dwellings at the construction stage. Areas within 100 m of AS 3959 classified vegetation are considered "bushfire prone" and will have increased construction requirements to meet the increased BALs. Bushfire prone areas within the site and surrounding area are shown in **Figure 12**. Increased BALs have not been considered within the LSP, as future assessment is recommended at the time of development to consider the temporary nature of some areas of the applicable hazards. The future assessment would determine the detailed BAL assessment for all lots.

4.6.3 Future Bushfire Management Requirements

The WAPC includes the following standard conditions on all subdivision applications (model subdivision conditions F2 and F3, WAPC 2012b) which state:

- *A fire management plan being prepared, approved and relevant provisions implemented during subdivisional works, in accordance with the WAPC's Guideline Planning for Bushfire Protection Edition 2 (in particular Appendix 3) to the specifications of the local government and/or the Fire and Emergency Services Authority. (Fire and Emergency Services Authority) OR (Local Government).*
- *A notification, pursuant to Section 70A of the Transfer of Land Act 1893 is to be placed on the certificate(s) of title of the proposed lot(s). Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows: "The lot(s) is/are subject to a fire management plan." (Local Government).*

As outlined above, and in the FMP prepared for the LSP, development within bushfire prone areas (within 100 m of an 'Extreme' or 'Moderate' hazard which is not classified as "Low Threat") will require site-specific AS 3959 BAL assessment prior to dwelling construction. Those areas which will require a BAL assessment within the site are shown in **Figure 12** as "bushfire prone areas."

The FMP proposes this detailed BAL assessment be undertaken as part of the subdivision process for the site. By deferring assessment until development, the location, structure and slope of any vegetation can be more accurately evaluated, and surrounding hazards may have been removed with the development of neighbouring lots, which may reduce the hazard and subsequent BAL requirements.

4.6.4 Predicted Environmental Outcomes

By utilising the Fire Management Plan at this early stage of planning process, the LSP has been able to incorporate bushfire hazard management considerations into the design of the development, ensuring that, if there is a bushfire within or near the site, the threat to residents, property and emergency response personnel will be reduced.

5 Summary and Conclusions

Emerge Associates was engaged by the proponent to provide a suite of environmental services to support the preparation of a Local Structure Plan (LSP) for Lots 109 and 110 Wattleup Road, Hammond Park. This has included numerous investigations to identify and assess the environmental attributes and values within the site.

The environmental attributes and values identified within the site have been outlined in **Section 2** and include:

- The topography of the site is gently undulating, ranging from 43 metres Australian Height Datum (mAHD) in south-west of the site to 29 mAHD in north-east of the site.
- The majority of the site has been classified as having a 'no known risk' of ASS occurring within three metres of the natural soil surface, while the north-east corner has a 'Moderate to Low' risk of ASS occurring within three metres of the natural soil surface.
- The site contains extensive remnant native vegetation. Vegetation condition ranges from 'Completely Degraded' to 'Excellent'.
- A Priority 1 Flora species and a Priority 4 Flora species occur within the site.
- Bush Forever Site No. 392 occurs immediately adjacent to the north of the site, associated with the Harry Waring Marsupial Reserve.
- The buffer of Regional Ecological Linkage 50 extends into the north of the site.
- Groundwater levels ranges from 17.5 mAHD in the south-east corner to 18.5 mAHD in the north-east corner.
- Vegetation within the Harry Waring Marsupial Reserve presents a permanent "Extreme" bushfire risk to the development.

The LSP has responded to the environmental values and attributes of the site and outlines an environmental management framework that will be progressed through the relevant stages of the planning process and development of the site.

Specifically the LSP has responded to the environmental values and attributes of the site through:

- The use of native vegetation in planted areas within POS and/or road reserves.
- The placement of public open space in the north of the site to manage the interface with Bush Forever Site No. 392 Harry Waring Marsupial Reserve.
- Placement of public open space and road reserves in the north of the site to accommodate a 20m Building Protection Zone (BPZ) required to manage permanent bushfire hazard implications.

The WAPC's *Model Subdivision Conditions Schedule* (2012) provide a planning framework for environmental factors to be considered within the LSP at subdivision and development stages, including:

- Preparation of an ASS self-assessment in accordance with model subdivision condition EN8 (WAPC 2012).
- Preparation of an Urban Water Management Plan in accordance with model subdivision condition D2 (WAPC 2012).
- A detailed Bushfire Attack Level (BAL) assessment for buildings within those areas identified as being "bushfire prone" in the Fire Management Plan (Emerge Associates and Bushfire Safety Consulting 2014) for the site, prior to development approval.

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- Standard subdivision condition requiring notification on certificates of title regarding lots being subject to a Fire Management Plan.

These mechanisms ensure that the future development of the site will not significantly impact on the environmental values and attributes of the site and that an appropriate planning and development framework exists to respond to, and manage, the environment.

As outlined in this report, the implementation of the planning framework through LSP design, subdivision and development, will ensure the objectives of the EPA and the WAPC can be met in accordance with the below guidelines, policies and standards:

- *EPA Guidance Statement No. 33 Environmental Guidance for Planning and Development* (EPA 2008).
- *EPA Environmental Assessment Guideline No. 8 Environmental factors and objectives* (EPA 2013).
- *State Planning Policy (SPP) 2.9 Water Resources* (WAPC 2006).
- *WAPC's Better Urban Water Management Guidelines* (WAPC 2008).
- *Planning for Bushfire Protection* (WAPC 2010).
- *AS3959 Construction of Buildings in Bushfire Prone Areas* (Standards Australia 2009).

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FIGURES



Figure 1: Location Plan

Figure 2: Current Metropolitan Region Scheme

Figure 3: Topography

Figure 4: Soils

Figure 5: Acid Sulfate Soils

Figure 6: Vegetation communities

Figure 7: Vegetation condition

Figure 8: Bush Forever, ESAs and Ecological Linkages

Figure 9: Groundwater

Figure 10: Bushfire Prone Areas

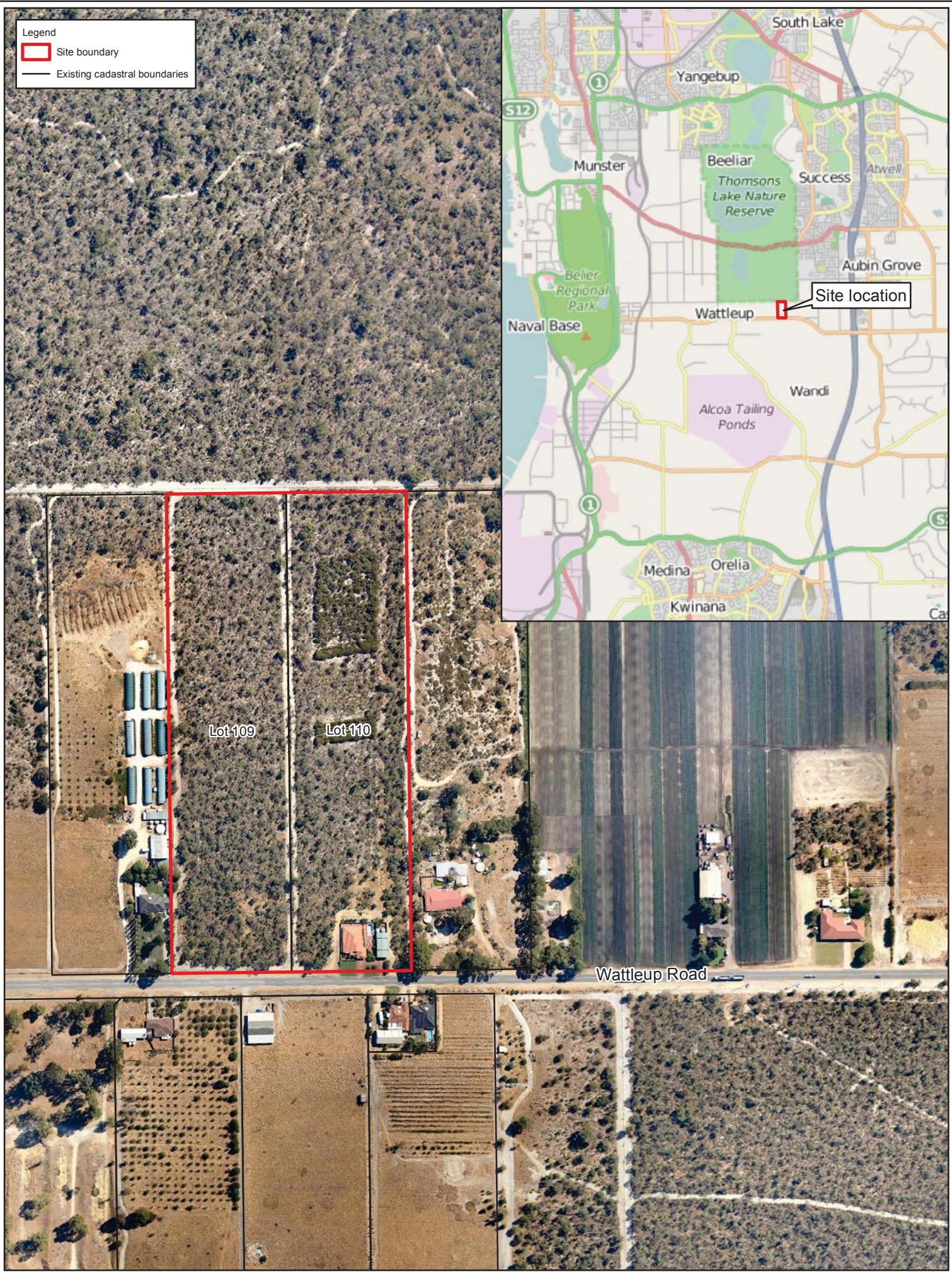


Figure 1: Site Plan

Project: Environmental Assessment and Management Strategy
Local Structure Plan - Lots 109 and 110 Wattleup Road

Client: Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.



Plan Number: EP14-021(02)-F09a

Drawn: ADB	Date: 01/12/14
Approved: CKK	Date: 01/12/14
Checked: VMK	Scale: 1:4,000@A4

0 40 80 160 Metres



Legend

Site boundary

Existing cadastral boundaries

Metropolitan Region Scheme Zones and Reserves

Parks and Recreation

Urban



Figure 2: Current Metropolitan Region Scheme			Plan Number: EP14-021(02)-F36a				
Project:	Environmental Assessment and Management Strategy Local Structure Plan - Lots 109 and 110 Wattleup Road		Drawn:	ADB		Date:	01/12/14
Client:	Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.		Approved:	CKK		Date:	01/12/14
			Checked:	VMK		Scale:	1:2,000@A4

Sources: The following datasets were used in the production of this map: Metropolitan Region Scheme Zones and Reserves - DoP (2014)



Legend

Site boundary

Topographic contours (mAHD)

Aerial photograph: Nearmaps

Figure 3: Topography

Project: Environmental Assessment and Management Strategy
Local Structure Plan - Lots 109 and 110 Wattleup Road

Client: Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.



Plan Number: EP14-021(02)--F10a			
Drawn:	ADB	Date:	01/12/14
Approved:	CKK	Date:	01/12/14
Checked:	VMK	Scale:	1:2,000@A4
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While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

Legend

Site boundary

Existing cadastral boundaries

Geological Unit

S7 - Sand

S8 - Sand

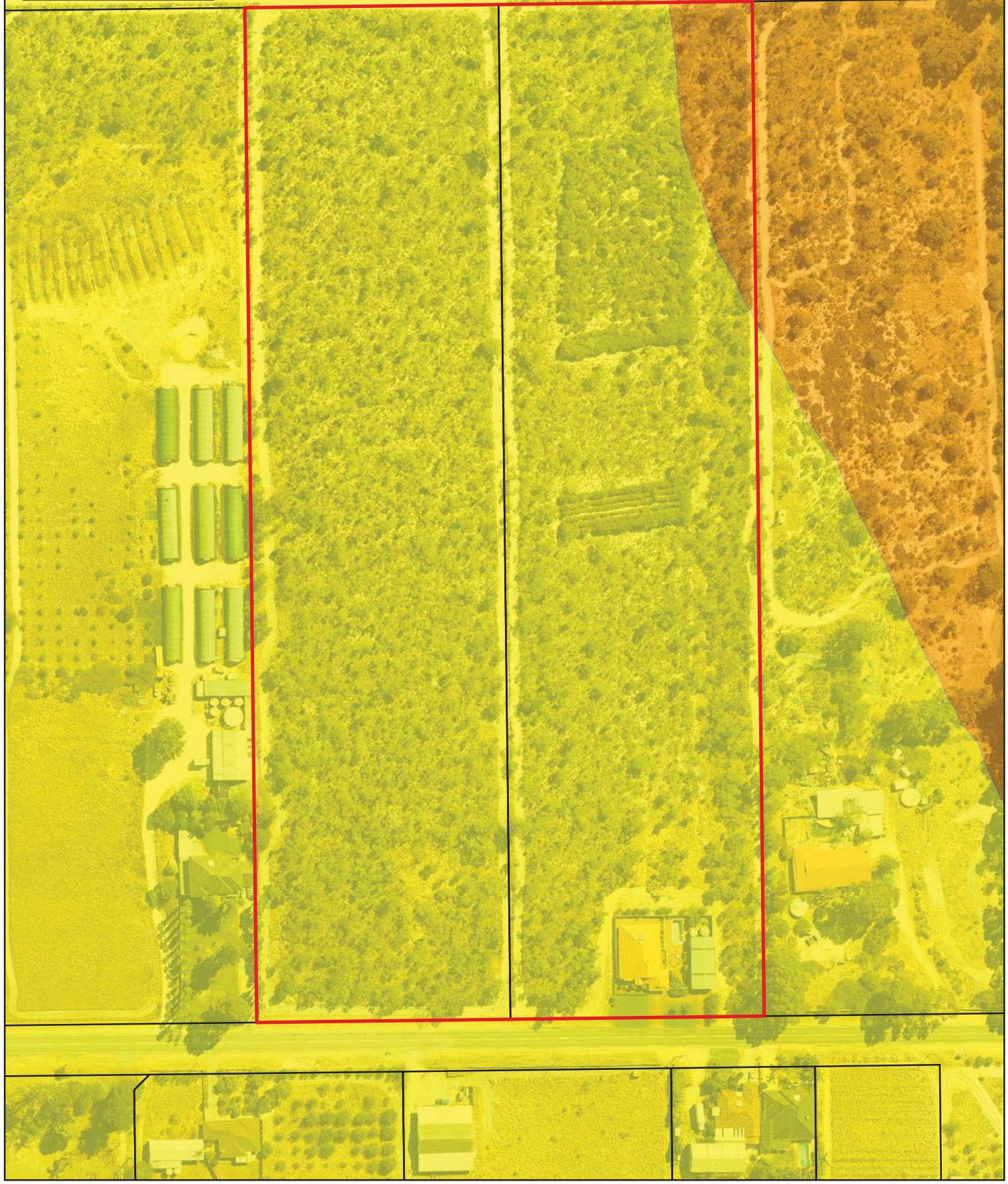


Figure 4: Soils

Project: Environmental Assessment and Management Strategy
Lots 109 and 110 Wattleup Road LSP Support

Client: Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.



Plan Number: EP14-021(02)--F12a

Drawn: ADB

Date: 01/12/14

Approved: CKK

Date: 01/12/14

Checked: VMK

Scale: 1:2,000@A4

0

20

40

80

Metres



Sources: The following datasets were used in the production of this map: Geological Unit - Perth Geological Survey (1986)

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

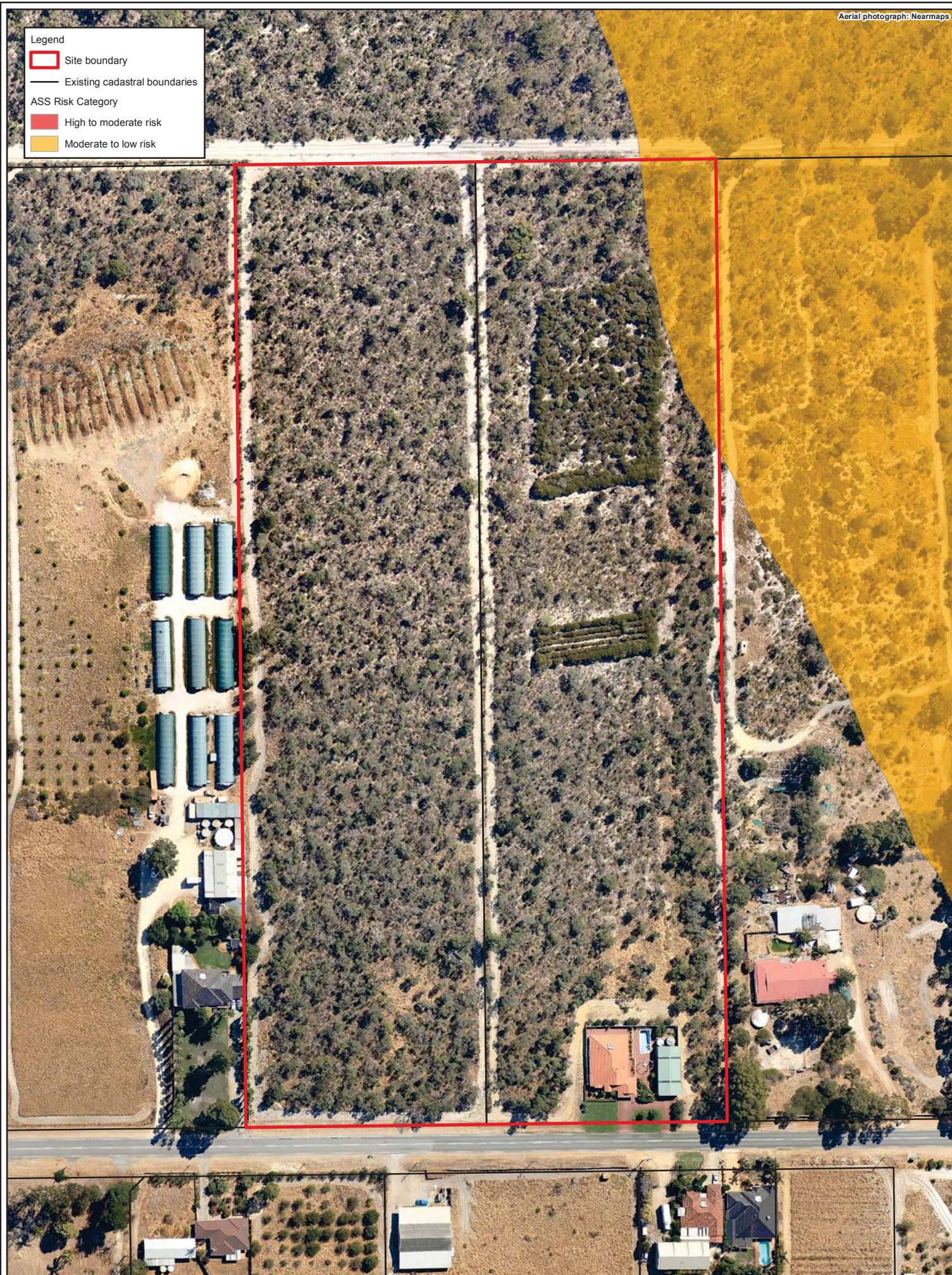


Figure 5: Acid Sulfate Soils

Project: Environmental Assessment and Management Strategy
Local Structure Plan - Lots 109 and 110 Wattleup Road

Client: Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.



Plan Number: EP14-021(02)--F13a

Drawn: ADB Date: 01/12/14

Approved: CKK Date: 01/12/14

Checked: VMK Scale: 1:2,000@A4

0 20 40 80 Metres

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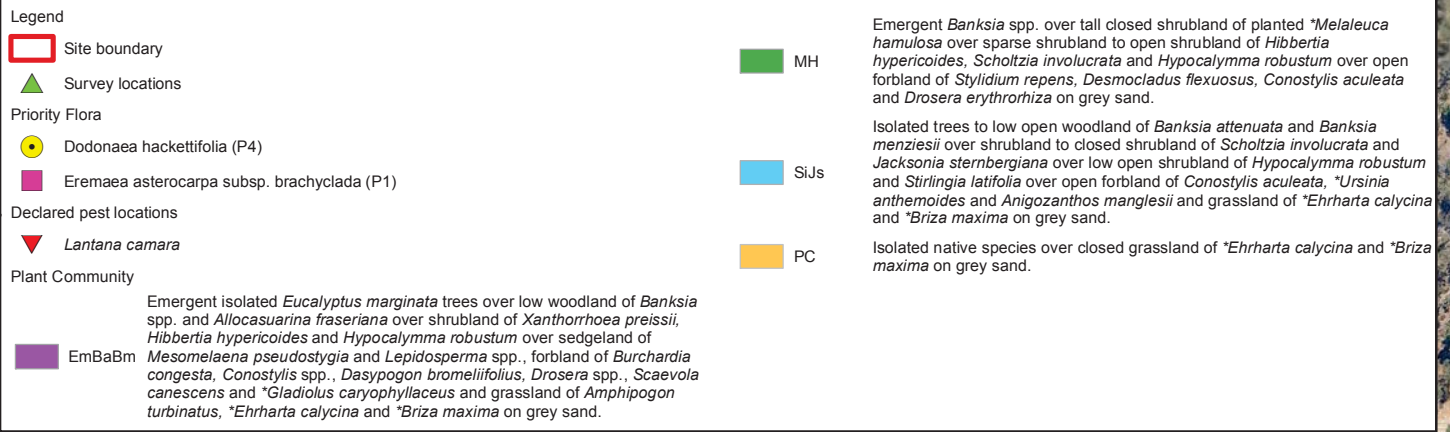


Figure 6: Plant Communities and Significant Flora Locations

Project:	Environmental Assessment and Management Strategy Local Structure Plan - Lots 109 and 110 Wattleup Road
Client:	Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.



Plan Number: EP14-021(02)--F38a			
Drawn:	ADB	Date:	01/12/14
Approved:	CKK	Date:	01/12/14
Checked:	VMK	Scale:	1:2,000@A4
0 20 40 80 Metres			





Figure 7: Vegetation Condition

Project: Level 1 Flora and Vegetation Assessment
 Lots 109 and 110 Wattleup Road, Wattleup

Client: Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.



Plan Number: EP14-021(02)--F39a

Drawn: ADB	Date: 01/12/14
Approved: CKK	Date: 01/12/14
Checked: VMK	Scale: 1:2,000@A4

0 20 40 80 Metres





Figure 8: Bush Forever, ESA's and Ecological Linkages

Project: Environmental Assessment and Management Strategy
Local Structure Plan - Lots 109 and 110 Wattleup Road

Client: Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.



Plan Number: EP14-021(02)--F15a

Drawn: ADB	Date: 01/12/14
Approved: CKK	Date: 01/12/14
Checked: VMK	Scale: 1:8,000@A4

0 75 150 300 Metres

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Legend

- Site boundary
- Maximum groundwater contours (2001)
- Minimum groundwater contours (2003)

Aerial photograph: Nearmaps

Figure 9: Groundwater	
Project:	Environmental Assessment and Management Strategy Local Structure Plan - Lots 109 and 110 Wattleup Road
Client:	Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic.

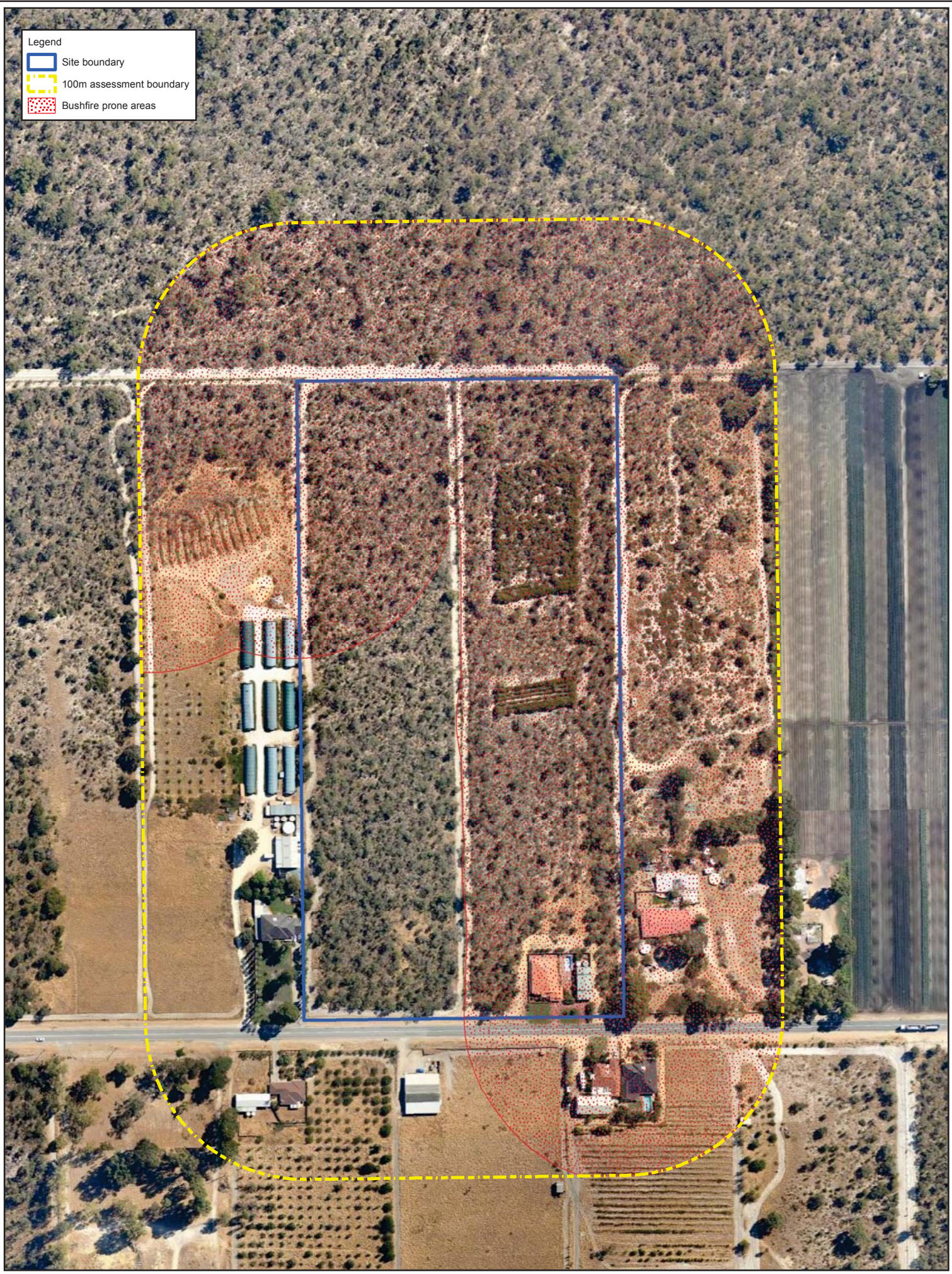


Plan Number: EP14-021(02)-F14a	
Drawn: ADB	Date: 01/12/14
Approved: CKK	Date: 01/12/14
Checked: VMK	Scale: 1:4,000@A4



Sources: The following datasets were used in the production of this map: Groundwater contours - DoW

While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used



Legend

- Site boundary
- 100m assessment boundary
- Bushfire prone areas

Figure 10: Bushfire Prone Areas

Project:	Environmental Assessment and Management Strategy Local Structure Plan - Lots 109 and 110 Wattleup Road
Client:	Wattleup Road Property Developments Pty Ltd and M. & A. Dropulic



Plan Number: EP14-021(02)--F40a	
Drawn: ADB	Date: 01/12/14
Approved: CKK	Date: 01/12/14
Checked: VMK	Scale: 1:3,000@A4



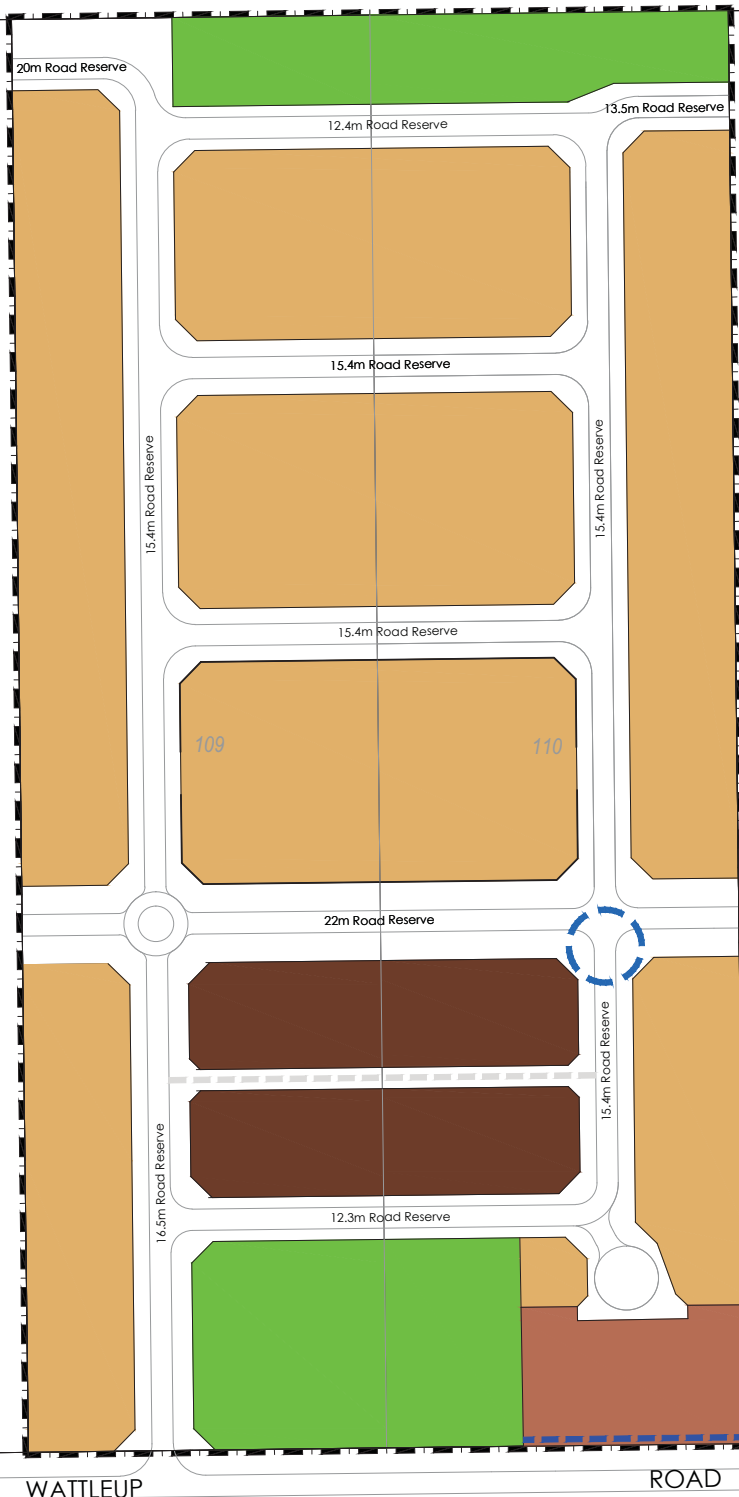
APPENDIX A



LOCAL STRUCTURE PLAN (BURGESS DESIGN GROUP 2014)

108

111



WATTLEUP

ROAD

NOTES

1. Single residential development for lots zoned R40 permitted as the first stage of development with further subdivision of lots prohibited until such time as vehicular access onto the existing Wattleup Road can be achieved.
2. Vehicular access prevented onto Wattleup Road until such time as the existing Wattleup Road is downgraded and the surface level reduced;

LEGEND

Zones

- Residential R30
- Residential R40 - refer to Note 1
- Residential R60

Local Scheme Reserves

- Parks & Recreation

Other

- Structure Plan Boundary
- Laneway
- Restricted Access - refer to Note 2
- Left in/Left out

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PLAN 1



burgess design group
TOWN PLANNING + URBAN DESIGN

PO Box 8779, Perth Business Centre 6849
www.burgessdesigngroup.com.au

P (08) 9328 6411
F (08) 9328 4062



NORTH

0 10 20 30 40 50m
SCALE 1:1,500 (A3)

PROPOSED STRUCTURE PLAN
LOTS 109 & 110 WATTLEUP ROAD
HAMMOND PARK
CITY OF COCKBURN

Plan No: OPE HAM 2-01f Client: OPE HAM/EGD WAT
Date: 25.11.14 Planner: JD/MB

APPENDIX B



LEVEL 2 FLORA AND VEGETATION REPORT (EMERGE 2014)

LEVEL 2 FLORA AND VEGETATION ASSESSMENT

LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP
Project Number EP14-021

**Prepared for Wattleup Road Property Developments Pty Ltd
and M. & A. Dropulic
December 2014**



LEVEL 2 FLORA AND VEGETATION ASSESSMENT
 LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

Document Control

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B					
C					
D					

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LEVEL 2 FLORA AND VEGETATION ASSESSMENT

LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

Executive Summary

The Burgess Design Group, on behalf of the Wattleup Road Property Developments Pty Ltd, has prepared a Local Structure Plan (LSP) for the residential development of Lots 109 and 110 Wattleup Road in Hammond Park ('the site') within the Southern Suburbs District Structure Plan area (City of Cockburn 2012), in the City of Cockburn.

The site is located in Hammond Park, approximately 24 kms south of the Perth Central Business District and is bounded by Wattleup Road to the south, Harry Waring Marsupial Reserve to the north and market gardens to the east and west; these are also proposed for residential development.

The scope of this assessment was to undertake a Level 2 flora and vegetation assessment in accordance with the Environmental Protection Authorities Guidance Statement No. 51 – *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) and targeted search for Threatened Flora species in accordance with the Department of Environment's *Draft Survey Guidelines for Australia's Threatened Orchids* (DoE 2013).

Two botanists from Emerge visited the site on the 9 July and 7 October 2014 and undertook a flora and vegetation assessment and targeted search for Threatened Flora species *C. huegelii*, *Drakaea elastica* and *D. micrantha*. The site was traversed on foot and detailed sampling of the vegetation was undertaken at ten locations using non-permanent 10 x 10 m quadrats, selected to adequately sample each plant community observed. Five Points of Interest were also recorded to show particular site characteristics. Photographs were taken to document the vegetation at all locations, and opportunistically. The targeted Threatened Flora search involved two botanists walking parallel transects five metres apart throughout the site, whilst looking for the targeted species in the area 2.5 metres to either side.

A total of 106 native and 24 introduced (weed) species were recorded within the site in 2014, representing 48 families and 75 genera. The dominant families containing native taxa were Fabaceae (12 native taxa and two introduced taxa), Proteaceae (11 native taxa) and Myrtaceae (nine native taxa, one introduced taxa). The most common genera were *Banksia* spp. and *Stylidium* spp. (five taxa each).

131 flora species were found to occur within the site, including 24 non-native introduced species. One of these introduced species (*Lantana camara*) is listed as a Declared Pest. No Threatened Flora was found occurring within the site despite a methodical search of the site during the flowering period of *C. huegelii*, *Drakaea elastica* and *D. micrantha*. This supports the previous targeted search of Lot 109 conducted by Weston and Bayley Environmental Services (2014) that specifically targeted rare flora species. Two Priority Flora species were however identified as occurring within the site - *Eremaea asterocarpa* subsp. *brachyclada* (P1) and *Dodonaea hackettiana* (P4). *E. asterocarpa* subsp. *brachyclada* was recorded at two survey locations (Q9 and Q15) in the centre of Lot 109. The previous survey had recorded this as the more common subspecies, *Eremaea asterocarpa* subsp. *asterocarpa*, however *E. asterocarpa* subsp. *brachyclada* is taxonomically separated from this species based on the lower stature of the plant (up to 0.7 m), high degree of zigzagging of the branches, smaller fruits and the width of the leaves being greatest around the middle (Hnatiuk 1998). The DPaW Threatened and Priority Flora dataset indicates that this species is known from a cluster of populations ranging in size from one to 85 individuals located approximately four kilometres to the south-east of the site in Wandi, as shown on **Figure 2**. One additional population is known to occur further to the east in Armadale. The Wandi populations are located within land zoned 'Rural – Water Protection' (WAPC 2014).

LEVEL 2 FLORA AND VEGETATION ASSESSMENT

LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

The Priority 4 Flora species, *Dodonaea hackettiana* was recorded at survey location Q1 (shown on **Figure 4**). This species is known from a number of locations to the north of the site within the Harry Waring Marsupial Reserve, as shown on **Figure 2**. Given that the population within the Harry Waring Marsupial Park is highly likely to remain in perpetuity, and the species is represented by a single individual within the site, the occurrence within the site is not considered to be highly significant.

One remnant plant community and three disturbed plant communities were described across the site. These communities are described below.

EmBaBm – Emergent isolated *Eucalyptus marginata* trees over low woodland of *Banksia* spp. and *Allocasuarina fraseriana* over shrubland of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Hypocalymma robustum* over sedgeland of *Mesomelaena pseudostygia* and *Lepidosperma* spp., forbland of *Burchardia congesta*, *Conostylis* spp., *Dasypogon bromeliifolius*, *Drosera* spp., *Scaevola canescens* and **Gladiolus caryophyllaceus* and grassland of *Amphipogon turbinatus*, **Ehrharta calycina* and **Briza maxima* on grey sand.

SiJs – Isolated trees to low open woodland of *Banksia attenuata* and *Banksia menziesii* over shrubland to closed shrubland of *Scholtzia involucreta* and *Jacksonia sternbergiana* over low open shrubland of *Hypocalymma robustum* and *Stirlingia latifolia* over open forbland of *Conostylis aculeata*, **Ursinia anthemoides* and *Anigozanthos manglesii* and grassland of **Ehrharta calycina* and **Briza maxima* on grey sand.

Mh – Emergent *Banksia* spp. over tall closed shrubland of planted **Melaleuca hamulosa* over sparse shrubland to open shrubland of *Hibbertia hypericoides*, *Scholtzia involucreta* and *Hypocalymma robustum* over open forbland of *Stylidium repens*, *Desmocladius flexuosus*, *Conostylis aculeata* and *Drosera erythrorhiza* on grey sand.

'Parkland Cleared' – Isolated native species over closed grassland of **Ehrharta calycina* and **Briza maxima* on grey sand.

Plant community **EmBaBm** is likely to represent the vegetation that would once have occurred over the entirety of the site prior to disturbance. The statistical comparison to Gibson *et al.* (1994) site data indicated that plant community **EmBaBm** is most similar to FCT 28 – *Spearwood Banksia attenuata or Banksia attenuata-Eucalyptus woodlands*. FCT 28 is considered to be 'well reserved' and 'low risk' and is represented within the Harry Waring Marsupial Reserve to the north of the site.

Vegetation condition across the site ranged from 'Completely Degraded' to 'Excellent' condition.

On the basis that the site contains no TECs, PECs or Threatened Flora, the site is not considered to contain regionally significant vegetation values. However the presence of two Priority flora species and vegetation in 'Very Good' and 'Excellent' condition indicate that the site may be of local significance.

LEVEL 2 FLORA AND VEGETATION ASSESSMENT

LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

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Weston and Bayley Environmental Services 2014 Level 1 Vegetation Survey and Searches for Rare Flora
– Lot 109 Wattleup Road Hammond Park

Appendix B

Plant Community Dendrogram

Appendix C

Gibson *et al.* (1994) Comparison - dendrograms

Appendix D

Species List

Appendix E

Species List by Plant Community

Appendix F

Raw Data

LEVEL 2 FLORA AND VEGETATION ASSESSMENT
LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

1 Introduction

1.1 Project Background

The Burgess Design Group, on behalf of Wattleup Road Property Developments Pty Ltd, has prepared a Local Structure Plan (LSP) for the residential development of Lots 109 and 110 Wattleup Road in Hammond Park ('the site') within the Southern Suburbs District Structure Plan area (City of Cockburn 2012), in the City of Cockburn.

The site is located in Hammond Park, approximately 24 kms south of the Perth Central Business District and is bounded by Wattleup Road to the south, Harry Waring Marsupial Reserve to the north and market gardens to the east and west; these are also proposed for residential development. The location of the site is shown in **Figure 1**. The site is zoned "Urban" under the Metropolitan Region Scheme and "Development" under the City of Cockburn's Town Planning Scheme No. 3.

1.2 Purpose and Scope of Assessment

Emerge Associates (Emerge) was engaged to provide environmental consultancy services to support the preparation of a LSP. The purpose of this assessment was to provide sufficient environmental information pertaining to the flora and vegetation values within the site to inform the proposed LSP.

The scope of this assessment was to undertake a Level 2 flora and vegetation assessment in accordance with the Environmental Protection Authorities (EPA's) Guidance Statement No. 51 – *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004). As part of this scope of works, the following tasks have been undertaken:

- Desktop review of relevant information pertaining to the site and surrounds, including database searches for threatened flora species and communities.
- A Level 2 flora and vegetation survey in accordance with EPA Guidance Statement No. 51.
- Targeted searches for Threatened Flora species in accordance with the Department of Environment's *Survey Guidelines for Australia's Threatened Orchids* (DoE 2013).
- A list of flora species recorded as part of the field survey.
- Determination and mapping of plant communities and vegetation condition across the site.
- Documentation of the desktop assessment and field methods and results into a combined report.

LEVEL 2 FLORA AND VEGETATION ASSESSMENT

LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

2 Background

2.1 Climate

The climate of the site (which applies to the wider Perth metropolitan region) is described as Mediterranean, with hot, dry summers and moderately wet, mild winters.

The majority of rainfall within the region occurs between May and October each year, and on average is between 600 to 1000 mm per year. However, in the last 40 years there has been a marked decrease in rainfall (between 10 to 15 % decrease), with a noticeable shift to a drier climate across the south-west of Western Australia.

The closest weather station to the site which records rainfall and temperature is the Medina Research Centre, located approximately 7 km south of the site. Average monthly rainfall and minimum and maximum temperatures (1983 - April 2014) are summarised in **Table 1** below.

Table 1: Rainfall and temperature averages for the Medina Research Centre weather station (1983 – April 2014) (BoM 2014)

STATISTICS	J	F	M	A	M	J	J	A	S	O	N	D
Maximum Temperature	30.6	31.5	29.4	25.6	22.1	19.3	18.3	18.8	20.3	22.6	25.9	28.1
Minimum Temperature	17.0	17.6	15.9	13.3	10.5	9.1	8.2	8.0	9.1	10.3	13.3	15.1
Rainfall (mm)	12.1	19.6	19.5	39.9	98.7	145.2	147.5	114.7	78.6	40.1	31.8	11.8

2.2 Landform and Soils

2.2.1 Topography

The topography of the site is undulating, with a north-eastern aspect. Contour information available for the site indicates that the site ranges from its lowest elevation of approximately 29 m AHD in north-east corner to its highest elevation of 43 m AHD in south-west portion of the site.

2.2.2 Regional geomorphology

The site is located in the central part of the Swan Coastal Plain, which forms the central portion of the Perth Basin. The Perth Basin extends from the Darling Fault in the east to the continental slope west of Rottnest Island, and from the Murchison River in the north to the Southern Ocean in the south. The Perth Basin is sedimentary in origin and is marginal to the west of the Australian Shield (Seddon 2004).

The Swan Coastal Plain is composed of two wide belts of sediment that differ in origin, with one formed from alluvial deposits (water-laid) and the other formed from aeolian origins (wind-laid). It is approximately 20 to 30 kilometres wide, consisting of a series of geomorphic entities that run parallel to the coastline with the alluvial deposits in the east and the aeolian deposits in the west. The youngest and western most geomorphic entity of aeolian origin is the Quindalup Dunes, followed by the Spearwood Dunes and the Bassendean Dunes (Beard 1990, Seddon 2004). The Pinjarra Plain follows

LEVEL 2 FLORA AND VEGETATION ASSESSMENT

LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

the Bassendean Dunes and is alluvial in origin, which then joins the Ridge Hill Shelf at the eastern most edge of the Swan Coastal Plain.

The site is situated near the junction of the Spearwood and Bassendean Dune Systems.

2.2.3 Landform, soils and geology

Landform and soil mapping undertaken by Churchward and McArthur (1980) indicates that the site is within the Bassendean soil and landform association, described as sand plains with low dunes and occasional swamps; iron or humus podzols; areas of complex steep dunes. Department of Agriculture (DoA) soil mapping however, places the site within the Spearwood S1b Phase, and thus part of the Spearwood Dune System. The Spearwood Dune system is described as an undulating landscape with deep yellow sands over limestone. The difference between datasets indicates the sites position at the junction of the two dune systems.

The *Perth Metropolitan Region 1: 50,000 Environmental Geology Series, Perth (Fremantle Part Sheets 2033 I and 2033 IV)* (Gozzard 1983) shows the site is comprised of “Sand” (S7 for the majority of the site and S8 in the north-east corner). The general descriptions of these are provided in **Table 2**.

Table 2: Environmental Geology Series Map Unit Descriptions

MAP UNIT	DESCRIPTION
S7	SAND - white to pale yellowish brown and olive-yellow, medium- to coarse-grained, sub-angular quartz with some trace of feldspar, moderately sorted, of residual origin
S8	SAND - white to pale grey at surface, yellow at depth, fine to medium-grained, moderately well sorted, subangular to subrounded quartz, of eolian origin

2.3 Regional vegetation

The site occurs within the Southwest Province natural region of Western Australia as defined by Beard (1990). Much of the Southwest Province occupies the ancient Western Shield. The Interim Biogeographic Regionalisation of Australia (IBRA) further divides the Southwest Province into smaller areas (Environment Australia 2000) and the site is contained within the Drummond Subregion which occurs along the south-western coast of Western Australia. The Drummond Subregion is characterised as containing mainly *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; woodland of tuart (*Eucalyptus gomphocephala*), jarrah (*E. marginata*) and marri (*Corymbia calophylla*) on less leached soils (Beard 1990).

At a local level, the site is mapped by Heddle *et al.* (1986) as containing the Bassendean Complex – Central and South complex which is described as “woodland of *E. marginata* – *C. fraseriana* – *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This area includes the transition of *E. marginata* to *E. tottiana* in the vicinity of Perth” (Heddle *et al.* 1986).

Prior to European settlement and the extensive land clearing that followed, the Bassendean Complex – Central and South covered 87,393 ha of the Swan Coastal Plain. In 2013, 24,206 ha (27.7%) of this complex was estimated to remain on the Swan Coastal Plain (LBP 2013). Of its pre-European extent 7,479 ha (or 8.56%) is under some form of protection (for example, within Department of Parks and Wildlife (DPaW) conservation estate, Bush Forever on DPaW managed lands or Bush Forever in Regional Parks) (LBP 2013).

LEVEL 2 FLORA AND VEGETATION ASSESSMENT

LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

Many studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). However this is a purely biodiversity orientated objective, and on the Swan Coastal Plain, which is considered a 'constrained area', the EPA has applied a biodiversity protection objective of retaining 10% of each vegetation complex (EPA 2006). The area remaining of Bassendean Complex – Central and South falls below the 30% objective, but above the 10% constrained area objective.

2.4 Significant Flora Species

At a Federal level, species of flora may be considered 'Threatened' pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). "Threatened" species under the EPBC Act are listed as "Critically Endangered", "Endangered" or "Vulnerable". Any action likely to have a significant impact on a species listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment.

At a state level, plant species acquire "Threatened" or "Priority" conservation status where populations are restricted geographically or threatened by local processes. The Department of Parks and Wildlife (DPaW) (previously known as Department of Environment and Conservation) recognise these threats and subsequently considers population protection and species conservation. DPaW enforces the *Wildlife Conservation Act 1950* (WC Act) to conserve Threatened flora and protect all populations. Threatened flora are gazetted under subsection 2 of section 23F of the WC Act and it is an offence to "take" or damage rare flora without Ministerial approval. Section 23F of the Act defines "to take" as "... to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora to cause or permit the same to be done by any means".

Priority flora species are potentially rare or threatened and are classified in order of threat, however are not under direct statutory protection. The definition and categories of Threatened and Priority Flora are listed in **Table 3**.

Table 3: Definition of Threatened and Priority Flora Species (Smith 2010)

CONSERVATION CODE	CATEGORY
T	Threatened Flora – Extant Taxa Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X	Threatened Flora – Presumed Extinct Taxa Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
P1	Priority One – Poorly Known Taxa Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Priority Two – Poorly Known Taxa Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.

LEVEL 2 FLORA AND VEGETATION ASSESSMENT
 LOT 109 AND 110 WATTLEUP ROAD, WATTLEUP

CONSERVATION CODE	CATEGORY
P3	Priority Three – Poorly Known Taxa Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4	Priority Four – Rare Taxa Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

A search was conducted of the DPaW's databases for Threatened and Priority flora and of the EPBC Act list of Matters of National Environmental Significance (MNES) that occur within the wider local area and the results are listed in **Table 4**. Nine Threatened Flora species and 19 Priority Flora species were found to occur within the wider local area. Species considered to potentially occur within the site based on substrate and habitat preferences are shaded grey in **Table 4**. Of the Threatened Flora species, five were considered highly unlikely to occur within the site (white rows in **Table 4**). Three of the four remaining Threatened Flora species (*Andersonia gracilis*, *Caladenia huegelii* and *Drakaea elastica*) are also listed as 'Endangered' and *Drakaea micrantha* is listed as 'Vulnerable' pursuant to the EPBC Act. Known locations of Threatened and Priority Flora species occurring within one kilometre of the site are shown on **Figure 2**.

Table 4: Significant flora species known to occur within the general area (DPaW Reference Number 03-0714FL). Species Information obtained from FloraBase (DPaW 2014).

SPECIES	LEVEL OF SIGNIFICANCE		LIFE STRATEGY	SUBSTRATE AND HABITAT	FLOWERING PERIOD
	STATE	EPBC ACT LISTING			
<i>Andersonia gracilis</i>	T	E	P	White/grey sandy, sandy clay, gravelly loam.	Sept-Nov
<i>Caladenia huegelii</i>	T	E	PG	Grey or brown sand, clay loam.	Sept-Oct
<i>Centrolepis caespitosa</i>	T	E	A	White sand, clay.	Oct-Dec
<i>Darwinia foetida</i>	T	CE	P	Peaty, sandy clay.	Oct-Nov
<i>Diuris micrantha</i>	T	V	PG	Brown loamy clay.	Sept-Oct
<i>Diuris purdiei</i>	T	E	PG	Grey-black sand, moist.	Sept-Oct
<i>Drakaea elastica</i>	T	E	PG	White or grey sand.	Oct-Nov
<i>Drakaea micrantha</i>	T	V	PG	White-grey sand.	Sept-Oct
<i>Lepidosperma rostratum</i>	T	E	P	Peaty sand, clay.	May-Aug
<i>Acacia lasiocarpa</i> var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay. Swampy areas, winter wet lowlands.	May or Aug
<i>Aponogeton hexatepalus</i>	P4	-	A	Mud. Freshwater: ponds, rivers,	Jul-Oct

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SPECIES	LEVEL OF SIGNIFICANCE		LIFE STRATEGY	SUBSTRATE AND HABITAT	FLOWERING PERIOD
				claypans.	
<i>Austrostipa mundula</i>	P2	-	P	Sands often over limestone. Plains, coastal dunes and cliffs.	(Aug) Sep-Oct (Nov)
<i>Byblis gigantea</i>	P3	-	P	Sandy-peat swamps. Seasonally wet areas.	Sep-Dec (Jan)
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay. Swamps, creek edges.	Sep-Jan
<i>Dodonaea hackettiana</i>	P4	-	P	Sand.	Jul-Oct
<i>Eremaea asterocarpa</i> subsp. <i>brachyclada</i>	P1	-	P	Deep grey sand.	Jul-Nov
<i>Grevillea olivacea</i>	P4	-	P	White or grey sand. Coastal dunes, limestone rocks.	Jun-Sep
<i>Jacksonia gracillima</i>	P3	-	P	Grey/brown/black sand, loam and clays. Dry flats, winter wet swamps (or adjacent to).	(Jun) Oct-Nov
<i>Microtis quadrata</i>	P4	-	Pg	Peaty sands, clays and loams. Wet flat, swamps, water on surface common.	Oct-Dec
<i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>	P3	-	P	White or grey sand, lateritic gravel.	Aug-Oct
<i>Pimelea calcicola</i>	P3	-	P	Sand.	Sept-Nov
<i>Pithocarpa corymbulosa</i>	P3	-	P	Gravelly or sandy loam. Amongst granite outcrops.	Jan-Apr
<i>Stylidium ireneae</i>	P4	-	P	Sandy loam. Valleys near creek lines, woodland, often with <i>Agonis</i> .	Oct-Dec
<i>Stylidium longitubum</i>	P3	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec
<i>Stylidium paludicola</i> ms	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Oct-Dec
<i>Thelymitra variegata</i>	P3	-	Pg	Sandy clay, sand, laterite.	Jun-Sep
<i>Tripterococcus paniculatus</i>	P4	-	P	Grey, black or peaty sand. Winter-wet flats.	Oct-Nov
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4	-	P	Sand, sandy clay. Winter-wet depressions.	May or Nov-Dec (Jan)

Note: P=Perennial, Pg=Perennial Geophyte, A=Annual, T=Threatened, E= Endangered, CE=Critically Endangered and V=Vulnerable. Grey shading denotes species considered to potentially occur within the site on the basis of substrate and habitat preferences.

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2.5 Threatened Ecological Communities (TEC's) and Priority Ecological Communities (PEC's)

In Western Australia, Threatened Ecological Communities (TECs) are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, WA Museum and DPaW.

Communities are assigned to one of the categories outlined in **Table 5** relating to their status of threat. While they are not afforded direct statutory protection at a state level (unlike Threatened Flora under the WC Act) their significance is acknowledged through other state environmental approval processes such as Environmental Impact Assessment pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the Part V EP Act Clearing Regulations.

Table 5: *Categories of Threatened Ecological Communities (English and Blyth 1997)*

CONSERVATION CATEGORY	DESCRIPTION
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

In addition to listing as a TEC, a community may be listed as a Priority Ecological Community (PEC). This is an ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined, and can be placed on the list of PECs in either Category 1, 2 or 3 (these are described in **Table 6**). Ecological communities that are adequately known and are rare but not threatened, or meet criteria for "Near Threatened", or that have been recently removed from the Threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5 (DEC 2009).

Threatened Communities are also afforded statutory protection at a Federal level pursuant to the EPBC Act. The EPBC Act provides for the protection of ecological communities, which are listed under section 181 of the Act. They are categorised as 'Critically Endangered', 'Endangered' or 'Vulnerable'.

Table 6: *Categories of Priority Ecological Communities (DEC 2009)*

PRIORITY CATEGORIES	DESCRIPTION
Priority 1	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey

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PRIORITY CATEGORIES	DESCRIPTION
	requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: <ul style="list-style-type: none"> (i) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (ii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring.
Priority 5	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

A search was conducted of the DPaW's TEC and PEC database, as well as the EPBC Act list of Matters of National Environmental Significance (MNES). These searches indicated that four PECs and six TECs occur within 10 km of the site; these are listed in **Table 7**. This included two 'Critically Endangered' communities (SCP19b and Mound Springs SCP) which are also listed as 'Endangered' pursuant to the EPBC Act.

Table 7: TEC's within the wider local area

COMMUNITY CODE	COMMUNITY NAME	TEC/PEC	LEVEL OF SIGNIFICANCE	
			STATE	EPBC ACT LISTED
SCP 19b	Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain	TEC	Critically Endangered	Endangered
Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	TEC	Critically Endangered	Endangered
SCP 26a	<i>Melaleuca huegelii</i> - <i>Melaleuca acerosa</i> (currently <i>M. systena</i>) shrublands on limestone ridges	TEC	Endangered	-
SCP 10a	Shrublands on dry clay flats	TEC	Endangered	-
SCP 08	Herb rich shrublands in clay pans	TEC	Vulnerable	-

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COMMUNITY	COMMUNITY NAME	TEC/PEC	LEVEL OF SIGNIFICANCE	
SCP 30a	<i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i>) forests and woodlands, Swan Coastal Plain	TEC	Vulnerable	-
SCP 21c	Low lying <i>Banksia attenuata</i> woodlands or shrublands	PEC	Priority 3	-
SCP 22	<i>Banksia ilicifolia</i> woodlands	PEC	Priority 3	-
SCP 24	Northern Spearwood shrublands and woodlands	PEC	Priority 3	-
SCP 25	Southern <i>Eucalyptus gomphocephala</i> - <i>Agonis flexuosa</i> woodlands	PEC	Priority 3	-

2.6 Bush Forever

The Government of Western Australia's *Bush Forever Policy* is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of Bush Forever (BF) is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of Western Australia 2000b). BF sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

There are no Bush Forever Sites within the site; however Bush Forever Site Number 392 lies directly north of the site, associated with the Harry Waring Marsupial Reserve. In addition, Bush Forever Site Number 393 – Wattleup Lake and Adjacent Bushland, Wattleup/Mandogalup, was located 1.2 km to the west of the site. Bush Forever Sites in the vicinity of the site are shown in **Figure 2**.

2.7 Local and Regional Significance

Apart from being listed as either Threatened or Priority flora, plant species may be significant for a number of other reasons. EPA *Guidance Statement No. 51* (2004) states that significant flora may include taxa that have:

- a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species
- relic status
- anomalous features that indicate a potential new discovery
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- the presence of restricted subspecies, varieties or naturally occurring hybrid
- local endemism/a restricted distribution
- being poorly reserved.

Similarly, plant communities may be significant for reasons other than a listing as a TEC or PEC. EPA (2004) indicates that these reasons include:

- scarcity
- unusual species
- novel combinations of species

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- a role as a refuge
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- being representative of the range of a unit (particularly, a good local and/or regional example
- of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- a restricted distribution.

The presence of any such species will be determined through the flora survey.

2.8 Biodiversity Linkages

Biodiversity or ecological linkages can be described as any area of remaining native vegetation that provides a corridor or linkage between larger patches of vegetation so as to allow movement of flora and fauna and their genetic material through the landscape, helping to maintain metapopulations. Linkages can prevent isolation of flora and fauna and ultimately extinctions. Ecological linkages can either be continuous or near continuous, the more fractured the linkage is, the less efficient the flora and fauna move along that corridor. Within built up areas, these linkages are more fractured.

Regional linkages have been designed by the State Government in *Bush Forever*, *Perth's Greenways* and the *System 6* study and supported by the WA Local Government and *Perth Biodiversity Project* (PBP) (WALGA and PBP 2004). The designed linkages are aimed to be used to conserve and enhance our regional biological linkages and reflect the on-ground linkages throughout the Perth Metropolitan area. PBP Regional Ecological Linkage 50 runs across the north of the site, with the buffer extending inside the site boundaries. This biodiversity linkage is shown on **Figure 2**.

2.9 Wetlands

The *Environmental Protection (Swan Coastal Lakes) Policy 1992* (EPP Lakes) protects the environmental values of selected lake wetlands on the Swan Coastal Plain. DPaW also maintains the *Geomorphic Wetlands of the Swan Coastal Plain* database, which identifies wetland areas and categorises individual wetlands into specific management categories, as outlined in **Table 8** (DEC 2012). It is important to understand that the significance of each wetland is based on hydrological, biological and human use features, which are the key components for the classification of management categories.

Table 8: *Geomorphic Wetlands of the Swan Coastal Plain management categories (DEC 2012)*

MANAGEMENT CATEGORY	GENERAL DESCRIPTION	MANAGEMENT OBJECTIVES
Conservation (CCW)	Wetlands which support a high level of attributes and functions.	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: <ul style="list-style-type: none"> • Reservation in national parks, crown reserves and State owned land • Protection under Environmental Protection Policies • Wetland covenanting by landowners No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands which may be	Priority wetlands. Ultimate objective is to manage, restore

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MANAGEMENT CATEGORY	GENERAL DESCRIPTION	MANAGEMENT OBJECTIVES
(REW)	partially modified but still support substantial ecological attributes and functions.	and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms such as crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple Use (MUW)	Wetlands with few remaining important attributes but still provide important hydrological functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

No wetlands occur within the site. A number of wetlands occur in the vicinity of the site, the closest being a Conservation Category Wetland (CCW) approximately 500 m north-east of the site.

2.10 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are areas prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. As a result ESAs are considered when a clearing permit is required under these regulations. ESAs have been identified to protect the native vegetation values of areas surrounding significant, threatened or scheduled ecosystems and communities. ESA's generally occur over or in association with:

- A declared World Heritage property.
- An area that is registered on the Register of the National Estate, because of its natural values.
- A defined wetland and the area within 50 m of the wetland.
- The area covered by vegetation within 50 m of Threatened Flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened Flora is found.
- The area covered by a Threatened Ecological Community.
- In the Metropolitan Region in a Bush Forever site listed in "Bush Forever" Volumes 1 and 2 (Government of WA 2000).

Or areas covered by the following policies:

- The *Environmental Protection (Gnangara Mound Crown Land) Policy 1992*.
- The *Environmental Protection (Western Swamp Tortoise) Policy 2002*.
- The areas covered by the lakes to which the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* applies.
- Protected wetlands as defined in the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*.
- Areas of fringing native vegetation in the policy area as defined in the *Environmental Protection (Swan and Canning Rivers) Policy 1998*.

There are no ESA's located within the site. An ESA occurs directly adjacent to the north of the site, associated with Bush Forever Site 392 and another occurs approximately 500 m to the north-east associated with the CCW. The ESAs adjacent to the site are shown on **Figure 2**.

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2.11 Previous Surveys

A level 1 flora and vegetation survey and rare flora search (Weston and Bayley Environmental Services 2014) was conducted for Lot 109 in September and October 2012. The survey found that the site consisted almost entirely of *Banksia attenuata* (- *B. menziesii* – *Eucalyptus marginata* – *Allocasuarina fraseriana* – *Jacksonia sternbergiana*) open low forest to low woodland over *Hibbertia hypericoides* – mixed species open low heath. The condition of the vegetation, based on the Keighery condition scale (1994) ranged from 'Good' to 'Very Good'. No TECs, PECs, Threatened Flora or Priority Flora were recorded on the site during the survey. This assessment is provided in **Appendix A**.

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3 Methods

3.1 Field Survey

3.1.1 Flora and Vegetation Survey

Two botanists from Emerge visited the site on the 9 July and 7 October 2014 and undertook a flora and vegetation assessment. The site was traversed on foot and detailed sampling of the vegetation was undertaken at ten locations using non-permanent 10 x 10 m quadrats, selected to adequately sample each plant community observed (as shown on **Figure 3**). Replication of sampling plots was provided within plant communities where possible. The position of each survey location was recorded with a hand-held GPS unit and all vascular plant species were recorded within the area of the quadrat. In addition, opportunistic plant taxa that were observed, but not located at a particular survey location, were recorded through the course of the survey. An estimate of the percentage Foliage Projective Cover (FPC) was made for each species at each survey location. Five Points of Interest were also recorded to show particular site characteristics.

Data recorded at each quadrat included:

- Site details (site name, site number, observers, date, location).
- Environmental data (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event).
- Biological data (vegetation structure and condition, degree of disturbance, species present and cover percentages).

The condition of the vegetation was assessed to assist in determining the conservation values of the site. The vegetation condition was rated according to Keighery (1994), a vegetation condition scale commonly used in the Perth Metropolitan Region, but which is also appropriate for other urbanised and rural areas. The categories are listed and defined in **Table 9** (Keighery 1994).

All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys.

Table 9: Vegetation Condition Scale (Keighery 1994).

VEGETATION CONDITION	DEFINITION
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

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VEGETATION CONDITION	DEFINITION
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

3.1.2 Targeted Threatened Flora Search

The targeted Threatened Flora search involved two botanists walking parallel transects five metres apart throughout the site, whilst looking for the targeted species in the area 2.5 metres to either side. Photographs and taxonomic references were taken to allow for any required in situ identification of species, as Threatened Flora species are not permitted to be sampled without the relevant DPAW approval.

3.2 Mapping and Data Analysis

Aerial photography (1:1,250) was used to map the local plant communities. The plant communities were identified from the quadrat data points. A cluster analysis was performed on the quadrat data by converting the FPC for each species at each sample location to a Domin value (Kent and Coker 1994). Classification was undertaken using hierarchical clustering within the analysis package Primer-6 (Clarke and Gorley 2006), with groups defined using the Bray-Curtis distance measure. Groups were further defined using a 50% similarity cut off. The resultant dendrograms is provided in **Appendix B**.

Once the groups had been defined by the cluster analysis, the plant communities were described according to the dominant species present using the structural formation descriptions of the National Vegetation Inventory System (NVIS) (ESCAVI 2003). The identified plant communities were then mapped on aerial photography (1:1,250) from the quadrat data points and boundaries interpreted from aerial photography.

Once plant communities were described and mapped, each community was statistically compared to the regional Floristic Community Type (FCT) studies and dataset by Gibson *et al.* (1994). Floristic Community Types (FCTs) were determined statistically using presence/absence species data. Site data was reconciled with the SCP dataset of Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package Primer-6 (Clarke and Gorley 2006). Classification was undertaken using a group-average hierarchical clustering technique using the Bray-Curtis distance measure (as described above for plant community determination). This analysis was focussed on the survey locations sampled during the spring visit, to include the maximum number of species present. The dendrograms are provided in **Appendix C**.

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4 Results

A total of 106 native and 24 introduced (weed) species were recorded within the site in 2014, representing 48 families and 75 genera. The dominant families containing native taxa were Fabaceae (11 native taxa and two introduced taxa), Proteaceae (11 native taxa) and Myrtaceae (nine native taxa, one introduced taxa). The most common genera were *Banksia* spp. and *Stylidium* spp. (five taxa each). For a complete species list, species list by plant community and individual survey site data refer to **Appendix D**, **Appendix E** and **Appendix F** respectively.

4.1 Declared Pests

One weed species was recorded that is listed as a 'Declared Pest' pursuant to the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Declared Pest status means weed species are highly invasive and aggressive. Species may be a Declared Pest over the whole of the state, or by particular local government areas.

Under the BAM Act, all Declared Pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management). These categories are described further in **Table 10**.

Declared Pest species **Lantana camara* (lantana) was recorded at one location on the western boundary of the site. The area of lantana is shown in **Plate 1**. In addition to a Declared Pest, lantana is listed as a Weed of National Significance (Department of Agriculture and Food 2014). Lantana is particularly invasive in New South Wales and Queensland, but within Western Australia, lantana invades areas along rivers and near wetlands, usually when birds spread the seeds. Lantana is categorised as a C3 species.

Table 10: Categories of Declared Pest species under the BAM Act (DAFWA 2013).

CATEGORY	DESCRIPTION
C1 (Exclusion)	Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Under the BAM Act, a person must not; "a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest" (Part 2.3.23).

In addition, **Opuntia stricta* (Common Prickly Pear) was recorded in one location within the site and is listed as a Declared Pest on the Western Australian Organism List, however the Declared Pest status of this species only relates to its occurrence in that portion of Western Australia north of 26 degrees latitude (roughly around Shark Bay), thus this species is not a Declared Pest within the southern portion of Western Australia containing the site.

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Plate 1: Occurrence of Declared pest **Lantana camara* on the south western edge of the site (390335 E; 64394155 S).

4.2 Threatened, Priority Flora and Species of Significance

Two Priority Flora species were identified during the field survey of the site.

One specimen of *Dodonaea hackettiana* was recorded at one location (Quadrat 1) in the south eastern portion of Lot 110. *D. hackettiana* is an erect shrub or tree reaching up to five metres in height (**Plate 2A**). This species is known to occur in a number of locations to the north of the site within the Harry Waring Marsupial Reserve, locations are shown on **Figure 2**.

Priority 1 flora species *Eremaea asterocarpa* subsp. *brachyclada* was recorded at two survey locations (Q9 and Q15) in the centre of Lot 109. This species is a low growing shrub up to 0.7 m high and is shown in **Plate 2B**. The species is known from two populations, one in Wandi (as shown on **Figure 2**) and one in Armadale closer to the Darling Scarp. The previous survey had recorded this as the more common subspecies, *E. asterocarpa* subsp. *asterocarpa*, however *E. asterocarpa* subsp. *brachyclada* is taxonomically separated from this species based on the lower stature of the plant (up to 0.7 m), short branches (2-6 cm per growth cycle) with a high degree of zigzagging, smaller fruit (8-11 mm wide) and the width of the leaves being greatest around the middle (Hnatiuk 1998). These characteristics are shown in **Plate 3**.

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The recorded locations of *D. hackettiana* and *E. asterocarpa* subsp. *brachyclada* within the site are shown on **Figure 3**.



Plate 2: Images of Priority species found to occur within the site. A.) *Dodonaea hackettiana* and B.) *Eremaea asterocarpa* subsp. *brachyclada*. Courtesy of the Australian Plant Image Index (Australian National Botanic Gardens).



Plate 3: Specimen of Priority 1 species *Eremaea asterocarpa* subsp. *brachyclada* collected from the site showing smaller fruit size, zigzagging branches and leaf shape used to separate this subspecies from the more common subspecies *E. asterocarpa* subsp. *asterocarpa*.

No Threatened Flora species were identified during the survey or targeted search. One orchid species similar in appearance to *Caladenia huegelii* was recorded; however, taxonomic identification indicated that this was *Caladenia arenicola* (**Plate 3**), as was previously identified within the site by Weston (2014). This species is distinguished from *C. huegelii* by its smaller flowers with shorter labellum fringe segments and a longer leaf (Brown *et al.* 2008).

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Plate 4: *Caladenia arenicola* specimen identified as occurring within the site. This species appears similar, but is taxonomically distinct from Threatened species *C. huegelii*.

4.3 Plant Communities

One remnant plant community and three disturbed plant communities were described across the site. These communities are described below and shown on **Figure 3**.

EmBaBm – Emergent isolated *Eucalyptus marginata* trees over low woodland of *Banksia* spp. and *Allocasuarina fraseriana* over shrubland of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Hypocalymma robustum* over sedgeland of *Mesomelaena pseudostygia* and *Lepidosperma* spp., forbland of *Burchardia congesta*, *Conostylis* spp., *Dasypogon bromeliifolius*, *Drosera* spp., *Scaevola canescens* and **Gladiolus caryophyllaceus* and grassland of *Amphipogon turbinatus*, **Ehrharta calycina* and **Briza maxima* on grey sand (**Plate 5**).

SiJs – Isolated trees to low open woodland of *Banksia attenuata* and *Banksia menziesii* over shrubland to closed shrubland of *Scholtzia involucreata* and *Jacksonia sternbergiana* over low open shrubland of *Hypocalymma robustum* and *Stirlingia latifolia* over open forbland of *Conostylis aculeata*, **Ursinia anthemoides* and *Anigozanthos manglesii* and grassland of **Ehrharta calycina* and **Briza maxima* on grey sand (**Plate 6**).

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Mh – Emergent *Banksia* spp. over tall closed shrubland of planted **Melaleuca hamulosa* over sparse shrubland to open shrubland of *Hibbertia hypericoides*, *Scholtzia involucrata* and *Hypocalymma robustum* over open forbland of *Stylidium repens*, *Desmocladius flexuosus*, *Conostylis aculeata* and *Drosera erythrorhiza* on grey sand (**Plate 7**).

Parkland Cleared – Isolated native species over closed grassland of **Ehrharta calycina* and **Briza maxima* on grey sand (**Plate 8**).



Plate 5: Plant Community **EmBaBm**. Taken at Survey Location Q1 (390455 E; 6439385 S).

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Plate 6: Plant Community *SiJs*. Taken at survey location Q2 (390467 E; 6439427 S).



Plate 7: Plant Community *Mh*. Taken at Survey Location Q4 (390495 E; 6439650 S).

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Plate 8: Parkland Cleared vegetation. Taken at Survey Location POI 11 (390478 E; 6439407 S).

4.4 Conservation Status of Plant Communities

Three of the communities listed above (**Mh**, **SiJs** and **'Parkland Cleared'**) are considered likely to be the product of historical disturbance and clearing of vegetation within the site leading to an altered flora species composition. Plant community **EmBaBm** is likely to represent the plant community that would have occurred over the entire site originally.

The comparison of the site data collected in spring for plant community *EmBaBm* (Survey locations 14 and 15) to the Gibson *et al.* (1994) dataset showed a highest level of similarity (47%) to HARRY-1, which is located approximately 600 m to the west of the site. This site represents FCT 28 – *Spearwood Banksia attenuata* or *Banksia attenuata-Eucalyptus woodlands*. This FCT is considered to be 'well reserved' and 'low risk'. The dendrograms are provided in **Appendix C**.

4.5 Vegetation Condition

The vegetation across the site ranged from 'Completely Degraded' to 'Excellent' condition. 'Completely Degraded' areas occurred within the numerous tracks located within the site, areas of 'Parkland Cleared' vegetation and planted community **Mh**. 'Degraded' areas existed as patches of relatively disturbed areas within the remnant vegetation in the southern portion of the site. Vegetation in 'Good' condition occurred at the southern extent of the site and along the eastern boundary, due to increased weed invasion and historical disturbance. 'Very Good' condition areas of the site were located throughout the majority of Lot 109 and relatively undisturbed portions of Lot 110 and were associated with relatively minor weed invasion and some disturbance to individual species (i.e.

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numerous dead *Banksia* spp. present). Smaller areas of 'Excellent' condition vegetation were noted at the northern extent of Lot 110 and in the centre of Lot 109 due to the presence of fewer weeds and disturbances to individual species noted (i.e. fewer dead *Banksia* spp. than observed in areas of 'Very Good' condition). Vegetation condition across the site is shown in **Figure 4**.

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5 Discussion

The site is mapped by Churchward and Macarthur (1980) as comprising vegetation of the Bassendean Complex – Central and South complex which is described as “woodland of *E. marginata* – *A. fraseriana* – *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites. This area includes the transition of *E. marginata* to *E. todtiana* in the vicinity of Perth” (Hedde *et al.* 1986). More recent soil mapping by DoA (2007) indicates that the site may form part of the Karrakatta Complex – Central and South (part of the Spearwood Dune System). The remnant vegetation within the site is considered to be more consistent with the Karrakatta Complex – Central and South, due to the presence of a number of flora species either within the site or noted within the local area that are not known to occur on Bassendean soils and are common on the Spearwood Dune System, such as *Mesomelaena pseudostygia* and *Eucalyptus gomphocephala*. The vegetation within the site also showed higher similarity to FCT 28 which is usually found on the Spearwood dune system.

Approximately 23.9% of the original extent of the Karrakatta Complex – Central and South remains on the Swan Coastal Plain, which is above the 10% biodiversity objective threshold for ‘constrained areas’ (EPA 2006) and below the biodiversity objective of 30% retention.

130 flora species were found to occur within the site, including 24 non-native introduced species. No Threatened Flora was found occurring within the site despite a methodical search of the site during the flowering period of *C. huegelii*, *Drakaea elastica* and *D. micrantha*. This supports the previous targeted search of Lot 109 conducted by Weston and Bayley Environmental Services (2013) and specifically targeted rare flora species. Two Priority Flora species were however identified as occurring within the site - *Eremaea asterocarpa* subsp. *brachyclada* (P1) and *Dodonaea hackettiana* (P4). *E. asterocarpa* subsp. *brachyclada* was recorded at two survey locations (Q9 and Q15) in the centre of Lot 109. The DPaW Threatened and Priority Flora dataset indicates that this species is known from a cluster of populations ranging in size from one to 85 individuals located approximately four kilometres to the south-east of the site in Wandi, as shown on **Figure 2**. One additional population is known to occur further to the east in Armadale. The Wandi populations are located within land zoned ‘Rural – Water Protection’ under the MRS, which is defined as “rural land over public groundwater areas, where land use is controlled to avoid contamination” (WAPC 2012). This area is also declared as a Priority 2 Public Drinking Water Source Area (PDWSA) under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* and also within the policy area for the *State Planning Policy 2.3 Jandakot Groundwater Protection Policy* (SPP 2.3)(WAPC 2003). Priority 2 PDWSAs have been identified to ensure there is no increased risk of pollution to the water source, and are declared over land where low intensity development (such as rural) already exists. The policy stipulates further intensification of land use may result in contamination of the public drinking water source and therefore urban development is not considered appropriate within a Priority 2 area. This suggests that the rural zoning in this area is likely to persist into the longer term.

The Priority 4 Flora species, *Dodonaea hackettiana* was recorded at survey location Q1 (shown on **Figure 4**). This species is known from a number of locations to the north of the site within the Harry Waring Marsupial Reserve, as shown on **Figure 2**. Given that the population within the Harry Waring Marsupial Park is highly likely to remain in perpetuity, and the species is represented by a single individual within the site, the occurrence within the site is not considered to be highly significant.

One remnant native plant community and three disturbed communities were recorded on the site. Remnant plant community **EmBaBm** was located throughout the majority of the site. The statistical comparison to Gibson *et al.* (1994) site data indicated that plant community **EmBaBm** is most similar

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to FCT 28 – *Spearwood Banksia attenuata* or *Banksia attenuata-Eucalyptus woodlands*. FCT 28 is considered to be ‘well reserved’ and ‘low risk’ and is represented within the Harry Waring Marsupial Reserve to the north of the site. The presence of this FCT confirms the likelihood discussed above that the site is more closely aligned to the Karrakatta Complex – Central and South vegetation complex.

Plant community **SiJs** was located in the central portions of Lot 110. Historical aerals indicate that the centre of the lot was cleared between 1981 and 1985. The subsequent regrowth of native species has led to an altered species composition. *Banksia* spp. were scattered throughout this community with *Scholtzia involucreata* and *Jacksonia sternbergiana* formed a dominant shrubland in this community.

Plant community **Mh** was located in two locations in the centre of Lot 110. This plant community consisted of planted *Melaleuca hamulosa* shrubs, with scattered native species occurring where the planted shrubs did not form a dense canopy.

Areas of ‘Parkland Cleared’ vegetation had been previously cleared and tended to contain isolated native species over a weed dominated understorey. This was located along the tracks, close to the house on Lot 110 and within a number of patches in Lot 109.

The vegetation across the site ranged from ‘Completely Degraded’ to ‘Excellent’ condition. ‘Completely Degraded’ areas occurred within the numerous tracks located within the site, areas of ‘Parkland Cleared’ vegetation and planted community **Mh**. ‘Degraded’ areas existed as patches of relatively disturbed areas within the remnant vegetation in the southern portion of the site. Vegetation in ‘Good’ condition occurred at the southern extent of the site and along the eastern boundary, due to increased weed invasion and historical disturbance. ‘Very Good’ condition areas of the site were located throughout the majority of Lot 109 and relatively undisturbed portions of Lot 110 and were associated with relatively minor weed invasion and some disturbance to individual species (i.e. numerous dead *Banksia* spp. present). Smaller areas of ‘Excellent’ condition vegetation were noted at the northern extent of Lot 110 and in the centre of Lot 109 due to the presence of fewer weeds and disturbances to individual species noted (i.e. fewer dead *Banksia* spp. than observed in areas of ‘Very Good’ condition).

The site, and especially Lot 110, has been subject to historical disturbance through clearing. Despite this, a relatively high level of biodiversity remains through Lot 9 and the northern portion of Lot 110. This is most likely due to the presence of remnant bushland occurring to the north of the site and sufficient seed dispersal between these areas of bushland.

The site was found to contain two Priority flora species (*Dodonaea hackettiana* and *Eremaea asterocarpa* subsp. *brachyclada*), but no Threatened Flora, TECs or PECs. The site is not considered likely to be regionally significant, but the presence of *D. hackettiana*, *E. asterocarpa* subsp. *brachyclada* and vegetation in ‘Very Good’ and ‘Excellent’ condition indicate that vegetation within the site may be of local significance.

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6 Conclusions and Recommendations

The flora and fauna assessment undertaken by Emerge in July and October 2014 identified 130 flora species (106 native and 24 introduced) occurring within the site.

One Declared Pest species (**Lantana camara*) was recorded at one location within the site.

Two species of conservation significance (*Dodonaea hackettiana* and *Eremaea asterocarpa* subsp. *brachyclada*) were found to occur within the site. *D. hackettiana* is a Priority 4 species and has been identified as occurring in a number of locations to the north of the site within the Harry Waring Marsupial Reserve. *E. asterocarpa* subsp. *brachyclada* is a Priority 1 species known to occur approximately 4 kms to the south east of the site.

Vegetation across the site comprised four plant communities. Three of these communities (**Mh**, **SiJs** and **'Parkland Cleared'**) are likely to be the product of historical disturbance – originally it is likely that the entirety of the site contained plant community **EmBaBm**. Plant community **EmBaBm** is likely to represent FCT 28, which is not listed as a TEC or PEC.

Vegetation condition across the site ranged from 'Completely Degraded' to 'Excellent' condition.

On the basis that the site contains no TECs, PECs or Threatened Flora, the site is not considered to contain regionally significant vegetation values. However the presence of two Priority flora species and vegetation in 'Very Good' and 'Excellent' condition indicate that the site may be of local significance.

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FIGURES



Figure 1: Locality Plan.

Figure 2: Environmental Features.

Figure 3: Plant Communities and Significant Flora Locations.

Figure 4: Vegetation Condition.



Figure 1: Location Plan

Project:	Level 2 Flora and Vegetation Assessment Lots 109 and 110 Wattleup Road, Wattleup
Client:	Wattleup Road Development Trust and M. & A. Dropulic



Plan Number: EP14-021(07)-F41a	
Drawn: GRO	Date: 28/11/14
Approved: CKK	Date: 28/11/14
Checked: SKP	Scale: 1:4,000@A4

0 40 80 160 Metres



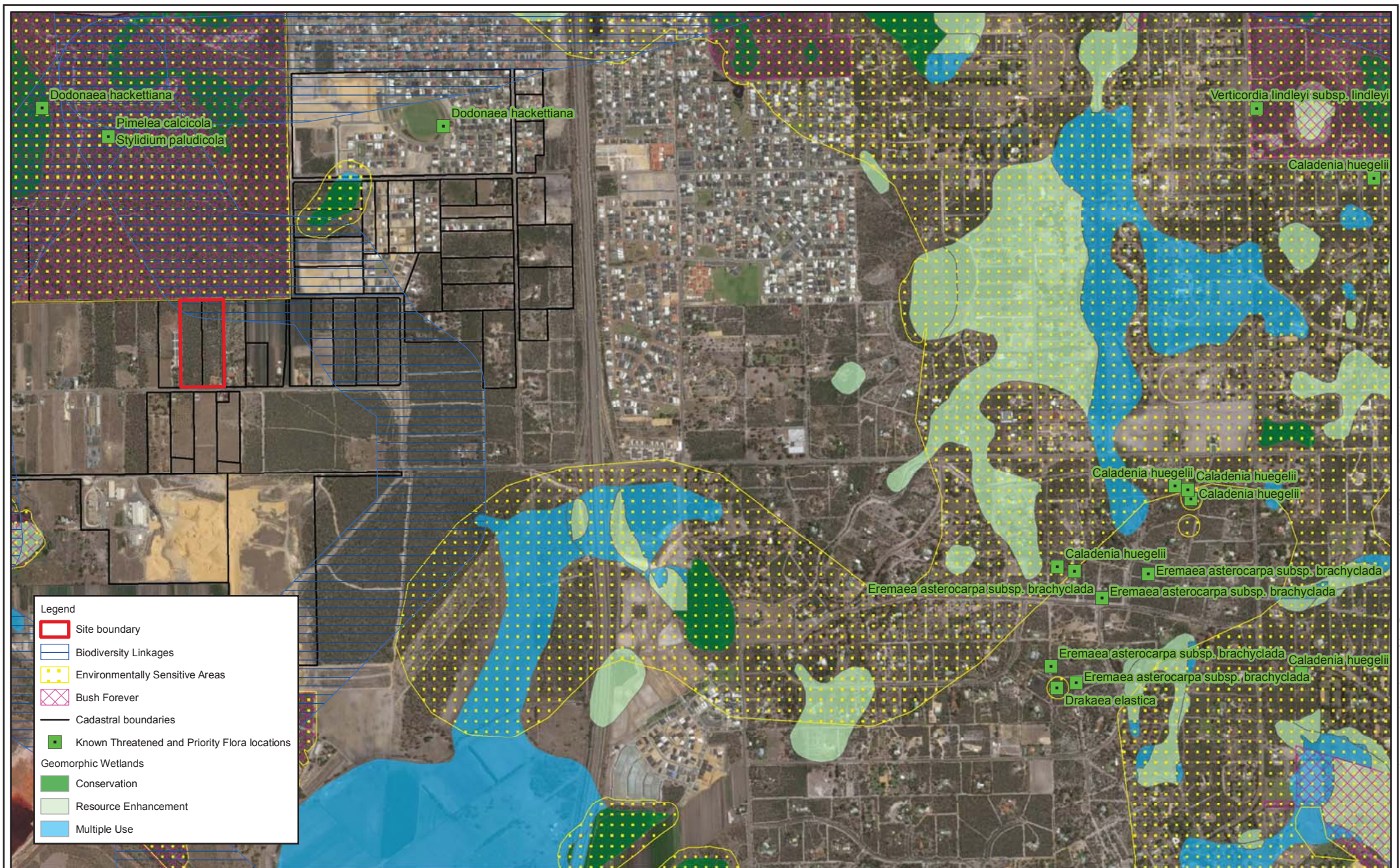


Figure 2: Environmental Features

Project: Level 2 Flora and Vegetation Assessment
Lots 109 and 110 Wattleup Road, Wattleup

Client: Wattleup Road Development Trust and M. & A. Dropulic

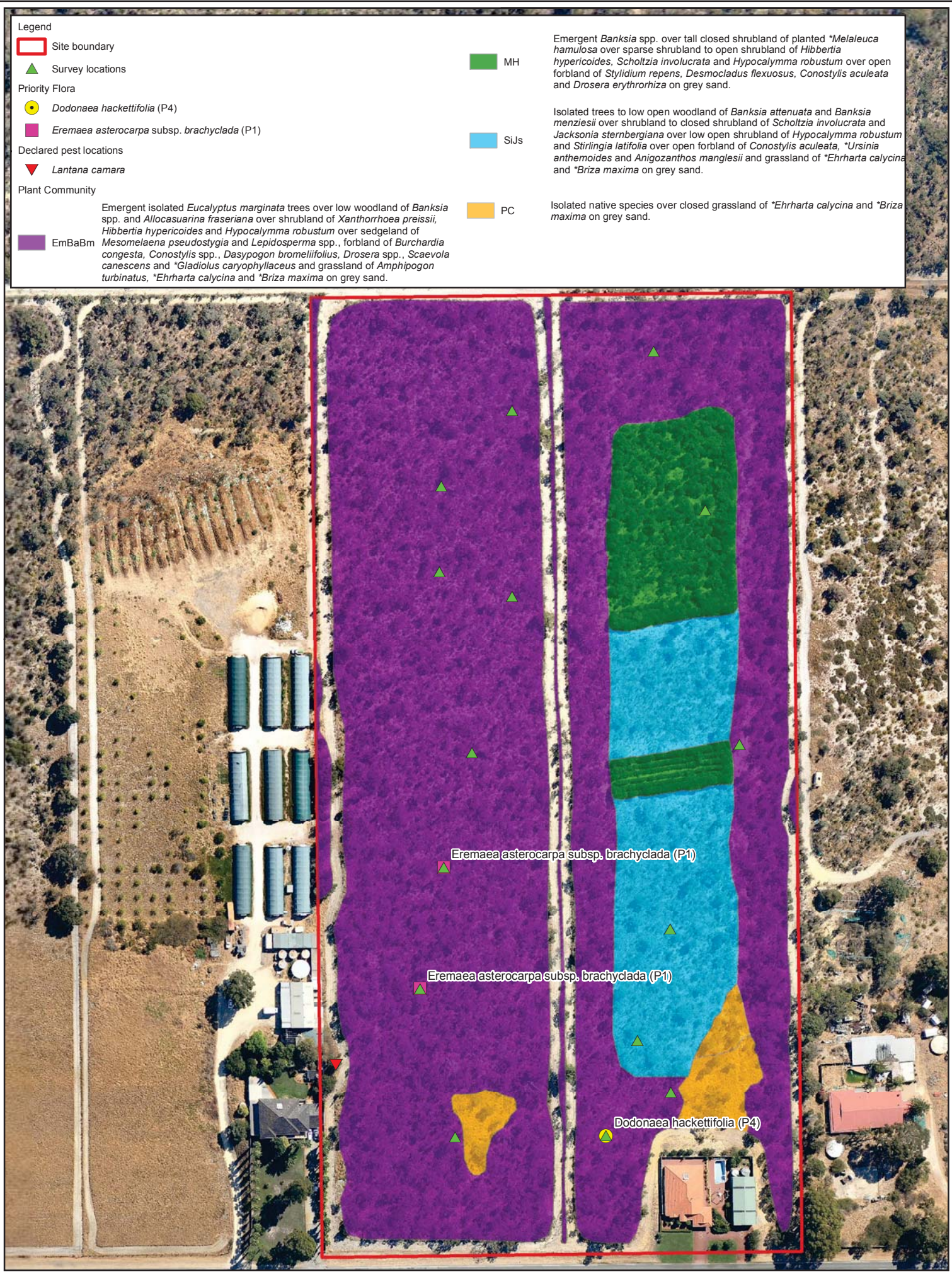


Plan Number: EP14-021(07)-F42a

Drawn: GRO Date: 28/11/14
Approved: CKK Date: 28/11/14
Checked: SKP Scale: 1:22,750@A4

0 200 400 800
Metres

emerge
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Legend

Site boundary

Survey locations

Priority Flora

Dodonaea hackettfolia (P4)

Eremaea asterocarpa subsp. *brachyclada* (P1)

Declared pest locations

Lantana camara

Plant Community

Emergent isolated *Eucalyptus marginata* trees over low woodland of *Banksia* spp. and *Allocasuarina fraseriana* over shrubland of *Xanthorrhoea preissii*, *Hibbertia hypericoides* and *Hypocalymma robustum* over sedgeland of *Mesomelaena pseudostygia* and *Lepidosperma* spp., forland of *Burchardia congesta*, *Conostylis* spp., *Dasyopogon bromeliifolius*, *Drosera* spp., *Scaevola canescens* and *Gladiolus caryophyllaceus* and grassland of *Amphipogon turbinatus*, *Ehrharta calycina* and *Briza maxima* on grey sand.

EmBaBm

MH

Sijs

PC

Emergent *Banksia* spp. over tall closed shrubland of planted *Melaleuca hamulosa* over sparse shrubland to open shrubland of *Hibbertia hypericoides*, *Scholtzia involucrata* and *Hypocalymma robustum* over open forland of *Stylidium repens*, *Desmodadus flexuosus*, *Conostylis aculeata* and *Drosera erythrorhiza* on grey sand.

Isolated trees to low open woodland of *Banksia attenuata* and *Banksia menziesii* over shrubland to closed shrubland of *Scholtzia involucrata* and *Jacksonia sternbergiana* over low open shrubland of *Hypocalymma robustum* and *Stirlingia latifolia* over open forland of *Conostylis aculeata*, *Ursinia anthemoides* and *Anigozanthos manglesii* and grassland of *Ehrharta calycina* and *Briza maxima* on grey sand.

Isolated native species over closed grassland of *Ehrharta calycina* and *Briza maxima* on grey sand.

Figure 3: Plant Communities and Significant Flora Locations

Project: Level 2 Flora and Vegetation Assessment
Lots 109 and 110 Wattleup Road, Wattleup

Client: Wattleup Road Development Trust and M. & A. Dropulic



Plan Number: EP14-021(07)-F43a

Drawn: GRO	Date: 28/11/14
Approved: CKK	Date: 28/11/14
Checked: SKP	Scale: 1:2,000@A4

0 20 40 80 Metres

emerge
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Integrated Science & Design



Legend

Site boundary

Vegetation Condition

- Pristine
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

Figure 4: Vegetation Condition

Project: Level 2 Flora and Vegetation Assessment
Lots 109 and 110 Wattleup Road, Wattleup

Client: Wattleup Road Development Trust and M. & A. Dropulic



Plan Number: EP14-021(07)--F44a			
Drawn:	GRO	Date:	28/08/14
Approved:	CKK	Date:	28/11/14
Checked:	SKP	Scale:	1:2,000@A4

