



Our Ref: 530

3 November 2023

The Secretary
 Western Australian Planning Commission (WAPC)
 Locked Bag 2506
 Perth WA 6001

Attn: Anthony Muscara – Principal Planning Officer, Land Use Planning

Dear Sir / Madam,

**PROPOSED METROPOLITAN REGION SCHEME AMENDMENT
 WEST MUNDIJONG URBAN PRECINCT
 LAND BOUNDED BY LEIPOLD, GANGEMI, MUNDIJONG AND KING ROADS, OLDBURY**

On behalf of WPG Landholdings Pty Ltd (WPG) and the Mundijong West Landowners Group (MWLG), please accept the formal lodgement of the enclosed submission for the proposed Metropolitan Region Scheme (MRS) amendment to rezone 650 hectares of land described as the West Mundijong Urban Precinct (WMUP) from Rural to Urban. The rezoning will facilitate the future planning and development of land which is largely free of constraints and is readily, and relatively quickly developable for residential purposes.

As you are aware, this submission was originally lodged with the Department in June 2022, and following the subsequent lodgement meeting with DPLH officers the proponent agreed to engage with the pre-referral process as a precursor to lodgement of the MRS Amendment itself.

The responses from the relevant statutory authorities are collated into a matrix along with the proponent's subsequent responses and incorporated into the submission as Addendum 1.

In summary:

- 1) *Department of Biodiversity, Conservation and Attractions*
 No objections subject to normal infrastructure, buffers and management plans.
- 2) *Department of Fire and Emergency Services*
 Supported subject to BHLA modifications (*Revised & included in submission*).
- 3) *Department of Mines, Industry Regulation and Safety*
 No objections.
- 4) *Department of Health*
 No objections subject to adequate infrastructure and management plans being implemented as part of future planning process.
- 5) *Department of Transport*
 Supported subject to adequate pedestrian and cycling facilities.



- 6) *Department of Water and Environmental Regulation*
Not supported on the basis that the site is not identified in the South Metropolitan Peel Sub-Regional Planning Framework. *(Addressed in depth in the submission).*
- 7) *Main Roads Western Australia*
Not supported on the basis that the site is not identified in the South Metropolitan Peel Sub-Regional Planning Framework. *(Addressed in depth in the submission).*
- 8) *Public Transport Authority*
No objections
- 9) *Shire of Serpentine Jarrahdale*
No objections subject to further investigations and planning works.
- 10) *Water Corporation*
Not supported on the basis that the proposal is not consistent with the South Metropolitan Peel Sub-Regional Planning Framework, and remote from existing infrastructure *(Addressed in depth in the submission).*
- 11) *Westport*
Not supported as the proposal area falls within one of several catchments over which Westport is undertaking a site selection feasibility study for freight logistics nodes for a 'possible' deep water port at Kwinana at some point in the future *(Addressed in depth in the submission).*

The proponent firmly maintains its longstanding position that much of the land identified for future urban uses in the Mundijong District Structure Plan and the more recently designated Planning Investigation Areas in the Sub-Regional Planning Framework to the west of the WMUP are burdened by very significant constraints as detailed in this submission including but not limited to highly fragmented ownership (many hundreds of individual lots and land owners), and environmental issues which will considerably delay both development delivery time frames and the realistically achievable ultimate yields.

The proposed WMUP on the other hand is largely absent of constraints, has only 10 landowners (The Mundijong West Landowners Group) over the entire 650 hectares who are all very supportive of the proposal, and has had significant preliminary investigative and planning works completed over the preceding 5 years. The proponent undertakes to continue to Project Manage and fund the proposal through the MRS process and future planning works as required.

Given the much publicised residential land and housing shortage in the Perth Metropolitan area, this proposal presents a very real opportunity for the State to offset this shortfall considerably in the short to mid-term.

The proponent asserts that the proposal should not be disqualified from due consideration on its merits simply because to date it has not been included in the Sub-Regional Planning Framework. Rather, town planning is an organic process which should respond to the needs of the community as and when they arise. Clearly more than ever there is now a need and a nexus for significant additional residential land stock in the south-eastern metropolitan area moving into the future which will not be able to be adequately serviced by the existing allocations.



Pertaining to Westport, as an outcome of the MRS pre-referral process the proponent was made aware only late last year that Westport has evidently included the WMUP area into its considerations for possible future/long term ancillary port facilities, along with several other areas. The proponent has endeavoured to collaboratively engage in dialogue with Westport over much of the preceding 12 months however has been unsuccessful.

The proponent very strongly contends that the proposed WMUP area is vastly more suitable for urban and residential development use than for industrial/port related infrastructure, and particularly so with the looming critical housing shortage as it can be developed relatively quickly. The suitability of the site as an urban precinct is addressed in depth in the submission.

There are many thousands of hectares available in the adjoining areas to the north which are immeasurably more suitable operational areas for Westport's proposed facilities.

The Mundijong West Landowners Group very firmly opposes Westport's consideration of its members private land holdings for any long-term future ancillary port uses, which may or may not become reality.

We look forward to working with and assisting the Western Australian Planning Commission in the assessment of the proposed amendment.

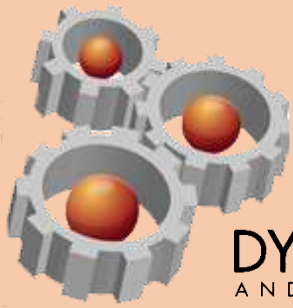
Should you have any queries or require further clarification please do not hesitate to contact the undersigned on 9275-4433.

Yours faithfully,

A handwritten signature in blue ink, appearing to read 'Neil Teo', with a long horizontal flourish extending to the right.

NEIL TEO
DIRECTOR
Enc.

230816 530 MRS Amendment Cover Letter.doc



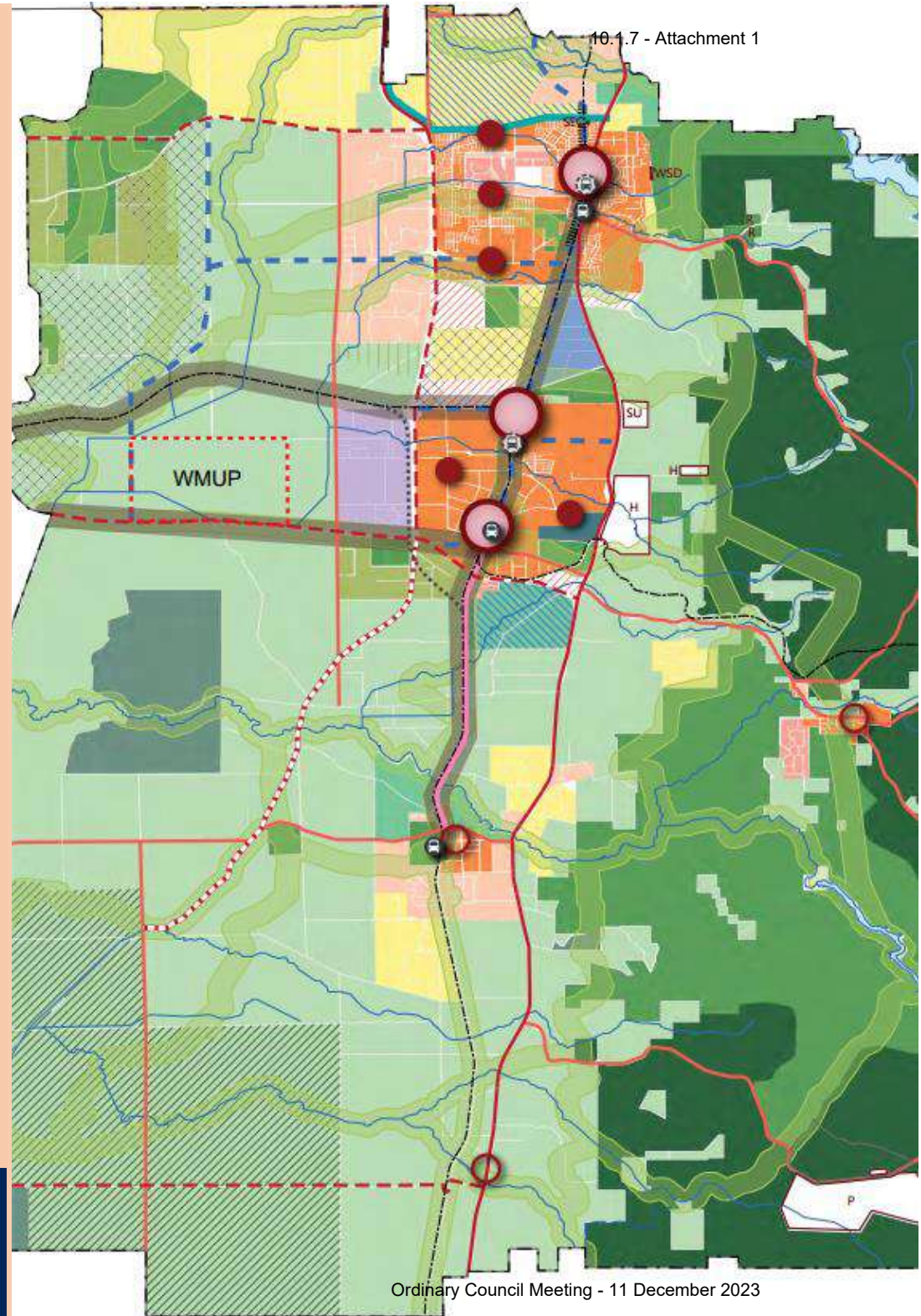
DYNAMIC PLANNING
AND DEVELOPMENTS

West Mundijong Urban Precinct (WMUP)

Proposed Metropolitan Region Scheme Amendment

Planning Report

Project Ref: 530



**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

Prepared for

Watson Property Group on behalf of WPG Landholdings Pty Ltd & WPG Landholdings No. 3 Pty Ltd
C/O Watson Project Management Group Pty Ltd
PO Box 934
Balcatta WA 6914

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**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

Executive Summary

This Metropolitan Region Scheme (MRS) amendment proposes to rezone an area of land described as the West Mundijong Urban Precinct (WMUP) from 'Rural' to 'Urban', to facilitate future planning and development for residential purposes.

The proposed WMUP is bounded by Mundijong, King, Leipold and Gangemi Roads, Oldbury, encompassing an area of 647 ha and comprising (only) 16 lots held by 10 landowners. Urbanisation of the proposed WMUP has received unanimous support from all landowners (collectively referred to as the Mundijong West Landowners Group) and is being led and coordinated by WPG Landholdings Pty Ltd & WPG Landholdings No. 3 Pty Ltd.

Subject to detailed structure planning and future approvals, the proposed WMUP will have the capacity to deliver up to an estimated 6,500 dwellings and 18,700 residents to support the growth of the broader Mundijong locality and the Shire of Serpentine Jarrahdale generally.

The Shire of Serpentine Jarrahdale is forecast to experience considerable growth over the coming decades, with the Shire's resident population expected to increase from 33,920 in 2020 (source: [profile.id](#)) to 110,000 by 2050.

According to the Shire's Draft Local Planning Strategy, by 2050 the population of the broader Mundijong locality (including Whitby) will increase from 4,068 (source: [forecast.id](#)) to 50,000. This represents more than a 1,100% increase in population and equates to an average annual growth rate of 1,640 residents per year for the next 28 years, to 2050.

To accommodate this projected population growth, the total number of dwellings in the broader Mundijong locality is planned to increase from

an estimated 1,334 in 2021 (source: [forecast.id](#)) to approximately 17,500 dwellings by 2050 (source: Draft Mundijong District Structure Plan).

However, our analysis of the Shire's strategic planning framework, particularly the Draft Local Planning Strategy and Draft Mundijong District Structure Plan, reveals that the Urban land allocation in the broader Mundijong locality is inadequate to accommodate this planned growth, and that substantially more Urban land will be needed to meet the population and dwelling targets stated above. The reasons for this include:

- The Draft Mundijong District Structure Plan relies on an average lot size of 350m² to achieve the forecast dwelling yields planned for the Mundijong locality. This average lot size is far smaller than the current average and median residential lot sizes in the locality of approximately 501m² and 468m² respectively (Source: CoreLogic). Market demand for these (current) lot sizes is expected to remain for the foreseeable future, given Mundijong's outer metropolitan context and semi-rural setting.
- Much of the new urban areas proposed by the Draft Mundijong District Structure Plan are characterised by multiple, small landholdings in fragmented ownership; without any Local Structure Planning proposed or in place; and with major environmental, servicing and infrastructure constraints to development. These factors are expected to increase the costs, timeframes, and complications associated with developing the new urban precincts under the District Structure Plan. Our analysis indicates these factors will also result in the delivery of approximately 4,500 fewer lots and

**WEST MUNDIJONG URBAN PRECINCT
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13,000 fewer residents than currently contemplated by the District Structure Plan.

Support for this MRS amendment will alleviate the abovementioned concerns by:

- Appropriately increasing the supply of Urban zoned land (and therefore the pool for future development contributions) in the broader Mundijong locality to compensate for constrained urban land under the District Structure Plan with little to no prospect of achieving its full development potential.
- Facilitating the timely and coordinated planning and residential development of a strategically located, readily serviceable, and easily developable precinct, coordinated by a single entity with the unanimous support of all landowners.
- Provide landowners in the WMUP with the opportunity and incentive to invest in further investigations to inform planning and design of the precinct, in addition to the comprehensive technical studies already commissioned and appended to this proposal, comprising:
 - Land Capability Assessment
 - Traffic Impact Assessment
 - Economic Impact Assessment
 - Infrastructure and Engineering Assessment
 - District Water Management Strategy
 - Environmental Assessment Report
 - Bushfire Hazard Level Assessment

Further details regarding the WMUP and justification in support of this MRS amendment are provided in the proceeding sections of this report.

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WEST MUNDIJONG URBAN PRECINCT PROPOSED MRS AMENDMENT

1.0 Introduction

Dynamic Planning and Developments Pty Ltd (DPD) and LK Advisory Pty Ltd act on behalf of WPG Landholdings Pty Ltd and WPG Landholdings No. 3 Pty Ltd, being the registered proprietors of Lots 272, 273 and 274 Mundijong Road, Oldbury.

This report proposes to amend the Metropolitan Region Scheme (MRS) by rezoning the land bounded by King Road, Leipold Road, Gangemi Road, and Mundijong Road (see Figure 1 below) from Rural to Urban, to facilitate future residential development.



Figure 1 – Land subject to MRS Amendment

For ease of reference the subject land is referred to in this report as the proposed West Mundijong Urban Precinct (WMUP).

WPG Landholdings Pty Ltd & WPG Landholdings No. 3 Pty Ltd are the single coordinating and funding entities for advancement of the WMUP and have received unanimous support for this scheme amendment proposal from all landowners in the Precinct, collectively referred to as the Mundijong West Landowners Group (see Landowner Register of Support in Table 2 and Appendix 4).

Rezoning of the WMUP will enable further, more detailed planning to be carried out under the local planning framework to ensure sufficient unconstrained, serviceable, and developable Urban zoned land is available within the Mundijong locality to meet the Shire of Serpentine Jarrahdale's forecast dwelling and population targets for the area.

Without urbanisation of the WMUP, there is expected to be a marked undersupply of Urban zoned land in the broader Mundijong locality to accommodate future growth, owing to servicing and environmental constraints; fragmented landholdings in multiple ownership; lack of a single entity to fund and coordinate further planning of the area; and absence of planned or proposed investigations to support future structure planning. The WMUP is not affected by any such limitations.

This report comprehensively addresses the characteristics of the WMUP, its context in the regional and local planning framework, and the merits for rezoning the land to Urban under the MRS.

WEST MUNDIJONG URBAN PRECINCT PROPOSED MRS AMENDMENT

2.0 Proposal

This proposal seeks to amend the MRS to rezone land within the WMUP from 'Rural' to 'Urban'. Figure 2 below illustrates the proposed MRS zoning. A copy of the rezoning map is otherwise contained as **Appendix 1**.

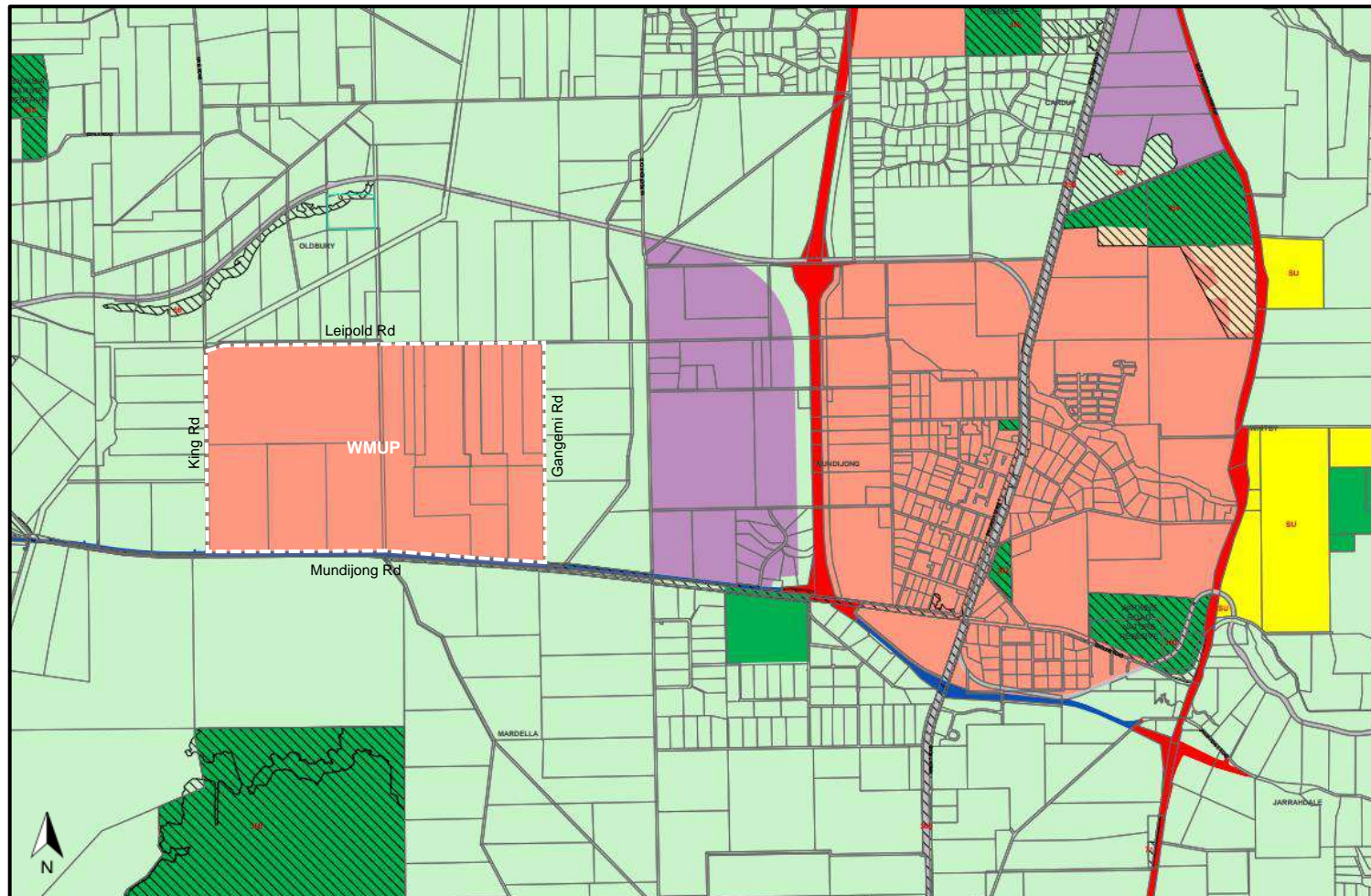


Figure 2 – Existing and Proposed MRS Zoning

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3.0 Site Details

3.1 Legal Description

The WMUP comprises 16 lots, held by 10 landowners, spanning approximately 647.03 ha. Table 1 below provides Title information for each of these lots subject of this MRS amendment.

Lot No.	No	Street	Vol / Folio	Plan	Area
275	1087	Mundijong Road	1404 / 934	152839	46.7163 Ha
727	771	King Road	1456 / 961	3484	58.9576 Ha
724	729	King Road	1771 / 700	3484	158.5245 Ha
2	467	Leipold Road	1486 / 108	52159	21.1682 Ha
800	457	Leipold Road	2590 / 716	44854	10.5894 Ha
801	447	Leipold Road	2590 / 717	44854	10.5821 Ha
264	409	Leipold Road	1275 / 455	152837	46.9005 Ha
123	289	Leipold Road	1299/789	9965	22.1970 Ha
2	365	Leipold Road	1449 / 938	51048	24.3378 Ha
1	331	Leipold Road	1449 / 938	51048	20.3312 Ha
272		Mundijong Road	1672 / 100	152839	31.3328 Ha
273		Mundijong Road	1672 / 100	152839	13.3749 Ha
274		Mundijong Road	1016 / 707	152839	44.1082 Ha
265		Leipold Road	1275 / 454	152837	22.5840 Ha
725		Mundijong Road	1276 / 108	3484	56.3297 Ha
726		Mundijong Road	1456 / 960	3484	58.9930 Ha

Table 1 – Property Details

All landowners of the above lots, comprising the MWUP are supportive of the proposed MRS amendment (see **Appendix 4**, Mundijong West Landowners Group – Letters of Support).

3.2 Location and Land Use Context

The WMUP, within the Shire of Serpentine-Jarrahdale, is located approximately:

- 36 kilometres south of the Perth Central City area;
- 17 kilometres east of the Rockingham Strategic Metropolitan Centre;
- 16 kilometres south-southwest of the Armadale Strategic Metropolitan Centre;
- 7 kilometres east of the Kwinana Freeway;
- 1 kilometre west of the West Mundijong Industrial Area; and
- 3 kilometres west of the Mundijong Townsite.

Key transport routes servicing the locality include South Western Highway, Mundijong Road, Kargotich Road, and the future Tonkin Highway, between the existing Mundijong Townsite and the Mundijong West Industrial Area, which is due to commence construction in 2023.

Figures 3 and 4 (over page) respectively depict the WMUP and Shire of Serpentine-Jarrahdale in the context of the South Metropolitan Peel Planning Region, and the WMUP's location within the Shire of Serpentine-Jarrahdale.



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3.3 Existing and Surrounding Land Uses

The Shire of Serpentine-Jarrahdale is predominantly characterised as a rural area, with most of its urban population concentrated in the northwest quadrant of the Shire, extending in a corridor from Byford in the north to Mundijong in the south.

Locally, Mundijong is characterised as a ‘rural village’ with the Town Centre located on the existing freight rail line. Due to recent changes in the planning framework the Mundijong Townsite and surrounds are now earmarked for significant urbanisation and population growth. Strategically located to the west of the townsite is the West Mundijong Industrial Area, comprising 440 ha of Industrial and employment-generating land.

At present, the West Mundijong Industrial Area remains largely undeveloped and continues to accommodate agricultural uses. However, the area is expected to attract new interest and investment as the resident workforce population grows and key infrastructure projects are delivered (such as the extension of Tonkin Highway to connect with South Western Highway).

The WMUP currently accommodates a range of agricultural pursuits, including horse agistment, livestock grazing, and hay production. However, the viability of these activities is rapidly declining due to the marginal capability of the land, resulting in limited commercial agriculture now being conducted in the area. Urbanisation of the WMUP will therefore not affect the availability of high quality, productive agricultural land in the Shire.

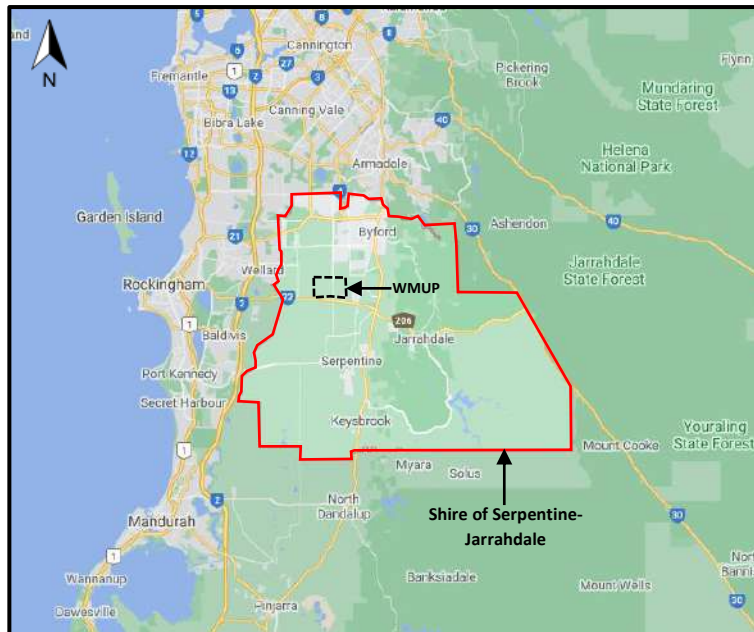


Figure 3 – Subject Site within the South Metropolitan & Peel Region

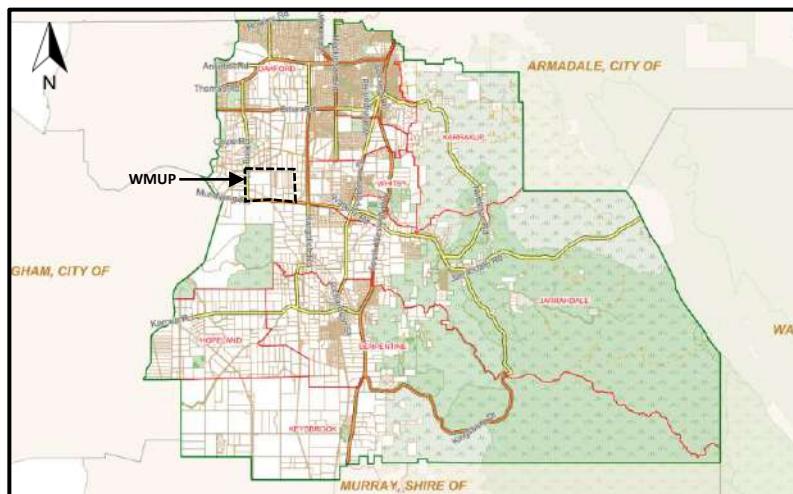


Figure 4 – Subject site within the Shire of Serpentine-Jarrahdale

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4.0 Background

The Shire of Serpentine-Jarrahdale's resident population is forecast to increase from 33,920 in 2020 (source: [profile.id](#)) to 110,000 by 2050. In this period, the population of the broader Mundijong locality (including Whitby) is planned to increase from 4,068 (source: [forecast.id](#)) to 50,000. This represents more than a 1,100% population increase and equates to an average growth rate of 1,640 residents per year for the next 28 years, to 2050.

To accommodate this future population, the total number of dwellings in the broader Mundijong locality is proposed to increase from an estimated 1,334 in 2021 (source: [forecast.id](#)) to approximately 17,500 dwellings by 2050 (source: Draft Mundijong District Structure Plan). In support of these targets, the Shire of Serpentine-Jarrahdale has undertaken substantial planning for the Mundijong locality in recent years, producing the following key documents:

- Draft Mundijong Local Development Strategy
- Draft Local Planning Strategy (LPS)
- Draft Local Planning Scheme No. 3 (LPS3)
- Draft Mundijong District Structure Plan (DSP)
- Shire-wide 'Community Infrastructure' Development Contribution Plan (DCP) and associated Scheme Amendment No. 207
- Draft Mundijong Urban DCP and associated Scheme Amendment No. 209

On behalf of WPG Landholdings Pty Ltd & WPG Landholdings No. 3 Pty Ltd, Dynamic Planning and Developments lodged comprehensive submissions on the Shire's Draft LPS and LPS3 (in December 2019), and the Draft Mundijong DSP and Mundijong Urban DCP (in August 2020). Our analysis of these documents revealed the location and distribution of existing and proposed Urban zoned land is incapable of accommodating

the population growth planned for the broader Mundijong locality. A complete copy of these submissions is included in **Appendix 2** to this report.

Critically, our submissions identified that:

1. The dwelling yields proposed by the Draft Mundijong DSP are premised on a Residential R25 density coding with an average lot size of 350m². This average lot size is far smaller than the current average and median residential lot sizes in the locality of approximately 501m² and 468m² respectively (Source: CoreLogic). Market demand for these (current) lot sizes is expected to remain for the foreseeable future, given Mundijong's outer metropolitan context and semi-rural setting.
2. Much of the new urban areas proposed by the Mundijong District Structure Plan are characterised by multiple, small landholdings in fragmented ownership; without any Local Structure Planning proposed or in place; and with major environmental, servicing and infrastructure constraints to development. These factors will increase the costs, timeframes, and complications associated with developing the new urban precincts under the District Structure Plan.
3. The constraints referenced above will result in the delivery of approximately 4,500 fewer lots, accommodating 13,000 fewer residents than contemplated by the Draft DSP.
4. Variations and over-estimates in forecast lot yields are likely to result in a substantial under-collection of development contributions by the Draft Mundijong Urban DCP and Shire-wide community infrastructure DCP. This, in turn, would inflate contribution costs due to a reduced contribution base and would impede the timely and



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coordinated delivery of infrastructure needed to support growth in district.

5. The WMUP:
 - a. Exhibits few to no constraints to urban development when compared to the urban growth areas proposed by the Draft LPS and Mundijong DSP;
 - b. Is readily serviceable;
 - c. Comprises a small number of landholdings with unanimous support for urbanisation from all landowners (see Register of Support from Mundijong West Landowners Group in Table 2, over page, and **Appendix 4**);
 - d. On behalf of all landowners, is being led and coordinated by WPG Landholdings Pty Ltd & WPG Landholdings No. 3 Pty Ltd, which possess the capabilities and experience to advance the planning and development of the precinct;
 - e. Does not comprise high quality, productive agricultural land;
 - f. Has the capacity to deliver up to an estimated 6,500 dwellings and 18,700 residents to support growth of the broader Mundijong locality, thus mitigating the forecast lot yield and population shortfall described in 3. above.
 - g. Will facilitate development earlier than the new growth areas proposed under the Draft LPS and DSP, thereby contributing vital early funding to the Shire-wide community infrastructure DCP and Mundijong Urban DCP;
 - h. Would increase the local workforce population, stimulating investment and growth in the West Mundijong Industrial Area.
 - i. Is unaffected by the planned 1km buffer for the West Mundijong Industrial Area.



**WEST MUNDIJONG URBAN PRECINCT
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The Mundijong West Landowners Group

C/O Watson Property Group - Unit 6 / 110 Erindale Road, Balcatta WA 3021

The undersigned represent all landowners within the proposed *West Mundijong Urban Precinct (WMUP)* bounded by Mundijong, Gangemi, Leipold and King Roads, Oldbury.

I/We hereby confirm that I/we are members of *The Mundijong West Landowners Group* and reaffirm our strong individual and combined group support for the proposal to rezone the *West Mundijong Urban Precinct* from Rural to Urban.

Mundijong West Landowners Group - Member & Support Register					
Lot No.	Street No.	Road	Registered Owner	Authorised Representative	Signed
275	1087	Mundijong Road	Vernon Cockell	Vernon Cockell	<i>Vernon Cockell</i>
725	-	Mundijong Road	Dr Graham Forward and Forrest Family Investments	Dr Graham Forward	<i>Graham Forward</i>
726	-				
727	771				
724	729	Leipold Road	BDJ 234 Pty Ltd	Ben Panizza	<i>Ben Panizza</i>
800	447	Leipold Road	Eric & Dianne Broadwith	Eric Broadwith	<i>Eric Broadwith</i>
2	467	Leipold Road	Wouter Geryts	Wouter Geryts	<i>Wouter Geryts</i>
801	441	Leipold Road			
264	409	Leipold Road	Ferdinando Cicolari	John Cicolari	<i>John Cicolari</i>
265	-				
123	389	Leipold Road	Michael & Patricia Cabassi	Michael & Patricia Cabassi	<i>Cabassi</i>
2	365				
1	331	Leipold Road	Rene & Patricia des Bouvrie	Rene & Patricia des Bouvrie	<i>Rene & Patricia des Bouvrie</i>
272	-	Mundijong Road	WPG Landholdings Pty Ltd	Stuart Griffiths (Group Facilitator)	<i>Stuart Griffiths</i>
273	-				
274	-				

*The Mundijong West Landowners Group
C/O Watson Property Group - Unit 6 / 110 Erindale Road, Balcatta WA 6021
info@watsonpropertygroup.com*

Table 2 – Mundijong West Landowners Group – Member & Support Register



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5.0 Strategic Planning Framework

5.1 Perth and Peel @ 3.5 Million

Perth and Peel @ 3.5 Million is the overarching strategic planning document for the Perth and Peel regions. Four sub-regions are defined in the document, being the Central sub-region, North-West sub-region, North-East sub-region, and South Metropolitan Peel sub-region – in which the WMUP is situated.

A separate framework applies to each sub-region and serves to inform future planning processes. Importantly, the sub-regional frameworks are:

- not statutory planning instruments;
- not intended to prejudice or preclude the ordinary consideration of new planning proposals on their individual merits;
- not static, but rather subject to regular monitoring and review to ensure they remain contemporary and responsive to government priorities and community needs.

According to the framework, the population of the South Metropolitan Peel sub-region is expected to more than double – from 523,430 to 1,264,450 people by 2050. Most of this growth in the Shire of Serpentine-Jarrahdale is to be accommodated around the Byford and Mundijong town centres, in areas identified as Urban and Urban Expansion under the sub-regional framework.

The framework also identifies a substantial Planning Investigation Area west of the WMUP, extending to the Kwinana Freeway, and a smaller Planning Investigation Area between Byford and Mundijong (see Fig. 5). The potential for urbanisation of these Planning Investigation Areas was examined as part of the 2021 review of the sub-regional frameworks. Whilst the outcome of that review is not yet known, the physical constraints afflicting those areas is likely to render them unsuitable for

residential development. Urbanisation of the WMUP is ideally placed to offset this potential loss of residential development opportunity.

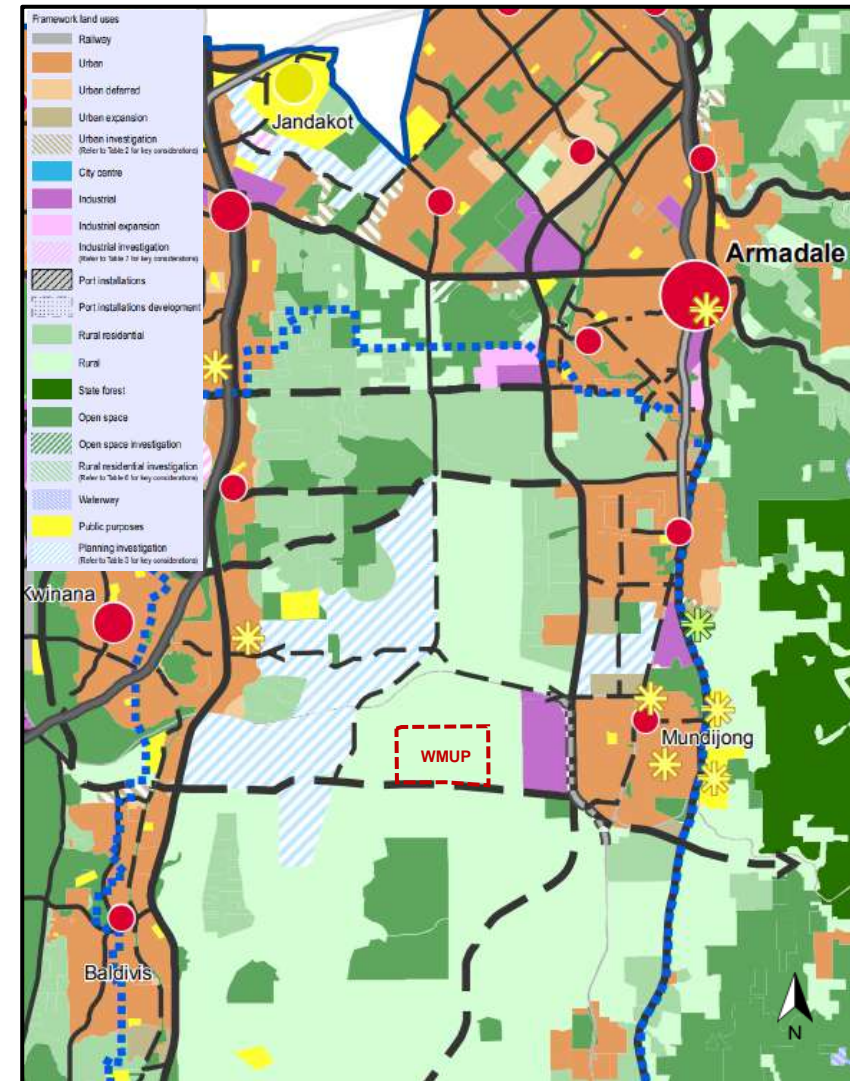


Figure 5 – Planning Investigation Areas

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Growth in the Shire’s population is expected to be supported by:

- Increasing investment and development in the West Mundijong Industrial Area, and Byford and Mundijong district centres, in turn contributing to job creation and diversification of the local economy (see Fig. 6);
- Delivery of major infrastructure projects including – the southern extension of Tonkin Highway from Thomas Road through Mundijong to South Western Highway; extension of the passenger rail line from Armadale to Byford with new Byford train station, as part of METRONET; associated public transport improvements in the district; and upgrades to Mundijong and Kargotich Roads – all of which will dramatically improve accessibility within, to and from the district; and
- Provision of new and upgraded community and educational facilities throughout Byford and Mundijong, comprising new recreation grounds, high schools, technical school, and university (see Fig. 7).

The WMUP is ideally positioned to capitalise on and contribute to these initiatives, by providing an economic stimulus in the form of timely and coordinated residential development, contributing towards shared infrastructure costs, and establishing a working population in proximity to growing employment sources.

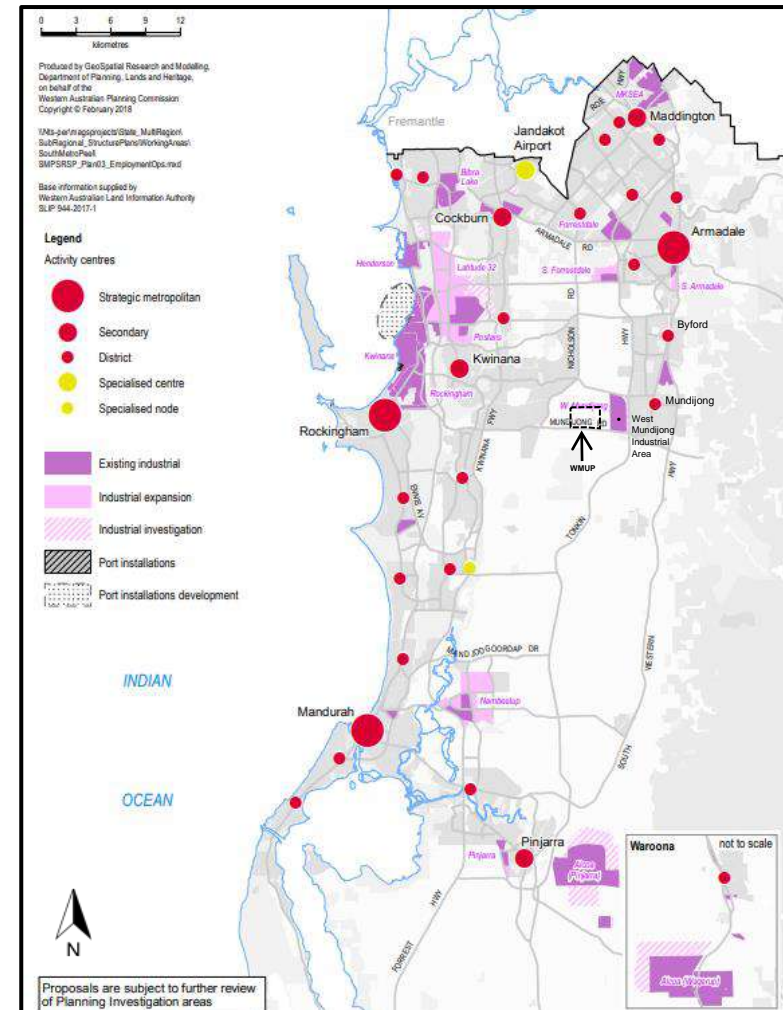


Figure 6 – Employment Opportunities

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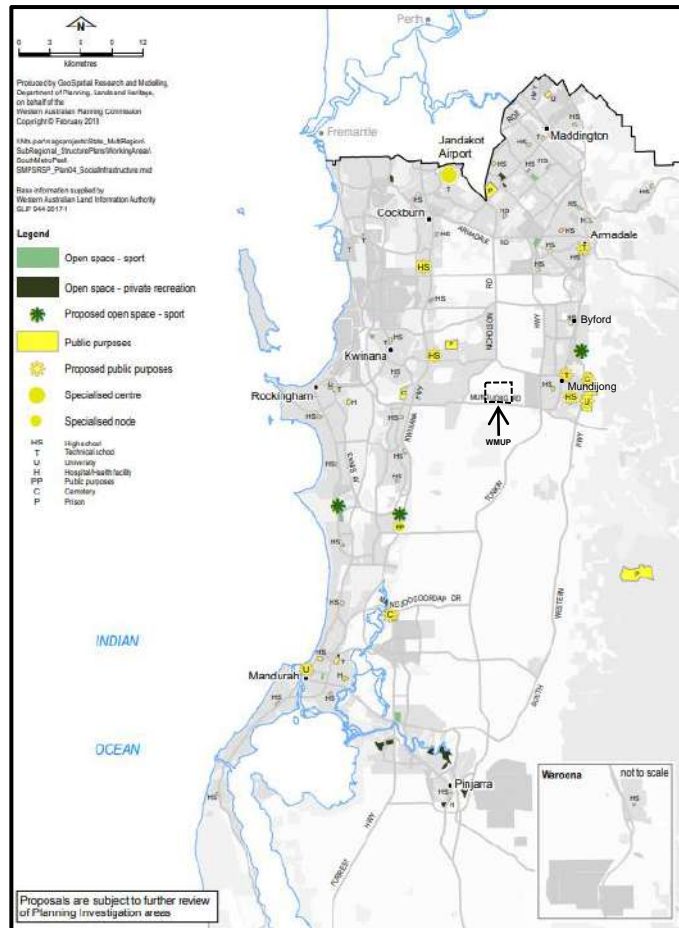


Figure 7 – Community and Social Infrastructure

Although the South Metropolitan Peel sub-regional planning framework depicts the WMUP as remaining rural, the comprehensive technical reports attached hereto demonstrate the precinct has fewer constraints to development, and greater accessibility, serviceability, and locational advantage than nearby Planning Investigation, Urban Expansion, and

Urban areas. Therefore, the sub-regional framework should not prejudice consideration of this MRS Amendment on its individual merits.

5.2 State Planning Policy 2.1 – Peel-Harvey Coastal Plain Catchment (SPP 2.1)

The WMUP is located within the Peel-Harvey Coastal Plain Catchment and is therefore subject to SPP 2.1.

Section 5 of the policy relates to scheme amendment proposals and states:

5.1 Except in accordance with this policy, land shall not be rezoned for urban purposes (which includes special residential but not rural residential or special or special rural) unless certification is received from the Water Authority that arrangements have been made so that connection to an adequate sewerage service, or alternative system satisfactory to the EPA and Health Department, will be available to all lots in the subdivision.

The WMUP is readily capable of being serviced by the Water Corporation reticulated sewerage service, as evidenced by the Infrastructure and Servicing Assessment report produced by Porter Consulting Engineers and included as **Appendix 2.4**.

5.2 Proponents shall ensure that proposed changes to land zonings take account of land capability/suitability criteria with regard to the net effect that such changes are likely to have on the nutrient load discharging from that catchment into the Peel-Harvey Estuarine System.

In support of the proposed MRS amendment, a comprehensive Land Capability Assessment (prepared by Land Assessment Pty Ltd) and District

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Water Management Strategy (prepared by Oversby Consulting) have been produced, which demonstrate that (among other things):

- The subject land is no longer suitable for agricultural production;
- Drainage and surface water run-off can be appropriately managed in the local and district context; and
- Nutrient load discharge into the Peel-Harvey Estuarine System will be well within acceptable levels.

Further to the above, agricultural/horticultural activities have the potential to generate higher nutrient loads than residential development, due to factors such as:

- the broadacre application of fertilizers, pesticides, and herbicides;
- distribution and decomposition of manure and feed (from livestock);
- discharge of wastewater from farming operations;
- uncontrolled infiltration and run-off; and
- clearing of vegetation leading to deterioration of soil conditions and drainage quality.

The impact of these factors would be exacerbated by further intensification of commercial agriculture, horticulture, or rural processing and production in the Precinct.

Considering the above, urbanisation of the WMUP in line with relevant water management strategies and plans has the potential to generate a net improvement in the Precinct's drainage impact compared to the status quo or further intensification of agricultural activities on the subject land.

5.3 *Land used for intensive agriculture, which is likely to drain towards the Peel-Harvey Estuarine System shall be managed to reduce or eliminate nutrient export from the land.*

The proposed MRS amendment will facilitate land use transition in the Precinct away from agricultural practices, thereby reducing or removing the risk of nutrient export from the land.

5.4 *The retention and rehabilitation of existing remnant vegetation is to be encouraged. A catchment target of 50% of land area established to deep rooted perennial plants, preferably local indigenous species but including high water using and suitable exotic species, shall be attempted. Remnant vegetation shall be retained along watercourses, or the margins shall be replanted to higher water-using vegetation, to maintain the stability of banks and exert some control on sediment and nutrient movement*

The WMUP is almost entirely cleared of remnant vegetation due to historical agricultural use of the land. If approved, this MRS amendment will facilitate more comprehensive planning for residential development of the land, resulting in a net increase in vegetation on the land.

5.5 *Subdivision proposals shall make provision for a drainage system, which maximises the consumption and retention of drainage on site. Biological wetland filters, or other means of drainage water retention or treatment approved by the EPA, will need to be incorporated into the drainage design possibly by amendment of the soils in drainage basins or by the provision of wetland filters with nutrient retentive soil amendments in accordance with drainage management to the satisfaction of the State Planning Commission and EPDA. Conservation reserves are not appropriate as biological wetland filters. Development near conservation reserves may require special constraints to protect and preserve them.*

A preliminary drainage strategy has been produced and is appended to this MRS amendment, demonstrating the capability of the land to



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accommodate an integrated drainage system in future; the details of which will be further addressed in subsequent planning stages.

5.6 *Open space recreation areas should be carefully designed to retain native vegetation and water, and plant with water (sic) using vegetation to minimise the need to apply fertilizer and water. The treatment of open space soils with nutrient retentive soil amendment should be undertaken where phosphorus retention is low and the necessity for this soil amendment should be identified in nutrient management plans prepared by developers. Drainage should be designed to retain nutrients on site in most years; direct drainage off-site will not be permitted unless to the satisfaction of local government*

Detailed information around the development of public open space and drainage design will be addressed in detail, at subsequent planning stages.

5.7 *The Commission may consider upon the advice of the Water Authority, the Health Department and the EPA, small-scale subdivisional developments with alternative wastewater treatment and effluent disposal systems for evaluative purposes. The onus of proof will rest with the subdivider to provide sufficient technical and engineering evidence that alternative systems or site modifications remove any adverse effects on public health, water resources or the environment while not detrimentally impacting on the character of the area*

As previously noted, future residential development of the WMUP will be connected to a reticulated sewerage service, thereby eliminating the need for an alternative wastewater treatment or effluent disposal system.

5.8 *Local Government is responsible for the supervision and management of alternative effluent systems, particularly Aerated Treatment Units (ATUs)*

This is not applicable to the WMUP for the reasons stated earlier.

5.9 *Approvals will be required from the Water Authority with regard to water supply from bores, wells, rivers in proclaimed water management areas and WAWA drains and for connection of private and local authority drains to WAWA drains. The limited availability of water may constrain some types of development.*

Future residential development of the WMUP will be connected to a reticulated water service with bores only being used to irrigate landscaping and vegetation on public land (to the Shire's requirements) and private properties (where domestic garden bores are permitted).

It is evident from the preceding points that the proposed MRS amendment for the WMUP satisfies all relevant provisions of SPP 2.1, and that the transition away from agricultural practices to Urban development will produce a net positive result for the Peel-Harvey Estuarine system.

5.3 State Planning Policy 2.5 – Rural Planning (SPP 2.5)

In accordance with Section 3.1(a) and Section 3.3(a) of SPP 2.5, MRS amendments proposing to rezone 'Rural' zoned land must have regard to the provisions of that Policy. Of particular relevance to the WMUP is Section 6.4 – Zoning proposals affecting rural land. Section 6.4 states that planning decision makers should consider the following in relation to the assessment of MRS amendment proposals:

a) *The suitability of the site to be developed for the proposed use;*

Comprehensive technical reports have been produced and are appended to this MRS amendment proposal (see Section 7.0 of this report and **Appendix 2**), comprising the following:

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- Land Capability Assessment
- Bushfire Hazard Level Assessment
- Economic Impact Assessment
- Environmental Assessment
- Infrastructure and Engineering Assessment
- Traffic Impact Assessment
- District Water Management Strategy

These investigations demonstrate (among other things) that the WMUP is not productive agricultural land, is not affected by any material constraints to development, and is capable, suitable and serviceable for accommodating urbanisation.

b) The siting of the zone/land use in the context of surrounding zones/land uses (existing and proposed);

The WMUP is ideally situated in proximity to the Mundijong townsite and West Mundijong Industrial Area, which will be a critical economic and employment hub for the district. Importantly, the WMUP achieves a 1-kilometre separation distance from the western edge of the West Mundijong Industrial Area, meaning that occupancy of that area by industrial land uses will not inhibit urbanisation of the WMUP.

As stated earlier, the WMUP will also benefit from access to key transport infrastructure providing connections to the broader Perth Metropolitan Area, including the Tonkin Highway extension, Mundijong Road, Kargotich Road and the future Byford passenger rail extension.

c) The capacity of the site to accommodate the proposed zone/land use and associated impacts and:

- i. Only support proposals which are consistent with endorsed planning strategies, or in exceptional circumstances, where the proposal meets the objective and intent of WAPC policy;*

This report and the appended technical documents demonstrate that:

- The WMUP is highly suitable for and capable of accommodating the proposed Urban zoning and future residential development; and
- Much of the land identified for future urban expansion in the Draft Mundijong DSP is not capable of accommodating the extent of residential development envisaged. This will generate an undersupply of developable residential land, which the WMUP can address, to achieve the Shire's forecast population and dwelling targets.

Although the sub-regional planning framework does not reflect urbanisation of the WMUP, this does not deny or diminish the WMUP's appropriateness for urbanisation and should not interfere with consideration of this proposal on its planning merits.

- ii. Only support the introduction of sensitive zones that may affect the existing and future operation of primary production where the management of impacts and/or mitigation approaches have been substantively resolved and are not wholly deferred to later stages of planning;*

Although the WMUP accommodates some rural activities, it does not contain high quality agricultural land, or any 'primary production' of significance which would affect or be affected by Residential zoning of the WMUP under the MRS. Importantly, notwithstanding any rural activities currently occurring in the precinct, all landowners have formally supported this proposal.

Beyond the WMUP, there are four nearby land uses that have the potential to affect or be affected by the proposed urbanisation of the WMUP, due to their recommended separation distances and buffer requirements. The impacts (if any) of and on these land uses will be comprehensively investigated and addressed through subsequent stages of the planning process. The four uses are discussed below:



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Peel Feedlot

- The Peel Feedlot, operated by Rural Export & Trading (W.A.) Pty Ltd, is situated on Lot 123 Mundijong Road, Mardella, approximately 550m south of Mundijong Road, opposite the WMUP (south of Lots 725 and 726 within the WMUP). The Feedlot has been operating since the late 1970s under licence from the Department of Water and Environment Regulation. Sheep are transported to the facility for quarantine purposes and to adjust to pelletised feed whilst awaiting transport to Fremantle Port for overseas shipment.
- Under the Environmental Protection Authority's *Guidance Statement No. 3 – Separation Distances between Industrial and Sensitive Land Uses* (EPA Guidance Statement No. 3), residential development is defined as a 'sensitive land use' with a buffer distance of 1,000m – 2,000m recommended from 'Animal feedlots' depending on size and circumstances.
- As the Peel Feedlot is located within the *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992* area, the facility is subjected to strict management and operational requirements to minimise offsite environmental impacts.
- Urbanisation of the WMUP is not expected to affect or be affected by the continued operation of the Peel Feedlot, as off-site impacts (if any) from that facility will be comprehensively addressed through its own operating licence conditions, and through the subsequent planning processes for the WMUP. This is particularly notable when considering the siting of the 'La Bergerie' Feedlot at Lot 1 Telephone Lane, Baldivis – approximately 5.5km west-northwest of the Peel Feedlot. The 'La Bergerie' facility is situated within 300m of dwellings on nearby rural land, and 1km from dwellings in Capertree Vista in the residential suburb of Wellard (Wellard Glen Private Estate). This indicates that the off-site impacts of feedlots can be appropriately

managed and need not represent a constraint to residential development.

West Mundijong Industrial Area

- The West Mundijong Industrial Area is situated 1km east of the WMUP. Land within this 1km separation distance is intended to remain zoned Rural under the Shire's Draft Local Planning Strategy and Scheme and will therefore act as a rural buffer between future residential development in the WMUP and industrial development within the West Mundijong Industrial Area.
- In accordance with EPA Guidance Statement No. 3, the separation distance between industrial and sensitive land uses is to be determined on a case-by-case basis, depending on the activities involved and EPA licence or registration requirements. The WMUP's minimum 1km separation distance from the West Mundijong Industrial Area will ensure the proposed future residential development does not affect and is not affected by the WMUP.

King Road Brewing Co.

- The King Road Brewing Co is situated on Lot 100 King Road (cnr Mundijong Road), Oldbury, approximately 200m west of the WMUP.
- Under EPA Guidance Statement No 3, a brewery is classified as 'beverage manufacturing – alcoholic' with a recommended separation distance of 200m – 500m from residential dwellings, depending on the size and type of product manufactured.
- King Road Brewing Co is a microbrewery serving meals to patrons. The operation is akin to a pub microbrewery which is a common use among and adjacent to residential areas.



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- The food and beverage functions of the King Road Brewing Co are not expected to have any impact on residential development in the WMUP.

Waste Materials Stockpile, Sorting and Recycling

- A former waste materials stockpile, sorting and recycling operation is situated on Lot 102 King Road, Oldbury – immediately north of King Road Brewing Co, 200m west of the WMUP.
- This operation was commenced without the requisite development approval, resulting in the Shire successfully prosecuting the landowner and operator for this offence, in 2019.
- The Shire subsequently issued a direction for approximately 60% of waste material stored on site to be removed from the property, with the remaining 40% of inert material used to construct a hardstand area. The Shire granted its development approval for this to occur in December 2020.
- Cessation of the operations on Lot 102, coupled with removal of 60% of waste materials from the site will ensure the activities on that property have no impact on future residential development within the WMUP.

iii. That the continuation of existing rural land uses are taken into account;

As stated earlier, all landowners in the WMUP support this MRS Amendment and the proposed future urbanisation of the precinct.

iv. Ensure that lifting of urban deferred land in a region scheme is in accordance with clause 6.4 (b);

This proposal does not involve lifting of ‘Urban Deferred’ land.

- v. Ensure that the sensitive zone does not overlap with any buffer determined to be necessary as a result of introducing the new zone, and the area within the buffer should retain its rural zoning until such time as the buffer is no longer required;*

The WMUP achieves sufficient buffers of rural zoned land from off-site rural and industrial activities that could have some impact on the WMUP. The nature of these impacts (if any) and measures needed to mitigate them will be addressed through subsequent planning and detailed design stages for the WMUP.

- vi. Ensure that adequate land is identified to contain impacts from existing primary production, before introducing sensitive or industrial zones on rural land.*

Limited ‘primary production’ now occurs within the WMUP with only small-scale rural activities currently being conducted in the precinct.

All landowners in the WMUP are in support of this MRS Amendment, demonstrating their commitment to transition away from rural land uses towards urbanisation.

5.4 State Planning Policy 3.7 – Planning in Bushfire Prone Areas

In accordance with the provisions of State Planning Policy 3.7 (SPP 3.7), the entirety of the amendment area is designated as being ‘Bushfire Prone’. A comprehensive Bushfire Hazard Level Assessment report is included in Appendix 2 and discussed in detail in Section 7.



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5.5 Draft State Planning Policy 4.1 – Industrial Interface

State Planning Policy 4.1 (SPP 4.1) was implemented to protect strategic industrial areas from the encroachment of incompatible land uses such as residential development. To achieve this, SPP 4.1 suggests that statutory buffers should be established around strategic industrial sites such as the West Mundijong Industrial Area.

Other than the ‘guidance’ provided in EPA Guidance Statement No. 3, no ‘statutory buffer’ applies to the West Mundijong Industrial Area.

The Draft West Mundijong Industrial Area Local Structure Plan depicts a 1km buffer from the ‘General Industrial’ core, extending to a line east of Gangemi Road. The WMUP comfortably achieves this 1km separation distance from the West Mundijong Industrial Area and therefore meets the buffer requirement stated in the Structure Plan for that Area.

5.6 State Planning Policy 5.4 – Road and Rail Noise

A portion of the WMUP is subject to the provisions of State Planning Policy 5.4 (SPP 5.4) due to the designation of Mundijong Road as an ‘Other Regional Road’. SPP 5.4 specifies that MRS amendments should address the impact of noise through:

- a) *identification of appropriate compatible land-use zoning that is commensurate with the function of the transport corridor;*
- b) *design solutions that utilise street and lot configuration to screen and/or buffer noise;*
- c) *consideration of density and built form outcomes that will help alleviate and/or manage noise;*
- d) *outlining the need for additional noise mitigation measures through quiet house requirements and or noise barriers in accordance with the guidelines; and*

- e) *consideration to appropriate future planning provisions to ensure more detailed planning is undertaken at the subdivision and development stage.*

The scale of the WMUP and subsequent planning and detailed design stages will provide ample opportunity to satisfactorily mitigate the potential impacts of road noise from Mundijong Road, in accordance with SPP 5.4 – in the same manner as residential development in Byford and Mundijong/Whitby is required to address noise impacts from the freight rail corridor and South Western Highway.

5.7 Shire of Serpentine Jarrahdale Draft Local Planning Strategy

The Shire of Serpentine Jarrahdale’s draft Local Planning Strategy (LPS) has been adopted by Council and endorsed by the Western Australian Planning Commission (WAPC), subject to modifications being made.

The draft LPS forecasts that by 2050, the Shire’s population will increase to 110,000 and the population of the Mundijong area will increase to 50,000. A key challenge to accommodate this forecast population growth will be the timely and coordinated delivery of investment-attracting and employment-generating infrastructure.

Whilst the draft LPS depicts the WMUP as remaining Rural, our prior submission on the Strategy comprehensively demonstrated:

- The inability of the new urban growth areas proposed around Mundijong to deliver the additional dwellings needed to accommodate the forecast population growth – due to substantial development constraints, multiple fragmented landholdings, and infrastructure timing and coordination challenges; and
- The WMUP is not afflicted by these same limitations, is ideally suited urbanisation, and has the capacity to accommodate the additional



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dwellings needed to cater for Mundijong's forecast population growth.

A copy of our previous submission on the draft LPS and draft Local Planning Scheme No. 3 is included at **Appendix 3.1**, with supporting technical reports (recently updated for the purposes of this MRS Amendment) included at **Appendix 2**.

5.8 Draft Mundijong District Structure Plan and Urban Development Contribution Plan

The Draft Mundijong District Structure Plan (DSP) establishes a framework to guide further planning for growth in and around the Mundijong Townsite. Complementing the draft DSP is a draft Mundijong Urban Development Contribution Plan (DCP) which would introduce a contribution arrangement to fund key infrastructure to facilitate residential development in the broader Mundijong locality.

The WMUP is not presently included within the draft Mundijong DSP area, although our submission on the draft DSP and Urban DCP presented a case for its inclusion and clearly demonstrated that:

- Without the WMUP, the Mundijong locality will be incapable of delivering the 17,500 dwellings required by 2050 to cater for the Shire's forecast population growth. In turn, this will result in a drastic under-collection of development contributions and a corresponding inability for the Shire to deliver vital infrastructure to facilitate urban expansion; and
- The WMUP has the capability and capacity to deliver up to an estimated 6,500 dwellings and 18,700 residents in a timely and coordinated fashion, to support early collection of contributions, infrastructure delivery, investment attraction, and population growth in the broader Mundijong locality.

A copy of LK Advisory's previous submission on the draft DSP and Urban DCP is included at **Appendix 3.2**.

5.9 Urban Land Development Outlook

The DPLH/WAPC's latest Urban Land Development Outlook (2020-21) includes the following dwelling projections for Mundijong and Whitby (combined) in the South-East sub-region (see Fig. 8):

- 735 dwellings in the short-term (to 2024/25);
- 2,302 in the medium-term (to 2029/30); and
- 6,409 in the long-term (beyond 2030/31).

This sums to a total forecast dwelling supply of (only) 9,446 for the whole of Mundijong and Whitby from now until well beyond 2031. By contrast, Section 3.2.1 of the draft Mundijong DSP identifies a target yield of 17,592 dwellings from its proposed urban growth areas, compared to the lesser (and more realistic) yield forecast of approximately 13,000 dwellings from those areas, as outlined in our prior submission on the draft LPS.

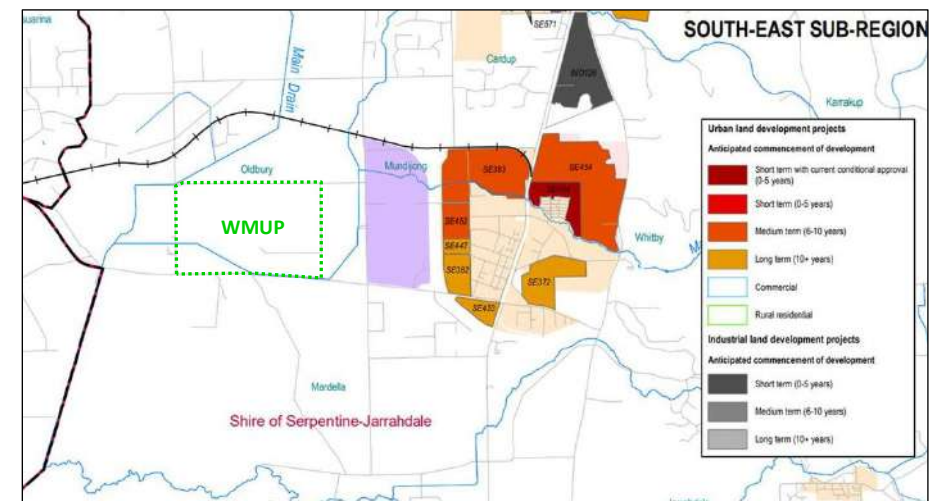


Figure 8 – Urban Land Development Outlook 2020-21 (South Metro Spatial Map)

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6.0 Statutory Planning Framework

6.1 Metropolitan Region Scheme (MRS)

The WMUP is currently zoned 'Rural' under the Metropolitan Region Scheme (MRS). This proposal seeks to amend the MRS to rezone the WMUP to 'Urban'.

6.2 Shire of Serpentine Jarrahdale Local Planning Scheme No. 2 (LPS2)

The WMUP is zoned 'Rural' under the Shire of Serpentine Jarrahdale Local Planning Scheme No. 2 (LPS2).

Subject to timing, rezoning of the WMUP to 'Urban' under the MRS will facilitate an amendment to LPS2 to rezone the WMUP to 'Urban Development' or similar, to permit future residential development in accordance with a Local Structure Plan.

6.3 Shire of Serpentine Jarrahdale Draft Local Planning Scheme No. 3 (LPS3)

Under the Shire's Draft LPS3, the WMUP is proposed to remain zoned 'Rural' in addition to the application of 'Special Control Area 6' which relates to buffers development that is likely to have an amenity impact on sensitive land uses.

Separation distances and recommended buffers pertaining to the WMUP are discussed in section 5.3 earlier in this report.

6.4 Draft West Mundijong Industrial Area Local Structure Plan (LSP)

The Shire of Serpentine Jarrahdale Council considered the Draft West Mundijong Industrial Area LSP at its meeting on 15 March 2021, and we understand the draft LSP is now awaiting final approval from the WAPC.

As stated earlier, the WMUP meets the 1km separation buffer prescribed by the Draft West Mundijong Industrial Areas LSP and will therefore not be impacted by any existing or future land uses within the Industrial Area.

6.5 Local Planning Policies

The Shire of Serpentine Jarrahdale has a range of local planning policies intended to guide land use, subdivision, and development within the Shire, however these policies are not applicable to the assessment of the proposed MRS amendment. The Shire's local planning policies will be addressed through subsequent stages of the planning process for the WMUP in the future.

7.0 Preliminary Servicing and Land Management Considerations

A multi-disciplinary project team has been engaged to comprehensively assess the servicing and land management considerations for urbanisation of the WMUP. The investigations undertaken include:

- Land Capability Assessment;
- Traffic Impact Assessment;
- Economic Impact Assessment;
- Infrastructure and Engineering Assessment;
- District Water Management Strategy;
- Environmental Assessment Report; and
- Bushfire Hazard Level Assessment.

These technical reports are provided in **Appendix 2** of this document and the findings summarised below.



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Importantly, the outcomes of the various investigations indicate no significant constraints to Urban development. Rather, the land is largely free from constraints and appropriate for Urban development.

7.1 Land Capability Assessment

- The *Land Capability Assessment* report, prepared by Land Assessment Pty Ltd, examines whether the WMUP is a 'key agricultural asset (i.e. a food bowl for the future)', and 'highly productive rural/agricultural land that should not be removed'.
- This assessment identifies that the WMUP does not fall within the 'Agricultural Protection' policy area under the Shire's 2017 Rural Strategy.
- The WMUP is predominantly cleared, with rural activities within the precinct limited (primarily) to livestock grazing of cattle and horses. Most land within the precinct has a capability assessment rating of 'Class 3 – Fair' for grazing. This is not consistent with an area of particularly high-quality agricultural land.
- The WMUP is not identified as either priority agricultural land or high-quality agricultural land in any contemporary regional or local planning document.
- Based on the land capability assessment and a review of planning-related studies, there is no evidence to suggest the WMUP is either "a key agricultural asset" or "highly productive rural/agricultural land".

7.2 Traffic Impact Assessment

- The Traffic Impact Assessment prepared by KCTT examines the traffic impact that would result from urbanisation of the WMUP. This assessment identifies that the intersections of Mundijong/Kargotich Roads and Mundijong/King Roads have traditionally exhibited higher

than average KSI (killed or seriously injured) crashes. General safety of these intersections could be improved through urbanisation of the WMUP, by reducing posted speed limits between these two intersections and making improvements to road geometry.

- Currently the WMUP is not serviced by public transport. If urbanisation of the WMUP proceeds, then consideration would need to be given to connecting the precinct to the existing Transperth network. This would likely be in the form of a connection to the future Byford train station and also to Rockingham and/or Wellard.
- The WMUP is not currently serviced by any pedestrian or cycling facilities, owing to its Rural zoning and land uses. Urbanisation of the WMUP will necessitate more detailed planning for delivery of pedestrian and cycling facilities in future.
- Currently three roads within the subject site are a part of the Restricted Access Vehicles (RAV) network:
 - Mundijong Road (Tri Drive Concessional Level 1 – Tri Drive 1.1)
 - King Road (Tri Drive Concessional Level 1 – Tri Drive 1.1)
 - Kargotich Road (Tri Drive Concessional Level 1 – Tri Drive 1.1, with conditions)

These designations will need to be assessed more closely in later planning stages, depending on the nature and extent of residential development proposed within the WMUP and recognising the planned extension of Tonkin Highway through to South Western Highway.

- The expected additional traffic from the subject site area is 60,792 daily vehicle trips and 5,740 vehicle trips in the peak hour. This is considered to be high impact on the surrounding road network. However, as the proposed development will simply assist in the delivery/accommodation of the forecast population growth in the area, these additional vehicular trips would have been generated in



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any event. Further, as urbanisation and demand on the road network increases, upgrades to the existing road network will be undertaken.

- KCTT considers that proposed major changes to the surrounding area and network will be able to successfully cater for the expected traffic volumes and distribution.

7.3 Economic Impact Assessment

- The Economic Impact Assessment prepared by Macroplan analyses the economic value of the WMUP.
- Due to development constraints and market demand factors, there is a probability that the existing Urban land allocation around Mundijong will not achieve the projected dwelling or population yields. This would have significant flow-on impacts for activity centre and retail viability, labour force constraints and planned community services in Mundijong specifically, and the Shire more broadly.
- Urbanisation of the WMUP would generate additional household expenditure and demand for goods and services, whilst supporting additional employment and commercial viability of existing and planned activity centres and the West Mundijong Industrial Area.
- Development of the 449-hectare West Mundijong Industrial Area to its full potential will require access to a sufficiently large and diverse labour force residing within a convenient travel catchment to the Area. With the proposed realignment of the freight rail line and potential for an intermodal terminal, the opportunity exists to establish logistics and distribution businesses within the West Mundijong Industrial Area, which would be well serviced by a resident workforce in the WMUP and other nearby areas.
- The 14-kilometre extension of Tonkin Highway to connect with South Western Highway represents a major trigger for future investment.

Planning and development works for this \$505 million project are currently underway, with construction due to be completed in 2024.

- Urbanisation of the WMUP (delivering approximately 6,500 dwellings) would produce a total economic output of around \$4.6 billion through the subdivision works, construction of dwellings and associated community services.
- Economic benefits have a significant impact at the local and district level because most of the expenditure benefits and jobs would be available to residents and workers within the Shire of Serpentine-Jarrahdale. In addition, any businesses that support interstate or overseas exports provide a net benefit to the State by attracting investment and expenditure from outside Western Australia.

7.4 Infrastructure and Engineering Assessment

- To examine the infrastructure and servicing ability of the WMUP, Porter Consulting Engineers were engaged to prepare an Infrastructure and Servicing Assessment.
- This assessment revealed the precinct's landform and ground conditions are consistent with those of other residential areas in the locality, at the base of the Darling Range.
- Detailed drainage investigations are required as part of the overall planning process. These will set groundwater, flood, and lot separation criteria. There appears to be opportunities to incorporate the existing drainage network into any future subdivision which will create features for the development as well as improve the overall water quality. This has been further explored as part of the District Water Management Strategy.
- With regards to the wastewater, the Water Corporation have confirmed its ultimate planning for the region shows a large "Type



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1000" relay pumping station. This is located on a secured parcel of land in Scott Road, Mundijong. This will convey effluent west to the Corporation's Rockingham or Kwinana treatment plants. This will service a significant area, likely to include Byford to the north to Serpentine in the south. Due to its close proximity and large capacity, the Type 1000's catchment is expected to include the WMUP. At the lot scale, the WMUP will be reticulated with a standard gravity sewer network. This will flow to a standard wastewater pumping station within the WMUP which will convey effluent to the Type 1000.

- With regard to potable water, discussions with the Water Corporation confirmed there are two potential options to provide a water supply for the WMUP – a connection to the existing large water mains or establishing an elevated reservoir on the scarp to supply the greater area. If the elevated reservoir option is pursued, a distribution main would likely extend to the WMUP with reticulation connections servicing the development. This distribution main would connect with the existing Mundijong network and would have then dual benefit of improving water supply to Mundijong, while also servicing the West Mundijong Industrial Area.
- In relation to power, a review of the Western Power mapping (2021) confirms the southwestern corner of the WMUP has approximately 25 to 30 MVA spare capacity whereas the balance of the site has less than 5 MVA spare capacity. Previous Western Power advice indicated reinforcing works are required on their Byford Station to increase the supply in the broader area. These reinforcing works will increase available power to the WMUP and the greater Serpentine Jarrahdale district. A high voltage feeder extension may be needed to provide a point of supply to the precinct, as is common with all large scale developments.

- There are existing communication networks in the surrounding road reserves. Due to the size and scale of the WMUP, it is expected NBN will establish a point of supply to the precinct and each of the individual lots.
- ATCO Gas' distribution mapping confirms a high pressure feeder line runs south along Soldiers Road, Mundijong terminating at Keirnan Street, and along Bishop Road, Mundijong terminating near Taylor Road – approximately 3.8km from the north eastern corner of the WMUP. This gas supply network would be extended to provide reticulated gas to future residential development of the WMUP.

7.5 District Water Management Strategy (DWMS)

- Oversby Consulting was engaged to prepare a District Water Management Strategy that assesses the drainage implications of the proposed WMUP.
- The DWMS details best practice approaches to water management for the WMUP, having regard to its former rural land uses, nearby waterways, landform, and groundwater characteristics.
- The WMUP is connected to and influenced by two Water Corporation Main Drains (Oaklands and Birrega). The recommended water management strategies for the WMUP take account of these drains and their functions.
- The key outcomes of the proposed DWMS include:
 - The Oakland Main Drain will retain current flow capacity and storage;
 - The existing on site flood storage volumes will be maintained;



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- Corridors will be established to transmit flood waters and manage flow rates and water quality;
- Fill will be placed to manage ground water and flood separation;
- Living streams will be established to attenuate post development runoff and allow for conveyance of stormwater generated onsite;
- Vegetated swales will assist with controlling groundwater rise;
- Standard street and lot drainage will be installed;
- The site is to be serviced with mains potable water and wastewater;
- Landscaping will utilise waterwise practices to reduce water usage; and
- Water dependent ecological systems will be protected through water sensitive urban design and access management to sensitive areas.
- In summary the drainage can be managed effectively throughout the WMUP with further detailed planning to be undertaken at subsequent planning stages.

7.6 Environmental Assessment Report

- Aurora Environmental has undertaken a comprehensive environmental assessment of the WMUP, which identifies that the precinct contains few environmental constraints to future development.

- From an ecological perspective, sensitive environments are unlikely to exist within the WMUP due to the degraded nature of the precinct, which is extensively cleared owing to its past rural/agricultural land uses.
- The entire WMUP is mapped as a Multiple Use Wetland (MUW) (UFI 16021) with a strip of Conservation Category Wetland (CCW) (UFI 14817) along the Mundijong Road road reserve, from a point west of King Road to east of Kargotich Road (Australian Government, 2020). This CCW also comprises Bush Forever Site No. 360.
- The Department of Biodiversity, Conservation and Attractions (DBCA) describes MUWs as *'wetlands with few important ecological attributes and functions remaining'* (DBCA, 2020b). Their use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning. Generally, multiple use wetlands do not represent a constraint to development.
- The DBCA describes CCWs as *'wetlands which support a high level of attributes and functions.'* These wetlands are the most valuable wetlands and any activity that may lead to further loss or degradation (including development or clearing) is considered inappropriate (DBCA, 2020b). The CCW adjacent to the WMUP is a poorly vegetated roadside drainage channel, with an extensive infestation of *Watsonia (Watsonia meriana var. bulbillifera)*. The ecological values of this wetland have been substantially compromised and in its current condition is not deserving of its CCW classification. It appears the CCW values of this wetland are attributable to the southern side of Mundijong Road, which would not be impacted by urbanisation of the WMUP.



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- The entire WMUP is mapped as a DWER 1 in 100 AEP floodplain development control area (Australian Government, 2020). This means that development controls may be applied to ensure an adequate level of flood protection is provided to any proposed development of the WMUP.
- There are no intact areas of native vegetation within the Site. The only native vegetation remaining comprises scattered paddock trees of Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) and Swamp Sheoak (*Casuarina obesa*). Due to on-going agricultural uses (such as cattle grazing) at the WMUP, there are no areas of natural regeneration occurring. Given the current site conditions, the vegetation throughout the WMUP has been assessed as Completely Degraded.
- Due to the Completely Degraded structure and condition of vegetation on the site, there are no Threatened Ecological Communities present at the site. Whilst there are State-listed Threatened Ecological Communities (TECs) and one Priority Ecological Community (PEC) mapped (inclusive of buffers) that encroach into the south-east and north-west corners of the WMUP, the areas of the ecological communities within the WMUP do not contain any intact areas of native vegetation and therefore are regarded as Completely Degraded. These areas are no longer representative of any TECs or PECs.
- It is highly unlikely that any of the conservation significant flora species would be present within the WMUP due to extensive previous clearing, the long history of widespread rural/agricultural uses throughout the area, and the Completely Degraded condition of vegetation in the precinct.
- Due to the degraded condition of the available habitat, the WMUP contains very few values for native fauna. No

conservation significant fauna species were observed during the site inspection.

7.7 Bushfire Hazard Level Assessment

- The Bushfire Hazard Level (BHL) assessment prepared by Lush Fire and Planning identifies that the WMUP comprises approximately 35ha (4% of the total precinct) of vegetation with an 'extreme' hazard rating. All external roads bordering the WMUP also have roadside vegetation with an 'extreme' hazard rating.
- Once developed, it is expected that 95% of the WMUP will have either a 'moderate' or 'low' bushfire hazard rating. Large portions of the site will have a 'low' hazard rating and consequently, subdivision and development of that area would not be subject to State Planning Policy SPP 3.7 Planning in Bushfire Prone Areas or the Bushfire Protection Criteria.
- Bushfires occur regularly within the Shire of Serpentine Jarrahdale and can pose a threat to life and property. The area surrounding land the WMUP comprises a mixture of rural and residential land uses. The rural land uses are typically large properties used for broad acre grazing with grassland being the predominant vegetation type. The primary bushfire threats to the WMUP are from a fast-moving grass fire and the proposed 50m wide revegetation buffer adjacent to the Mundijong Road CCW and Bush Forever Site No. 360. The impacts of such a fire on the precinct will be lessened by the provision of a reticulated water supply (which can be used for firefighting purposes), excellent district road access and egress in multiple directions, development setbacks, asset protection zones and local road access in multiple directions.



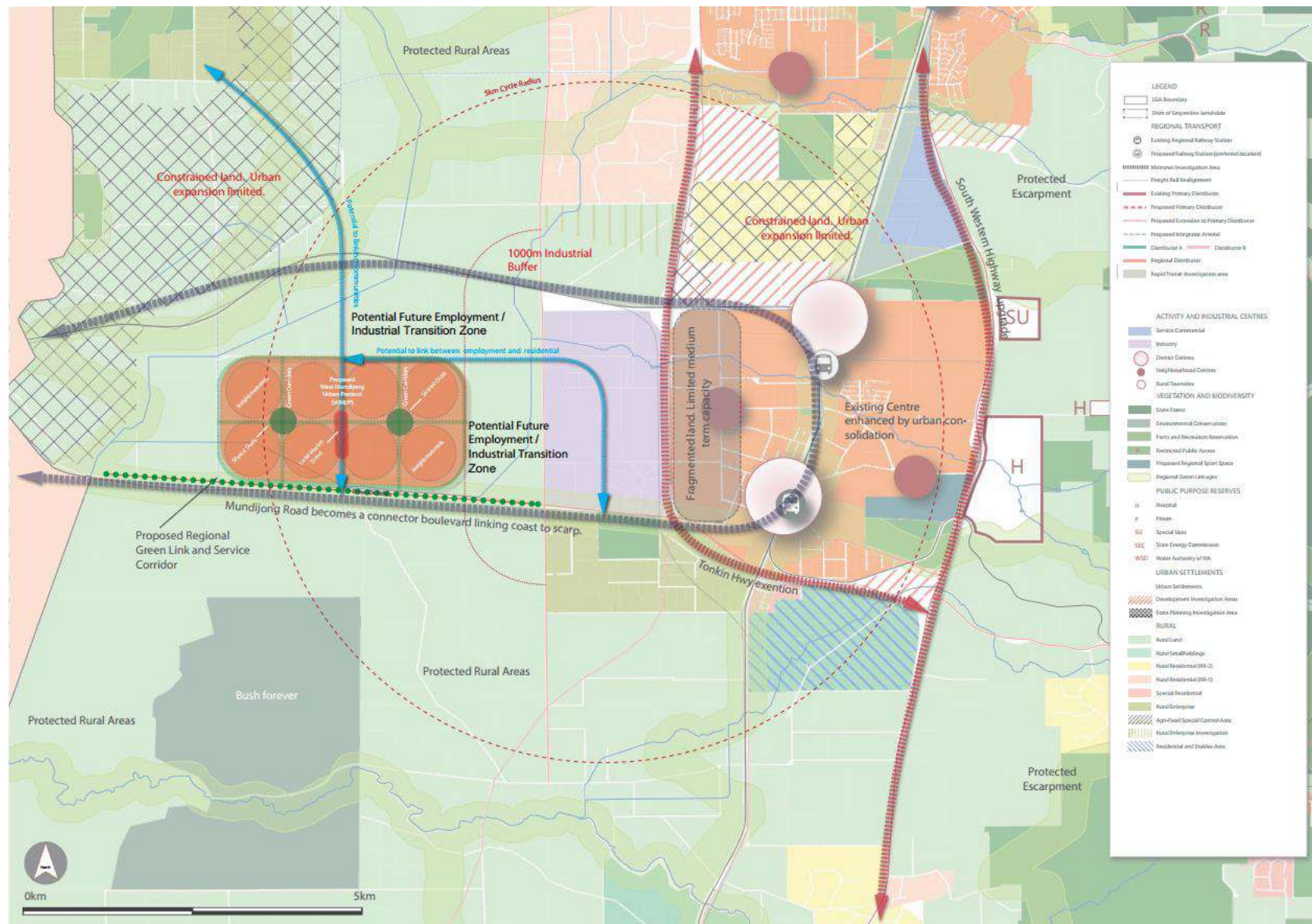
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- The BHL report demonstrates that the bushfire hazard level on the subject land will be reduced and permanently altered by future residential development of the WMUP.
- The development will be able to comply with the objectives of State Planning Policy 3.7 and the Bushfire Protection Criteria as contained in the Guidelines both now and in subsequent planning stages



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8.0 Opportunities and Constraints Mapping



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9.0 Justification – Need and Nexus for Amendment

9.1 Ability of Existing Urban Land Allocation to Accommodate Forecast Population Growth

SJ2050 and the Shire's draft *Local Planning Strategy* identify that the draft *Mundijong District Structure Plan* urban area will need to accommodate a population of approximately 50,000 people, requiring in excess of 17,000 dwellings by 2050 to meet the Shire's long term growth targets.

A detailed analysis of the draft *Local Planning Strategy* and the interrelated draft *Mundijong District Structure Plan* has identified that the land area allocated for urban purposes in the greater Mundijong townsite (including Whitby) is not adequate to cater for the forecast population growth. Specifically, our analysis indicates these factors will yield approximately 4,500 fewer lots and 13,000 fewer residents than currently contemplated by the District Structure Plan.

The primary reasons for the shortfall are:

- The draft *Mundijong District Structure Plan* utilises a zoning of R25 with an average lot size of 350m² to calculate the potential lot yields across the DSP area. An average 350m² lot size is not appropriate nor adequate for a semi-rural outer metropolitan area such as Mundijong and will not be accepted by the market which ultimately is the primary driver of the lot size product.
- Excluding approved Local Structure Plans, the *Mundijong District Structure Plan* identifies eight proposed/potential urban precincts. The identified precincts contain numerous constraints which will significantly impact the ultimate yields achievable. Mapping identifying these constraints has been included in our submission on the draft Local Planning Strategy in **Appendix 2**. In addition, two of the eight urban precincts are designated only as *Development*

Investigation Areas and the development potential of these is therefore unknown.

- The draft Local Planning Strategy adopted by Council specified that Development Investigation Area 3 (DIA 3) in Mundijong should only accommodate lots with an average area of 4,000m² whereas it was originally planned to accommodate 'Urban' development. As a result, the forecast yield for this DIA will reduce from 555 dwellings to 48 dwellings.
- The urban growth areas identified in the draft *Mundijong District Structure Plan* comprise multiple, small landholdings in fragmented ownership; without any Local Structure Planning proposed or in place; and with substantial environmental, servicing and infrastructure constraints to development. These factors will contribute to uncoordinated, ad-hoc and inefficient servicing and development and will increase the complexity, cost and time to plan for eventually develop those areas.
- Numerous other development constraints affect the urban growth areas identified in the draft *Mundijong District Structure Plan*, including:
 - Tree & canopy cover;
 - Railway line setbacks and noise impacts;
 - Existing reserves and proposed multiple use corridors;
 - Threatened priority flora;
 - Threatened priority fauna;
 - Bushfire threat;
 - Wastewater pump stations;
 - Schools;
 - Local and District open space;
 - Wetlands;
 - Tonkin Highway setbacks and noise impacts; and



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- South West Highway setbacks and noise impacts.

A critical by-product of this yield deficit will be a substantial shortfall in community infrastructure funding under the proposed Mundijong Urban Development Contribution Plan and whole-of-Shire Community Facilities Plan. This matter is comprehensively addressed in LK Advisory's submission, included at **Appendix 3.2**.

In addition to the shortfall of Urban land within the draft *Mundijong District Structure Plan* area, it is understood that the Cardup, and Baldivis/Oldbury/Oakford Planning Investigation Areas identified in the South Metropolitan Peel Sub-Regional Planning Framework, are heavily constrained and may be unsuitable for Urban development. Should this be the case, significant additional pressure would be placed on the Shire of Serpentine-Jarrahdale to accommodate the forecast population growth for the sub-region.

Ultimately, the potential removal and/or reduction of these two Planning Investigation Areas from the Sub-Regional Planning Framework will result in the need to substantially increase the Urban land allocation within the Shire. The proposed WMUP is ideally located and comparatively unconstrained to supply the expected shortfall in dwellings for the Mundijong locality. Critically, the entire WMUP consists of only 16 lots and 10 property owners, all of whom support the proposal – with a single coordinating and funding entity (WPG Landholdings Pty Ltd & WPG Landholdings No. 3 Pty Ltd) acting on behalf of all owners in the precinct, thus ensuring the timely and coordinated delivery of services, infrastructure, and development.

9.2 Capacity of Land to Accommodate Urban Development

The WMUP is a vital consideration when examining locations for additional 'Urban' zoned land within the Shire. We contend the WMUP is entirely appropriate for 'Urban' development for the following reasons:

1. A Land Capability Assessment has been undertaken that demonstrates the land does not warrant or support a classification as '*a key agricultural asset*' or '*highly productive rural/agricultural land*'. Agricultural productivity at the site is considered low.
2. An Environmental Assessment Report has been undertaken for the WMUP which indicates the precinct is largely free from any constraints that would prevent future urban development. From an ecological perspective, the degraded nature of the site due to previous clearing and many years of low intensity rural/agricultural use mean that sensitive environments are unlikely to exist or be adversely impacted by the proposed 'Urban' zoning.
3. A Bushfire Hazard Level Assessment determined that the bushfire hazard level for the WMUP is mostly 'low' to 'moderate' and this will be further reduced (permanently) once developed for residential purposes.
4. Drainage, groundwater, and servicing considerations for the WMUP can all be effectively and efficiently addressed through further detailed planning and residential development of the precinct in future.
5. Uniquely, the WMUP covers a large, developable area; comprising only a small number of lots and even smaller ownership; with a single, competent coordinating entity; and unanimous support from all landowners for urbanisation of the precinct. These factors ensure the WMUP is not affected by the same constraints and considerations that can otherwise impede the coordinated planning and delivery of new residential growth areas.



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9.3 Economic benefits

In addition to supplementing Mundijong's future Urban land supply to accommodate the Shire's forecast population growth, Urban development of the WMUP will deliver numerous economic benefits to the Shire and broader community, including:

1. The WMUP is located immediately adjacent the West Mundijong Industrial Area which is the Shire's primary strategic employment node. Urbanisation of the WMUP will provide a resident workforce close to the Industrial Area, which in turn is expected to attract and accelerate investment in the Industrial Area.
2. Urban development of the WMUP (approx. 6,500 dwellings) would produce a total economic output of around \$4.6 billion through the subdivision works, construction of dwellings and associated community services (see Section 7.3 earlier and Economic Impact Assessment included as Appendix 2.3).
3. Future development of the WMUP would:
 - Increase the pool of land required to make a development contribution payment, which in turn will reduce the DCP cost per lot and improve the affordability of the DCP;
 - Generate new contributions to fund the early delivery of critical infrastructure; and
 - Mitigate the risk of a severe funding shortfall due to the current forecast under-collection of DCP contributions.

LK Advisory's analysis of the Shire's draft Mundijong DSP (17,592 dwellings), Draft Mundijong 'Traditional Infrastructure' Developer Contribution Plan (DCP) (16,746 dwellings), and Draft 'Community

Infrastructure' DCP (16,382 dwellings) revealed several inconsistencies between the dwelling yields and population forecasts. Based on the stated contribution rate of \$16,507 per lot (dwelling), this equates to varying development contribution incomes of \$290.39 million, \$276.42 million, and \$270.41 million, respectively. This variance is significant considering the combined value of infrastructure to be funded from the Draft Mundijong DSP is \$286.12 million (at the time of drafting – May 2020). Hence, the yield forecast of 16,746 dwellings contained in the Draft Mundijong 'Traditional Infrastructure' DCP is likely to result in a substantial \$10 million funding shortfall. This shortfall increases to more than \$15 million if the estimated yield from the Draft 'Community Infrastructure' DCP is applied.

If applying the dwelling yield estimates contained in our own submission on the draft Local Planning Strategy of 13,056 dwellings (**Appendix 3.1**), the future DCP funding shortfall will increase to a colossal \$75 million.

If the future per lot (dwelling) contribution rate is raised to recover this deficit this will severely impact the commercial viability of development in the area with the resultant contribution rate, then expected to substantially exceed 10% of the lot sales price. This does not account for the following items, which will only further erode the feasibility of developing under the DSP:

- cost escalation.
- inflation.
- Development delays/payment of contributions.
- risk of lot yields not being achieved within the life of the DCP.

The timely introduction of additional, unconstrained, developable Urban land in the WMUP presents a strategic opportunity to avoid the aforementioned DCP funding crises while still achieving the



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Shire's strategic objectives for the Mundijong locality and the Shire more broadly.

9.4 Sub-Regional Planning Framework

It is understood that a review of the Sub-Regional Planning Frameworks occurred in 2021, and that the review was confined to a comprehensive assessment of the Planning Investigation Areas depicted in each Framework. Although the results of that review exercise have not yet been released, we understand that the outcome will not prejudice our client's ability to submit this MRS amendment proposal and for it to be meaningfully considered on its individual planning merits.

Although the WMUP is depicted as Rural land under the South Metropolitan Peel Sub-Regional Planning Framework, the Shire of Serpentine Jarrahdale has recognised that circumstances have changed, and further information has come to light since the Sub-Regional Planning Framework was produced, warranting closer examination of the WMUP.

Specifically, when considering the Draft Mundijong DSP and associated DCP at its meeting on 16 November 2020 (Agenda Items 10.1.12 and 10.1.14), Council recognised the need to examine the merits of the WMUP and subsequently engaged with the WAPC Chairman and Planning Minister regarding this matter, to clarify the important role this strategic land area could play in the sub-regional planning framework. This MRS amendment serves as the formal catalyst for this evaluation.



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10.0 Conclusion

According to SJ2050 and the Shire's draft LPS, the draft Mundijong DSP urban area will need to accommodate a population of approximately 50,000 people, requiring more than 17,000 dwellings by 2050 to meet the Shire's long term growth targets.

However, a detailed review of the draft LPS and DSP has identified that the land area allocated for urban purposes in and around the Mundijong townsite is incapable of accommodating the forecast population growth, principally due to:

- The draft Mundijong DSP relying on dwelling yields based on a blanket R25 density coding, with an average lot size of 350m². This average lot size is inconsistent with prevailing average lot sizes in the area and misaligned to market demand and take-up for this outer metropolitan area; and
- Excluding approved Local Structure Plans, the Mundijong District Structure Plan identifies eight urban growth areas. These precincts contain significant development constraints, which will dramatically reduce forecast dwelling yields and increase the time, cost and effort needed to plan for and develop these areas. In addition to the eight urban growth areas, there are two Development Investigation Areas the development potential of which is unknown.

Subject to support for this MRS Amendment, further detailed investigations, planning and design will be carried out to incorporate the WMUP in the Shire's LPS and Scheme, the Mundijong DSP and DCP, and whole-of-Shire community facilities DCP.

The proposed WMUP is largely unconstrained and will facilitate the timely release of Urban land in response to market demand, thereby guaranteeing an adequate supply of land to cater for Mundijong's future growth and achieve the Shire's future dwelling and population targets.

We respectfully request that the Western Australian Planning Commission resolves to initiate this amendment to the Metropolitan Region Scheme to consider rezoning the WMUP from Rural to Urban.



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Appendices



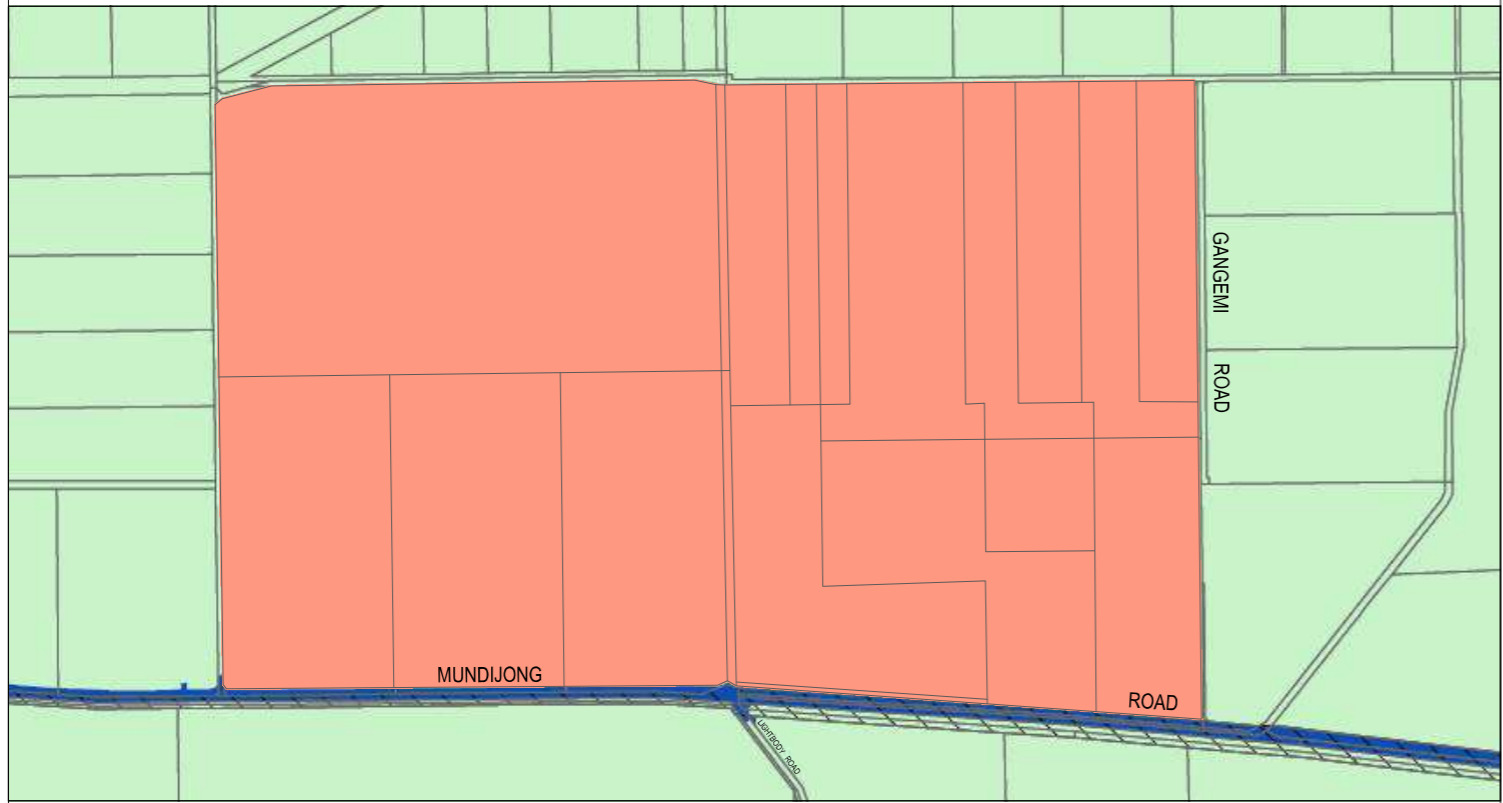
**WEST MUNDIJONG URBAN PRECINCT
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APPENDIX 1
MRS Amendment Zoning Map









EXISTING METROPOLITAN REGION SCHEME MAP



PROPOSED METROPOLITAN REGION SCHEME MAP

LEGEND:

-  OTHER REGIONAL ROADS
-  URBAN
-  RURAL
-  BUSH FOREVER

PROPOSED MRS AMENDMENT
MUNDIJONG ROAD
OLDBURY

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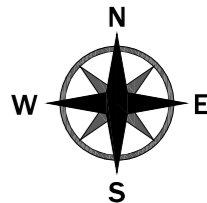
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e: admin@dynamicplanning.net.au
t: (08) 9275 4433
f: (08) 9275 4455
SUITE 15, 29 COLLIER ROAD
MORLEY WA 6062
ABN: 99 169 411 705



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APPENDIX 2.1
Land Capability Assessment



**AGRICULTURAL LAND CAPABILITY
WEST MUNDIJONG URBAN PRECINCT
PROPOSED METROPOLITAN REGION SCHEME
AMENDMENT**

Prepared for

WPG LANDHOLDINGS PTY LTD

by



LAND ASSESSMENT PTY LTD
5/27 York Street, SUBIACO WA 6008

Mob: 0417 900 724

Report No. 2023

12 May 2022

Agricultural Land Capability - West Mundijong

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1.0 INTRODUCTION

1.1 Background

Dynamic Planning and Developments (DPD), on behalf of WPG Landholdings Pty Ltd, is preparing a Metropolitan Region Scheme (MRS) Amendment for the proposed West Mundijong Urban Precinct (WMUP) - a 647 ha cell of land to the west of the *West Mundijong Industrial Area* (see extract of MRS in Figure 1). It is proposed by WPG Landholdings that this land should be rezoned from 'Rural' to 'Urban' under the MRS.

WPG Landholdings has engaged Land Assessment Pty Ltd to provide an *Agricultural Land Capability Assessment* report to form part of its MRS Amendment.

The *Land Capability Assessment* report is intended to determine whether or not land within the 'Urban Precinct' (see Figure 1 below) is "a key agricultural asset (i.e. a food bowl for the future)" and "highly productive rural/agricultural land that should not be removed".

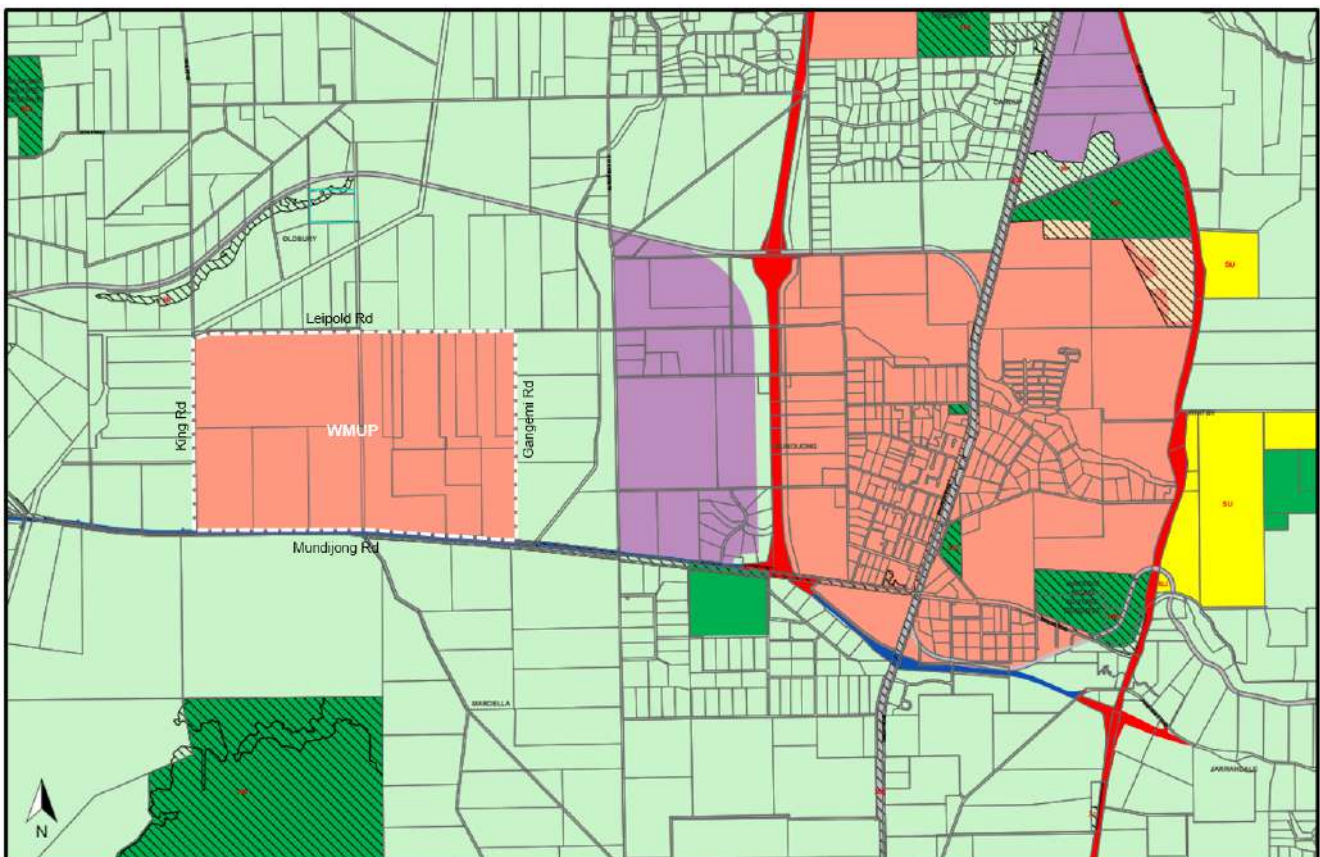


Figure 1: THE SUBJECT LAND (MRS extract showing proposed Urban zoning of WMUP)

1.2 Consultant Qualifications and Experience

Land Assessment Pty Ltd is a Western Australian environmental consultancy established in 1991 by Martin Wells and specialising in environmental planning, land use (capability / suitability) evaluation, soil surveys, and management of natural resources.

Martin Wells B.AgSc (1976) is an agricultural scientist with over 30 years' experience in the survey and evaluation of land resources to assist land use planning and agricultural development. He has played a key role in the development and application of land capability assessment within Western Australia as a former Department of Agriculture research officer and is the principal author of that Department's first publication on Land Capability Assessment Methodology (Wells and King 1989). He also established the land resource mapping framework for studies over the Swan Coastal Plain, including those relevant to the subject land.

As a consultant, Martin has conducted numerous property-specific land capability assessments (21 within Serpentine-Jarrahdale) and prepared both individual property, and whole of local government, assessments of agricultural capability and whether or not land should be considered 'priority agriculture'.

1.3 How The Matter Has Been Addressed

The question of whether or not the subject land is a key agricultural asset and highly productive has been addressed by reviewing and field checking the existing agricultural land capability mapping by the Department of Primary Industries and Regional Development (DPIRD). Key reference documents relating to rural planning and agricultural potential were then also reviewed and commented on in the context of their effect on the subject land. They include;

- a. Western Australian Planning Commission - *State Planning Policy 2.5 'Rural Planning'* (WAPC 2019) and associated *Rural Planning Guidelines* (WAPC 2016) relating to 'Priority Agriculture' land.
- b. Shire of Serpentine-Jarrahdale – *Draft Local Planning Strategy* (2019) and *Rural Strategy* (2017).
- c. Department of Primary Industries and Regional Development - *Potential Rural Land Uses on the Palusplain* (Safstrom 2012) and *Planning for the Peel Food Zone* (Percy 2020).

2.0 PLANNING CONTEXT

2.1 Local Planning Scheme

The subject land is zoned 'rural' under the Shire of Serpentine-Jarrahdale Local Planning Scheme (TPS No2). The Planning Scheme is informed by various studies including the Shire's Draft Local Planning Strategy (2019) and its Rural Strategy (2017). The subject land is not identified as having any particular significance for agriculture under the Local Planning Scheme.

2.2 Draft Local Planning Strategy (2019)

The 2019 Draft Local Planning Strategy recognises the need to “*preserve land classified as having a high land capability for annual and perennial horticulture and grazing in the regional soil-landscape to enable the protection of productive rural land*”.

Also, to “*encourage development nodes of closed agricultural systems ...*” the draft Strategy proposes to “*include an agri-food processing and production special control area (SCA) within LPS 3*”. The subject land is remote from the proposed agri-food SCA (see Figure 2) which forms part of the Peel Food Zone (Percy 2020 and GHD 2017).

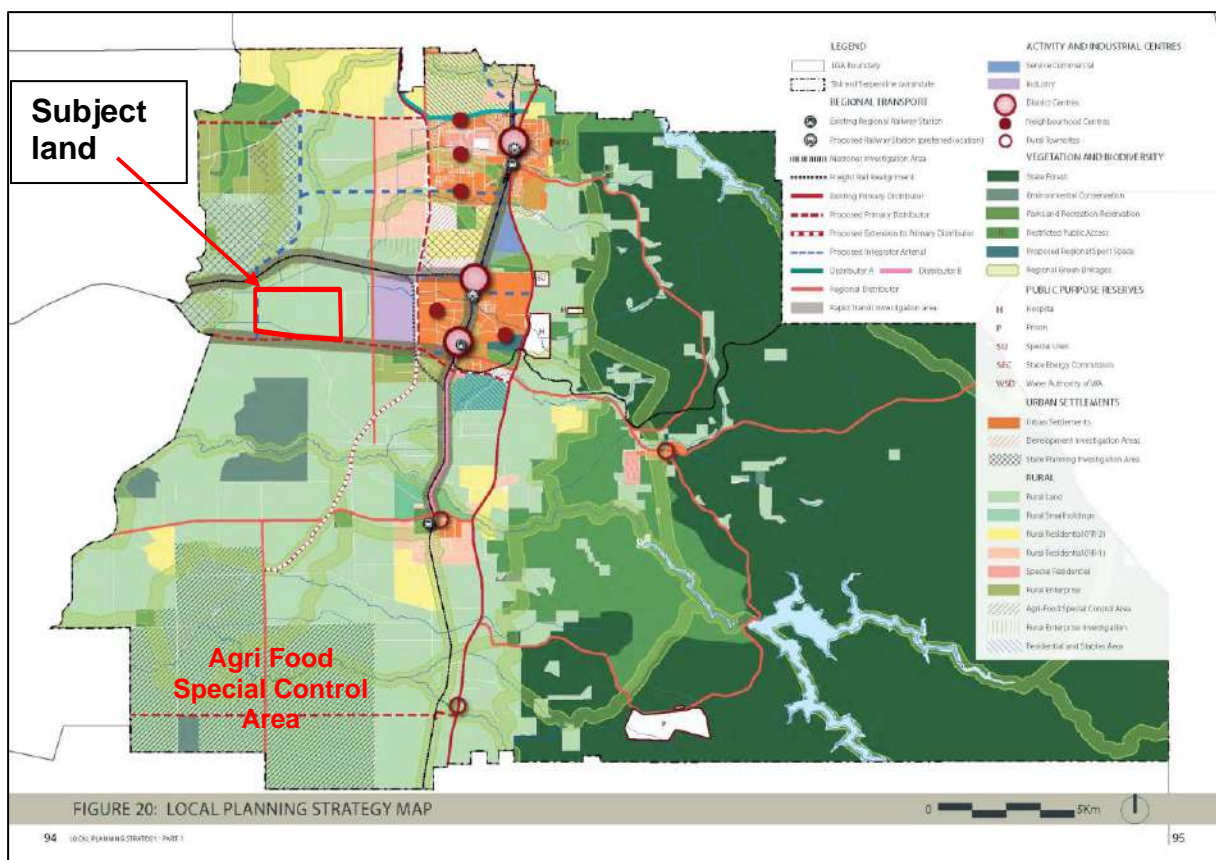


Figure 2: Subject Land in relation to 2019 Draft Local Planning Strategy Map.

2.3 Rural Strategy (2017)

The Shire's original *Rural Strategy* was prepared in 1994 with many subsequent reviews until endorsed by the WAPC in 2017. As shown in Figure 3, the *Rural Strategy* (Land Insights 2017) identified seven policy areas (distinct from zones) to inform the 2019 Draft Local Planning Strategy.

The policy areas included separate 'Rural' and 'Agricultural Protection' areas. While the 'Rural' policy area includes an objective 'to retain and maintain traditional agricultural uses', the 'Agricultural Protection' policy area focusses on 'retaining and maintaining the productive capability of land for agricultural enterprises in proximity to Perth and its markets'.

In common with its designation in the 2019 Draft Local Planning Strategy, the subject land is not identified under the 2017 Rural Strategy as having any particular agricultural significance. Accordingly, neither of these studies support to the subject land being "a key agricultural asset" or "highly productive rural/agricultural land".

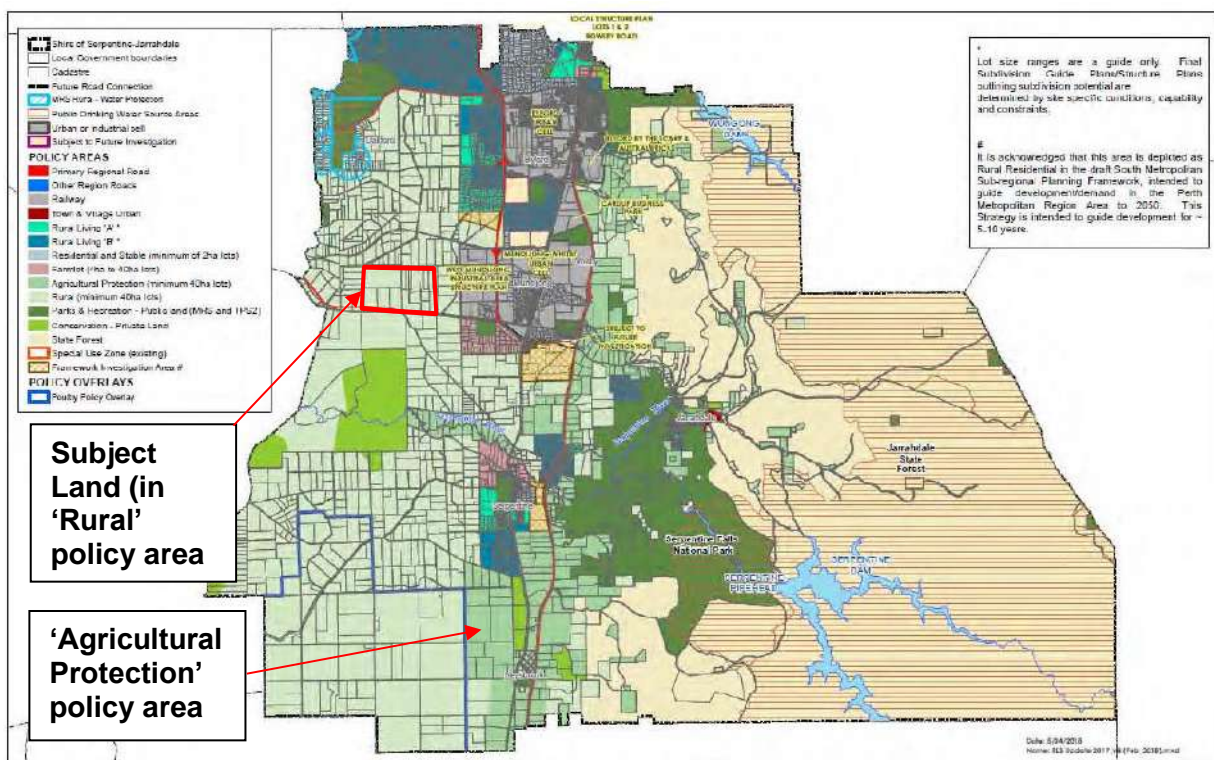


Figure 3: Subject Land in relation to the 2017 Rural Strategy Map

Source: Shire of Serpentine-Jarrahdale Rural Strategy (Land Insights 2017) – from Part 2 of the Draft Local Planning Strategy (2019).

3.0 NATURE OF THE SUBJECT LAND

3.1 Current Use and Catchment Perspective

The subject land is predominantly cleared and used for livestock grazing, primarily cattle, and to a lesser extent horses.

The land forms part of the northern portion of the catchment to the Peel-Harvey Estuarine System which is subject to government policies (EPA 1992, WAPC 1992) seeking to improve and protect environmental values and reduce nutrient inputs to that system from the coastal plain drainage network.

3.2 Landforms and Soils

3.2.1 Existing mapping

DPIRD's Agricultural capability assessments have been conducted over the Serpentine-Jarrahdale area by the Department of Primary Industries and Regional Development (DPIRD) based on soil-landscape mapping produced by the former Department of Agriculture (van Gool 1990) at a publication scale of 1:50,000. Figure 4 depicts the relevant portion of that mapping.

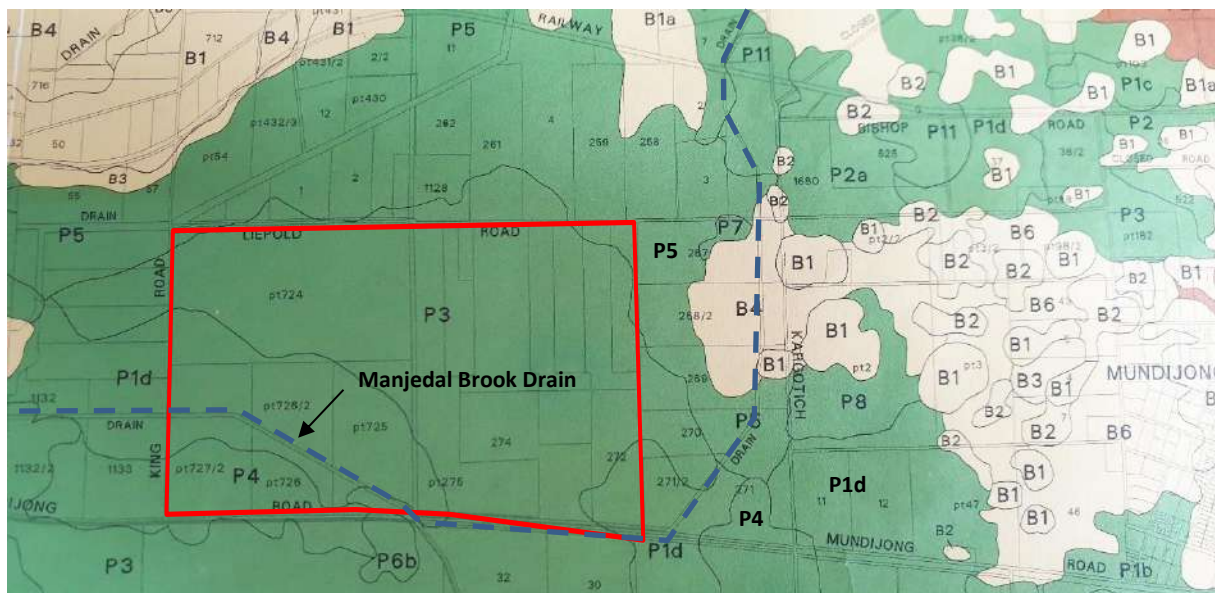


Figure 4: SOIL-LANDSCAPE MAPPING

Source: Adapted from mapping titled *Land Resources in the Northern Portion of the Peel Harvey Catchment* (van Gool 1990)

Figure 4 and the associated descriptions in Table 1 show the subject land encompasses an inland portion of the Coastal Plain (Pinjarra system) characterised by

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flat, relatively poorly drained terrain and predominantly duplex (loam or clay loam over clay) soils or deep uniform clays. To the north east, the terrain is slightly better drained with a thin sandplain overlying the buried soils of the Pinjarra system.

Table 1: MAPPING UNIT DESCRIPTIONS

Pinjarra Plain System	Swan Coastal Plain from Perth to Capel. Poorly drained coastal plain of alluvium over sedimentary rocks. Semi-wet soils, grey deep sandy duplexes, brown loamy earths, pale sands and clays.
P1d	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and moderately susceptible to salinity.
P3	Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.
P4	Poorly drained flats, sometimes with gilgai microrelief and with moderately deep to deep black, olive grey and some yellowish-brown cracking clays and less commonly non-cracking friable clays with generally acidic subsoils.
P5	Poorly drained flats, commonly with gilgai microrelief and with deep black-grey to olive-brown cracking clays with subsoils becoming alkaline.
P7 (minor)	Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and gley sandy duplex and effective duplex soils.
Bassendean System	Swan Coastal Plain from Busselton to Jurien. Sand dunes and sandplains with pale deep sand, semi-wet and wet soil.
B1 (minor)	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale-yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
B4	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.

3.2.2 Reconnaissance and checking

Given the scale of soil-landscape mapping in Figure 4 some 'on-ground' variation can be expected in soil and landform conditions at a 'local property' level. A reconnaissance survey, or 'ground truthing' of the conditions described in the earlier mapping was therefore undertaken as a basis for checking the agricultural capability assessment.

Soil and landform conditions were checked through aerial photo interpretation and reconnaissance field survey work. Specific soil site data was obtained from DPRD (via NRInfo online mapping) and compared against the map unit descriptions in Table 1 to determine the robustness of those descriptions in the local context. Soil site locations and associated classifications are shown in Figure 5 and Table 2 respectively. Landform, surface soil and drainage conditions were also examined at multiple 'observation sites' shown in Attachment A with some associated photos.

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Minor areas of discrepancy were found between the mapping and local conditions; however, they are attributed to small inclusions of adjacent map units (with ultimately similar capability – see section 4.2). It was concluded that the existing soil-landscape mapping and descriptions provide an appropriate basis for a ‘property specific’ agricultural capability assessment.

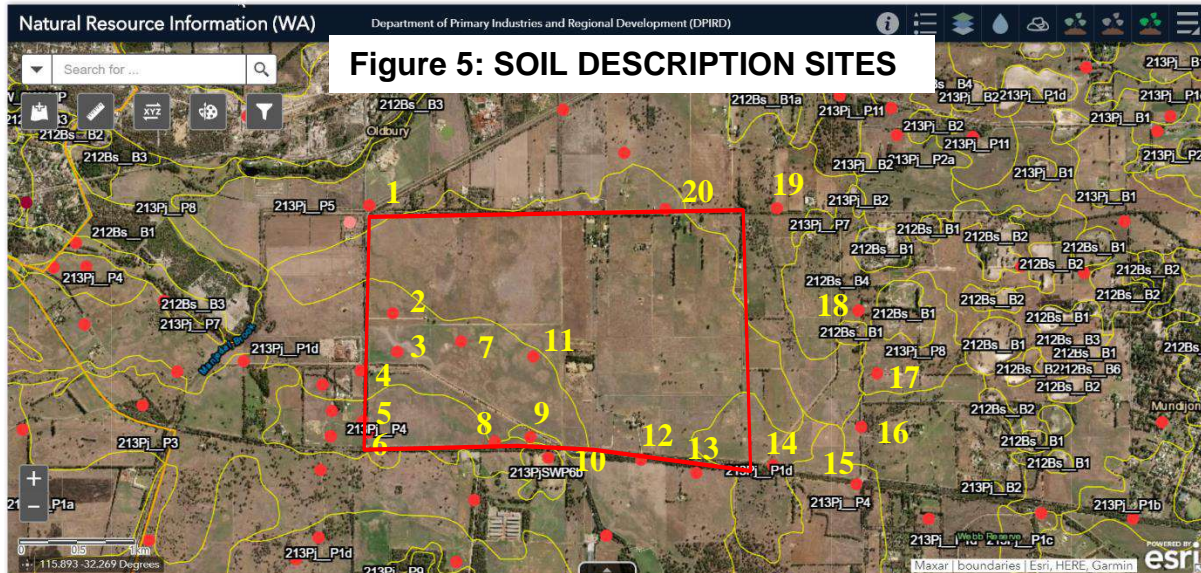


Table 2: COMMENT ON SOIL CLASSIFICATIONS AT DESCRIPTION SITES

Site	Map Unit	Soil Classification	Comment
1	P5	Hard cracking clay	Compatible with map unit description
2	P1d	Grey shallow sandy duplex	Compatible
3	P1d	Brown loamy earth	Not compatible – possible inclusion of adjacent P3
4	P1d	Grey shallow sandy duplex	Compatible
5	P4	Hard cracking clay	Compatible
6	P4	Hard cracking clay	Compatible
7	P1d	Brown loamy earth	Not compatible – possible inclusion of adjacent P3
8	P4	Hard cracking clay	Compatible
9	P3	Hard cracking clay	Not compatible – possible inclusion of adjacent P4
11	P1d	Brown loamy earth	Not compatible – possible inclusion of adjacent P3
12	P3	Grey non-cracking clay	Not compatible – possible inclusion of P4
13	P3	Friable red/brown loamy earth	Generally compatible (better drained)
14	P1d	Brown loamy earth	Not compatible – possible inclusion of adjacent P3
15	P4	Hard cracking clay	Compatible
16	P1d	Alkaline grey shallow sandy duplex	Compatible
18	B4	Pale deep sand	Compatible (assuming semi-wet)
19	P5	Grey non-cracking clay	Generally compatible
20	P3	Brown loamy earth	Compatible

Note: Sites 10 and 17 occur in minor map units and hence were not assessed.

4.0 AGRICULTURAL CAPABILITY

4.1 Capability Assessment Method

'Land capability' is a term used to express the ability of land to support a proposed use with minimal risk of degradation to its soil and water resources. A general methodology for capability assessment developed by the (now) Department of Primary Industries and Regional Development (Wells and King 1989, and more recently by van Gool et al 2005), forms the basis for agricultural assessments over the subject land.

Specific land use rating tables are used to compare soil and landform qualities of relatively homogeneous mapped areas (mapping units) against the optimal desired requirements of that form of land use. Attachment B provides a copy of the rating table for grazing, being the current land use.

Using data from the soil-landscape mapping, factors considered in the rating tables include plant rooting depth, soil water storage and drainage, and risks associated with nutrient export, erosion and waterlogging. Based on the 'degree of fit', mapping units are assigned a capability class ranging from 'very high' capability (class one) to 'very low' capability (class five). The classes are described in Table 3.

Table 3: LAND CAPABILITY CLASSES

Capability class	General description
1 Very high	Very few physical limitations present and easily overcome. Risk of land degradation is negligible.
2 High	Minor physical limitations affecting either productive land use and/or risk of degradation. Limitations overcome by careful planning.
3 Fair	Moderate physical limitations significantly affecting productive land use and/or risk of degradation. Careful planning and conservation measures required.
4 Low	High degree of physical limitation not easily overcome by standard development techniques and/or resulting in high risk of degradation. Extensive conservation measures required.
5 Very low	Severe limitations. Use is usually prohibitive in terms of development costs or the associated risk of degradation.

Source: van Gool et al (2005)

The simple five class system shown above was used to express the capability of the land for agricultural activities as part of the original land resource (soil-landscape) mapping over the northern portion of the Peel Harvey catchment (including Shire of Serpentine-Jarrahdale) by the then Department of Agriculture (Wells 1989, and van Gool 1990).







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Subsequent to the original land resource mapping and capability assessments, the then Department of Agriculture and Food* established a state-wide soil-landscape mapping framework (Purdie et al 2004). This involved the collation of data from multiple surveys (sometimes at different mapping scales) to extend the map unit descriptions and capability ratings over significantly larger portions of the state, including the Swan Coastal Plain here.

As an inevitable result of that process there is a degree of variability associated with the soil-landscape descriptions and capability assessments which now form part of DPIRD's soil-landscape mapping database (accessed via its on-line NRInfo application). To address this variability, the concept of 'proportional capability codes' is used (Table 4).

* Now part of the Department of Primary Industries and Regional Development (DPIRD)

Table 4: PROPORTIONAL CAPABILITY CODES

Category A land: Generally high capability	
 A1	>70% of the area has high capability (is Class 1 or 2)
 A2	50-70% of the area has high capability (is Class 1 or 2)
Category B land: Generally fair or moderate capability	
 B1	>70% of the area has moderate to high capability (is Class 1, 2 or 3)
 B2	50-70% of the area has moderate to high capability (is Class 1, 2 or 3)
Category C land: Generally low capability	
 C1	50-70% of the area has low capability (is Class 4 or 5)
 C2	>70% of the area has low capability (is Class 4 or 5)

Instead of assigning a specific (class 1 - 5) capability rating to locally defined map unit, proportional capability codes are used to more conservatively express capability as a range (e.g. 50-70% of certain classes). This is applicable to the broader occurrence of that map unit arising from the collation and amalgamation of multiple surveys. It can however be considered less specific when compared to earlier localised surveys such as that by van Gool (1990) which affects the subject land.

4.2 Assessment Results

DPIRD's agricultural land use capability ratings for the map units within the subject land are shown in Table 5. The rating for the current land use, grazing, is highlighted and illustrated overleaf in Figure 6.

Potential perennial and annual forms of horticulture have also been assessed, although without consideration of availability of a water resource for irrigation.

For each of the assessed land uses, the simple (5 class) ratings from the original survey (van Gool 1990) are shown, along with the proportional capability code currently used within the Department's state-wide mapping database (NRInfo).

TABLE 5. AGRICULTURAL CAPABILITY RATINGS FOR SUBJECT LAND

Map Unit	% of Subject Land	Grazing		Perennial Horticulture*		Annual Horticulture*	
		Class	Code	Class	Code	Class	Code
P1d	22	3 (Fair)	B1	4 (Low)	C2	4 (Low)	C2
P3	54	3 (Fair)	B1	3 (Fair)	C2	4 (Low)	C2
P4	7	3 (Fair)	B1	4 (Low)	C2	5 (V low)	C2
P5	10	3 (Fair)	B2	4 (Low)	C2	5 (V low)	C2
P7	<1	4 (Low)	C2	5 (V low)	C2	5 (V low)	C2
B1	<1	4 (Low)	C2	3 (Fair)	C2	3 (Fair)	B1
B4	7	3 (Fair)	B1	4 (Low)	C2	4 (Low)	C2

Sources: **Capability Class** – from original survey (van Gool 1990)
Proportional Capability Code – from NRInfo
<https://maps.agric.wa.gov.au/nrm-info/> accessed August 2020)

NOTE:

Agricultural capability ratings for both annual or perennial forms of horticulture are based on soil conditions only and without consideration of whether or not groundwater resources are available for irrigation.

Agricultural capability ratings for 'dryland cropping' are also available for the subject land through NRInfo (all map units rated C2) but this form of land use was not assessed as part of the original survey by van Gool (1990).

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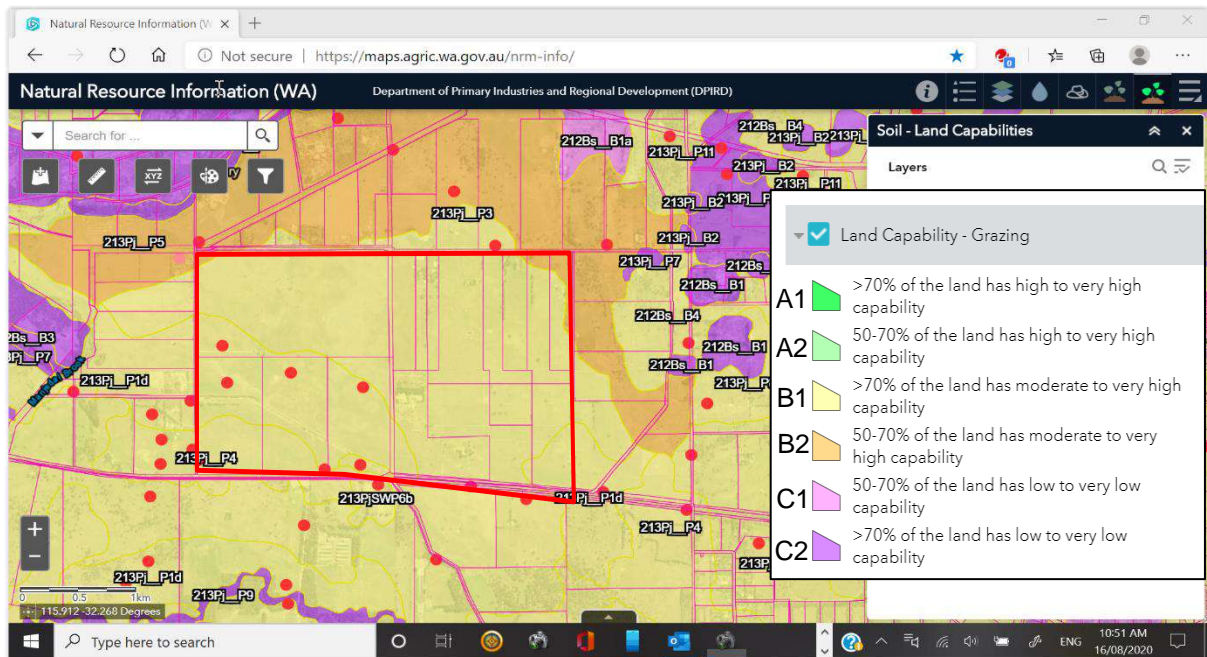


FIGURE 6. LAND CAPABILITY FOR GRAZING

Source: DPIRD Proportional Capability Mapping – from NRInfo
<https://maps.agric.wa.gov.au/nrm-info/> (accessed August 2020)

For grazing, being the existing dominant form of agricultural activity within the subject land, the original survey and land capability assessment (van Gool 1990) rated almost all of the land as Class 3 – Fair capability. In DPIRD’s more contemporary terminology this is category B1 or B2 land. By contrast, categories A1 and A2 generally encompass areas of productive high-quality agricultural land.

In both the original assessment by van Gool (1990) and DPIRD’s contemporary database, the degree of susceptibility to soil waterlogging and possible future salinity are identified as factors (land qualities) which limit the capability rating for grazing over most of the subject land to a ‘Fair’ or a ‘B’ category. In small areas, susceptibility of sandy soils to nutrient loss and wind erosion are also limiting factors.

In relation to other forms of agriculture, the subject land is even more limited by these factors. For horticultural activity and dryland cropping it is rated low to very low capability, or C class land (see Table 5).

In summary, based on the land capability assessment information, the land appears unlikely to be able to support greater agricultural diversity and commercial production beyond the current level of livestock grazing activity. Accordingly, there seems to be no justification for considering the subject land as “a key agricultural asset” or “highly productive rural/agricultural land”.

5.0 OTHER INDICATORS

Other possible indicators of the subject land being a possible 'key agricultural asset' within the Shire, or an area of particularly high productivity, are discussed below.

5.1 Priority Agricultural Land

The purpose of *State Planning Policy 2.5 'Rural Planning'* (WAPC 2019) is to protect and preserve Western Australia's rural land assets for purposes including primary production. The WAPC seeks to recognise particularly productive areas of rural land and protect them from urban and rural living encroachment through their identification as 'Priority Agricultural Land' in planning strategies or schemes.

Priority agricultural land is "*land that is of State, regional or local significance for agricultural and/or food production purposes due to its comparative advantage in terms of soils, climate, water (rain or irrigation) and access to services*" (WAPC 2016).

The identification of priority agricultural land is based on 'high quality agricultural land' (HQAL) data sourced (where available) from the Department of Primary Industries and Regional Development (DPIRD).

WAPC policy for rural land is intended to be given effect through regional planning strategies identifying 'priority agricultural land'. Local government planning schemes are then expected to provide more detailed consideration and guidance on the matter. Local governments are also able to prepare local planning policies to supplement or elaborate on the issue of agricultural land protection.

The subject land, west of Mundijong townsite, is not identified as either 'priority agricultural land' or 'high quality agricultural land' in any contemporary regional or local planning document.

5.2 Special Control or Protection Areas

The Shire's 2019 Draft Local Planning Strategy identifies an "Agri Food Special Control Area" (Figure 2) and its 2017 *Rural Strategy* map (Figure 3) identifies an 'Agricultural Protection' policy area. However, the subject land is not encompassed by any of these areas which might otherwise have provided support for it being considered "a key agricultural asset" or "highly productive rural/agricultural land".

5.3 The Palusplain Study

The former Department of Agriculture and Food (now part of DPIRD) conducted the study, *Agriculture futures: Potential rural land uses on the Palusplain* (Safstrom and Short 2012). A 'palusplain' is a seasonally waterlogged area and this represents much of the Pinjarra Plain portion of the Shire, including the subject land.

The purpose of the Palusplain study was to identify agricultural land use options and opportunities within the southern Perth Metro and Peel regions where the land is under pressure from urban and rural lifestyle development, as well as facing environmental issues associated with drainage and nutrient loss.

In addressing potential uses for rural land, the Palusplain study goes beyond consideration of just the physical 'capability' of the land to address the broader topic of the land's 'suitability' for various forms of agriculture.

A community workshop was held to explore potential agricultural futures with a vision emerging that the palusplain should support a 'food bowl' for Perth. This idea is currently being progressed by government agencies as part of the 'Peel Food Zone' initiative in the southern portion of the Shire of Serpentine-Jarrahdale (the agri-food SCA in Figure 2) and the adjacent northern part of the Shire of Murray (Percy 2012). The 'Peel Food Zone' does not include the subject land.

Of more direct relevance to the potential productivity of the subject land, the Palusplain study report documents the status and potential of the predominant agricultural industries within the palusplain, and concludes;

"the main agricultural industry, beef cattle production, is marginally economic as a stand-alone enterprise for many landholders."

6.0 CONCLUSIONS

This *Land Capability Assessment* report demonstrates that the subject land (the proposed West Mundijong Urban Precinct) is not “*a key agricultural asset (i.e. a food bowl for the future)*” and is not “*highly productive rural/agricultural land that should not be removed*”.

From a review of existing land capability data and a subsequent reconnaissance survey, it was concluded that there are an adequate number of soil description sites for the existing DPIRD soil-landscape mapping and descriptions to provide an appropriate basis for agricultural capability assessment specific to the subject land.

The subject land is predominantly flat terrain with soils that are subject to seasonal waterlogging (i.e. a palusplain) where the (former) Department of Agriculture and Food report “*the main agricultural industry, beef cattle production, is marginally economic as a stand-alone enterprise for many landholders*” (Safstrom and Short 2012).

For livestock grazing, being the existing dominant agricultural activity in the Shire to the west of Mundijong, the capability assessment rates almost all of the subject land as ‘Class 3 – Fair’ or ‘category B1’ land. This is not consistent with it being an area of particularly high-quality agricultural land.

The subject land is not identified as either ‘priority agricultural land’ or ‘high quality agricultural land’ in any contemporary regional or local planning document (including the Shire’s Local Planning Scheme, its Draft Local Planning Strategy (2019), and its Rural Strategy (2017)).

The subject land is not encompassed by the 2019 Draft Local Planning Strategy’s ‘Agri Food Special Control Area’ or by the 2017 Rural Strategy’s ‘Agricultural Protection’ policy area.

In summary, based on the land capability information and a review of planning-related studies, there is no apparent justification for considering the subject land as “*a key agricultural asset*” or “*highly productive rural/agricultural land*”.

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ATTACHMENT A

Observation Sites and Representative Photographs

Agricultural Land Capability - West Mundijong



Map unit P1d – Observation Site 22 view north from Mundijong Rd. Shallow sand to sandy loam over clay (yellow duplex soils).



Map unit P1d – Observation Site 16 view east from King Road along Manjedal Brook drain.





Map unit P3 – Observation Site 10 view south-west from near end of Gangemi Road. Gradational earths and duplex soils with loam to clay loam surface horizons.



Map unit P3 – Observation Site 10 view east near end of Gangemi Road along a tributary agricultural drain leading to Manjedal Brook drain.

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<p>Map unit P3 – Observation Site 13 view south from Leipold Road.</p>	<p>Map unit P4 – Observation Site 17 view north from near intersection of King and Mundijong roads. Deep clay soils (generally acidic).</p>
	
<p>Map unit P5 – Observation Site 8 view south east from near intersection of Leipold and Gangemi roads. Deep clay soils (generally alkaline).</p>	<p>Map unit B4 – Observation Site 4 view south west from near intersection of Leipold and Katgotich Roads. Deep sands over buried clay.</p>

ATTACHMENT B

Capability Rating Table for Grazing

Source: van Gool, D. Tille P, and Moore, G (2005) *Land Evaluation Standards for Land Resource Mapping. Guidelines for assessing land qualities and determining land capability in south-west Western Australia.*

Agricultural Land Capability - West Mundijong

LAND EVALUATION STANDARDS FOR LAND RESOURCE MAPPING

3.4 Land capability for grazing

This assessment covers the grazing of sheep and cattle on broadscale dryland (i.e. non-irrigated) pastures in agricultural areas (receiving an average annual rainfall more than 350 mm).

Pastures are typically based on annual species (such as sub-clover or ryegrass), but perennial species (such as kikuyu or perennial ryegrass) are often present in higher rainfall areas and may dominate some locations. This land use incorporates occasional reseeding and fertiliser topdressing using tractors or similar machinery.

This assessment does not apply to irrigated pastures or to intensively managed paddocks (where supplementary feeding is essential due to high stocking rates and windbreaks are necessary to control wind erosion). See notes on stocking rates, small holdings and horses below. Tables 3.4a considers physical requirements only and ignores socio-economic factors.

Table 3.4a. Land capability ratings for grazing

Land quality and (capability subscript)	Land capability class				
	1	2	3	4	5
Flood hazard (<i>f</i>)	N, L	M	H		
Land instability (<i>c</i>)	N, VL, L		M	H	
pH 0-10 cm (<i>zf</i>)	Slac, N	Sac, Mac, Malk	Vsac, Salk		
pH 50-80 cm (<i>zh</i>)	Slac, N	Mac, Malk, Salk	Sac	Vsac	
Phosphorus export (<i>n</i>)	L, M	H	VH	E	
Rooting depth (<i>r</i>)	VD, D, M	MS	S	VS	
Salinity hazard (<i>y</i>)	NR	PR	MR	HR	PS
Salt spray exposure (<i>zi</i>)	N		S		
Surface salinity (<i>ze</i>)	N	S	M	H	E
Surface soil structure decline (<i>zb</i>)	L, M	H			
Soil water storage (<i>m</i>)	M, H	ML	L	VL	
Soil workability (<i>k</i>)	G, F, P		VP		
Subsurface acidification (<i>zd</i>)	L, M	P, H			
Subsurface compaction (<i>zc</i>)	L, M	H			
Trafficability (<i>zk</i>)	G, F	P	VP		
Water erosion (<i>e</i>)	VL, L, M	H	VH	E	
Water repellence (<i>za</i>)	N, L	M	H		
Waterlogging (<i>i</i>)	N, VL, L	M	H	VH	
Wind erosion (<i>w</i>)	L	M	H	VH	E

**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 2.2
Traffic Impact Assessment



TRANSPORT IMPACT ASSESSMENT

Land bound by Mundijong Road, King Road,
Leipold Road and Gangemi Road;

Oldbury

May 2022

Rev C



Transport Impact Assessment
KC01182.000 Oldbury-Mundijong MRS Amendment

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Prepared by: KCTT (Trading as KC Traffic and Transport Pty Ltd)

ABN 35 148 970 727 |

Postal address: PERTH: Unit 7, No 10 Whipple Street Balcatta WA 6021 |
 BELGRADE: Kralja Milana 15b/2, Beograd 11000

Phone: 08 9441 2700 |

Website: www.kctt.com.au |

Ordinary Council Meeting - 11 December 2023

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Appendices

Appendix 1 - The layout of the proposed development

Appendix 2 - Transport Planning and Traffic Plans

1. Executive Summary

Site Context

- Land bound by Mundijong Road, King Road, Leipold Road and Gangemi Road is currently zoned Rural under the South Metropolitan Sub-regional Planning Framework (PPF) and the Metropolitan Region Scheme (MRS), and at a local level under the Shire of Serpentine Jarrahdale Draft Local Planning Strategy July 2019 (LPST), Draft Local Planning Scheme No. 3 September 2019 (LPSC), and the Draft Mundijong District Structure Plan December 2018 (MDSP).
- This submission proposes to rezone lots located west of Gangemi Road, within a Subject Site area, from "Rural" to "Urban" under the MRS amendment, after which it should be included in the Shire of Serpentine Jarrahdale LPST and by extension, the interrelated MDSP to facilitate future urban development.

Technical Findings

- Intersections of Mundijong Road & Kargotich Road and Mundijong Road & King Road have higher than network average KSI crashes.
 General safety in the area could be improved through the urbanisation of the area: limiting vehicular speed and modifications to road geometry. These measures should reduce the incidence of KSI crashes and improve road safety.
 Casualty traffic incidents are concentrated at existing intersections. West Mundijong Industrial Area LSP shows a number of signalised intersections in future (including Mundijong Road / Kargotich Road); however, current MRWA position is that roundabouts are the preferred intersection configuration over traffic signals, wherever possible.
- Currently, the subject site area is not serviced by public transport.
 At present, the PTA does not have plans for expansion of the network through the Subject Site. Should this area be developed for urban residential, and provided it is connected to the existing urban front, consideration would be given to connecting it to the existing Transperth network. This would likely be in the form of a connection to Byford Station, and depending on development to the west, that service may connect across to Wellard Station. The introduction of additional routes would require a more detailed development proposal.
- There is no pedestrian or cycling infrastructure within the Subject Site and its immediate vicinity. It is essential to develop an efficient and connected network of pedestrian paths in order to encourage pedestrian movement. Every major road within the subject site area should have either a shared path or a dedicated cycle lane and a separate pedestrian path. All pedestrian and shared paths should be designed to be accessible by all members of the community regardless of physical ability. Existing upgrade plans for the surrounding road network include pedestrian and cycling infrastructure.
- Currently, three roads within the subject site are a part of the RAV network:
 - Mundijong Road - Tri Drive Concessional Level 1 - Tri Drive 1.1, Tandem Drive Level 4
 - King Road - Tri Drive Concessional Level 1 - Tri Drive 1.1, Tandem Drive Level 4
 - Kargotich Road - Tri Drive Concessional Level 1 - Tri Drive 1.1 (with conditions), Tandem Drive Level 3

Depending on the area's future urbanisation, some of these routes might no longer be required. The Westport designated Anketell Road as a primary freight route corridor; therefore, the traffic anticipated on Mundijong Road (in particular heavy vehicles) should be lower than previously projected. This is to be assessed in a later planning stage.

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- The expected additional traffic from the subject site area is 60,792 daily vehicle trips and 5,740 vehicle trips in the peak hour. This is considered to be a high impact on the surrounding road network. Should the lots located west of Gangemi Road, within a Subject Site area be rezoned from "Rural" to "Urban" under the MRS amendment, it can be expected that traffic impact would be more disperse throughout the surrounding road network. KCTT believe that proposed major changes to the surrounding area and network will be able to successfully cater for the expected traffic volumes and distribution. Upon the proposed MRS amendment, the key will be to monitor the traffic volumes and intersections performance and upgrade them as necessary and as timely as possible. Therefore, assuming the planned road network upgrades will take place, there are no major traffic issues regarding the proposed rezoning from "Rural" to "Urban".

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2. Transport Impact Assessment

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2.1. Location

Suburb Oldbury

Description of Site

Land bound by Mundijong Road, King Road, Leipold Road and Gangemi Road are currently designated Rural under the South Metropolitan Sub-regional Planning Framework (PPF) and the Metropolitan Region Scheme (MRS), and at a local level under the Shire of Serpentine Jarrahdale Draft Local Planning Strategy July 2019 (LPST), Draft Local Planning Scheme No. 3 September 2019 (LPSC), and the Draft Mundijong District Structure Plan December 2018 (MDSP).

This submission proposes rezoning of the lots located west of Gangemi Road, within a Subject Site area from "Rural" to "Urban" under the MRS amendment after which it should be included in the Shire of Serpentine Jarrahdale LPST and by extension the interrelated MDSP to facilitate future urban development.

2.2. Technical Literature Used

Local Government Authority	Shire of Serpentine-Jarrahdale
Type of Development	Mixed
Are the R-Codes referenced?	YES
<i>If YES, nominate which:</i>	State Planning Policy 7.3 Residential Design Codes Volume 1 - 2019 R-Codes (incorporating amendments gazetted on 2/8/2013, 23/10/15 and 2/3/2018 and 24/5/2019)
Is the NSW RTA Guide to Traffic Generating Developments Version 2.2 October 2002 (referenced to determine trip generation / attraction rates for various land uses) referenced?	YES
Which WAPC Transport Impact Assessment Guideline should be referenced?	Volume 2 - Planning Schemes, Structure Plans & Activity Centre Plans
Are there applicable LGA schemes for this type of development?	YES
Number and Number of Scheme	Draft Local Planning Scheme No. 3
Is the Perth Transport Plan for 3.5 million and Beyond referenced?	YES

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2.3. Land Uses

Are there any existing Land Uses within the Subject Site Area? YES

If YES, nominate: 16 Rural lots

Property address	Lot area (ha)
Lot 272 Mundijong Road Oldbury	31.33
Lot 273 Mundijong Road Oldbury	13.37
Lot 274 Mundijong Road Oldbury	44.11
Lot 275 Mundijong Road Oldbury	46.72
Lot 725 Mundijong Road Oldbury	56.33
Lot 726 Mundijong Road Oldbury	58.99
Lot 727 Mundijong Road Oldbury	58.96
Lot 724 King Road Oldbury	158.42
Lot 02 Leipold Road Oldbury	21.17
Lot 801 Leipold Road Oldbury	10.6
Lot 800 Leipold Road Oldbury	10.6
Lot 264 Leipold Road Oldbury	46.9
Lot 265 Leipold Road Oldbury	22.58
Lot 123 Leipold Road Oldbury	22.2
Lot 02 Leipold Road Oldbury	24.34
Lot 01 Leipold Road Oldbury	20.33
TOTAL	646.95

What zone is the Subject Site Area included in according to the Metropolitan Region Scheme and LPS / TPS? Rural – Proposed rezoning of the lots located west of Gangemi Road, within a Subject Site area, from "Rural" to "Urban" under the MRS amendment

Proposed Land Uses

How many types of land uses are proposed?

Nominate land use type and yield

- East of Gangemi Road ≈ 200ha - Rural Enterprise (potential industrial in future)
- West of Gangemi ≈ 650ha:
 - Proposed ≈550ha Residential R20 (450m² average) = 6500 lots
 - Balance ≈100ha to be POS, drainage, public purpose, school, sports amenities etc. (subject to future structure planning)

Are the proposed land uses complementary with the surrounding land-uses?

YES – with the proposed land uses within the Draft Mundijong District Structure Plan

2.4. Local Road Network Information

How many existing roads are there within the Subject Site Area? 5 roads (additional unsealed internal circulation)

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Name of Roads within the Subject Site Area / Road Classification and Description:

Road 1

Road Name	Mundijong Road
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20m
Road Pavement Width	8m
Classification	Regional Distributor
Speed Limit	100kph
Bus Route	NO
On-street parking	NO

Road 2

Road Name	King Road
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20m
Road Pavement Width	8m
Classification	Regional Distributor
Speed Limit	100kph
Bus Route	NO
On-street parking	NO

Road 3

Road Name	Kargotich Road
Number of Lanes	two way, one lane each direction, undivided
Road Reservation Width	20m
Road Pavement Width	8m
Classification	Regional Distributor
Speed Limit	100kph
Bus Route	NO
On-street parking	NO

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Road 4

Road Name	Leipold Road
Number of Lanes	two way, one lane (no linemarking), undivided
Road Reservation Width	20m
Road Pavement Width	5.5m
Classification	Access Road
Speed Limit	50kph
Bus Route	NO
On-street parking	NO

Road 5

Road Name	Gangemi Road
Number of Lanes	two way, one lane (no linemarking), undivided
Road Reservation Width	20m
Road Pavement Width	5.5m
Classification	Access Road
Speed Limit	50kph
Bus Route	NO
On-street parking	NO

Name of Other Roads within 2km radius of site, or roads likely to take increased traffic due to the development.

Road 1

Road Name	Bishop Road
Number of Lanes	two way, one lane (no linemarking), undivided
Road Reservation Width	20m
Road Pavement Width	6m
Classification	Local Distributor
Speed Limit	50kph
Bus Route	NO
On-street parking	NO

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2.5. Traffic Volumes

Road Name	Location of Traffic Count	Vehicles Per Day (VPD)	Vehicles per Peak Hour (VPH)				Heavy Vehicle % <i>If HV count is Not Available, are HV likely to be in higher volumes than generally expected?</i>	Year	
			AM Peak Time	AM Peak - Peak VPH	PM Peak Time	PM Peak - Peak VPH		Date of Traffic Count	<i>If older than 3 years multiply with a growth rate</i>
Mundijong Road	East of King Road	5,167	07:30 – 416		16:00 – 521		13.7	2017/2018	–
		6,068	07:15 – 513		15:45 - 634		13.0	2020/2021	-
	500m east from Kargotich Road *	3,708	08:00 – 266		16:00 – 331		12.4	06/02/2019	–
Kargotich Road	South of Orton Road	3,272	07:00 – 262		16:00 – 349		13.5	2019/2020	–
King Road	500m south of Gossage Road *	1,351	06:00 – 96		16:00 – 141		21.3	28/02/2020	–
Scott Road	500m west from Taylor Road *	17	06:00 – 2		17:00 – 2		5.1	12/12/2018	–
Bishop Road	Midway between Hopkinson Road and Taylor Road *	2,483	08:00 – 302		15:00 – 267		6.7	15/02/2019	–
Gossage Road	500m west from Kargotich Road *	421	08:00 – 32		15:00 – 41		18.0	15/02/2019	–
Coyle Road	500m west from King Road *	426	06:00 – 40		16:00 – 41		7.0%	08/02/2019	–

Note - These traffic counts have been received from the Shire of Serpentine-Jarrahdale.*

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2.6. Vehicular Crash Information

Is Crash Data Available on Main Roads WA website?	YES
<i>If YES, nominate important survey locations:</i>	
Location 1	Mundijong Road SLK [2.79 - 7.32]
Location 2	Kargotich Road SLK [10.72 - 13.01]
Location 3	Leipold Road SLK [0.00 - 4.30] – no crashes
Location 4	King Road SLK [0.00 - 1.99]
Location 5	Gangemi Road SLK [0.00 - 1.33] – no crashes
Location 6	Intersection of Mundijong Road & Kargotich Road
Location 7	Intersection of Mundijong Road & King Road
Period of crash data collection	01/01/2017 - 31/12/2021

Road / Intersection Name	SLK	Road Hierarchy	Speed Limit	Crash Statistics			
				No of KSI Crashes	No of Medical Attention Crashes	No of PDO Major Crashes	No of PDO Minor Crashes
Mundijong Road (mid-block only)	2.79 - 7.53	Regional Distributor	100kph	3	2	11	3
No of MVKT Travelled at Location			≈6,000 VPD * 365 * 5 years * 4.74 km = 51.9 MVKT				
KSI Crash Rate			3 KSI crashes / 51.9 MVKT = 0.06 KSI crashes/MVKT				
Comparison with Crash Density and Crash Rate Statistics			0.06 KSI crashes/MVKT is higher than network average of 0.04 KSI crashes/MVKT				
All Crash Rate			19 crashes / 49.6 MVKT = 0.38 crashes/MVKT				
Comparison with Crash Density and Crash Rate Statistics			0.38 crashes/MVKT is lower than network average of 0.86 crashes/MVKT				
Intersection of Mundijong Road & Kargotich Road	3.01	Regional Distributor/ Regional Distributor	100kph / 100kph	2	4	2	3
No of MVKT Travelled at Location			≈8,000 VPD * 365 * 5 years * 0.4 km = 5.84 MVKT				
KSI Crash Rate			2 KSI crashes / 5.84 MVKT = 0.34 KSI crashes/MVKT				
Comparison with Crash Density and Crash Rate Statistics			0.34 KSI crashes/MVKT is higher than network average of 0.07 KSI crashes/MVKT				
All Crash Rate			11 crashes / 5.84 MVKT = 1.88 crashes/MVKT				
Comparison with Crash Density and Crash Rate Statistics			1.88 crashes/MVKT is higher than network average of 1.83 crashes/MVKT				
Intersection of Mundijong Road & King Road	7.32	Regional Distributor/ Regional Distributor	100kph / 100kph	1	2	0	0
No of MVKT Travelled at Location			≈6,300 VPD * 365 * 5 years * 0.3 km = 3.45 MVKT				
KSI Crash Rate			1 KSI crashes / 3.45 MVKT = 0.29 KSI crashes/MVKT				
Comparison with Crash Density and Crash Rate Statistics			0.29 KSI crashes/MVKT is higher than network average of 0.07 KSI crashes/MVKT				
All Crash Rate			3 crashes / 3.45 MVKT = 0.87 crashes/MVKT				
Comparison with Crash Density and Crash Rate Statistics			0.87 crashes/MVKT is lower than network average of 1.83 crashes/MVKT				

The following table shows the Crash Density and Crash Rates on Metropolitan Local and Regional Roads as obtained from Main Roads WA on the 13th May 2020 by email request:

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Crash Density and Crash Rate on Metropolitan Local Roads Network only

	All Crashes		Serious Injury Crashes (Fatal+Hospital)	
	Average Annual Crash Density (All Crashes/KM)	Average Annual Crash Rate (All Crashes/MVKT)	Average Annual Crash Density (Ser. Inj. Crashes/KM)	Average Annual Crash Rate (Ser. Inj. Crashes/MVKT)
Metro Local Road - Midblock	2.67	0.86	0.11	0.04
Metro Local Road - All	5.70	1.83	0.22	0.07

Note: Based on 5-years data for the period 2015 to 2019.

Although the safety record is quite poor at present, this will be improved through the urbanisation of the area. Designing and constructing urban roads of appropriate geometric standards and reducing the speed limit will improve the road safety on Mundijong Road in particular.

In the period 2017-2021 a total of 47 crashes were recorded on the existing roads within the subject area (inclusive of intersections). As per the image below, most of those crashes were on Mundijong Road and intersections.



Crash incidents along Mundijong Road were looked at in detail below. There is an obvious pattern where casualty crashes are concentrated at the intersection of Mundijong Road and Kargotich Road, with one fatality recorded in 2019. In this particular case, the driver travelling along Kargotich Road failed to stop at the stop sign, although rumble strips are present in approach to the intersection and the signage was clearly visible, colliding with a vehicle travelling along Mundijong Road. In late 2020/ early 2021, the intersection was converted from a sign-controlled intersection to a roundabout. No incidents were recorded at this intersection in 2021.

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Figure 1 - Casualty crashes Mundijong Road (2017-2021)

Conversely, Property Damage Only (PDO) crashes appear to be more prevalent along the mid-block sections of Mundijong Road. Eleven out of nineteen PDO crashes involved only one vehicle (off path, hitting an object or an animal). This pattern is fairly common on high-speed roads outside of urban areas.

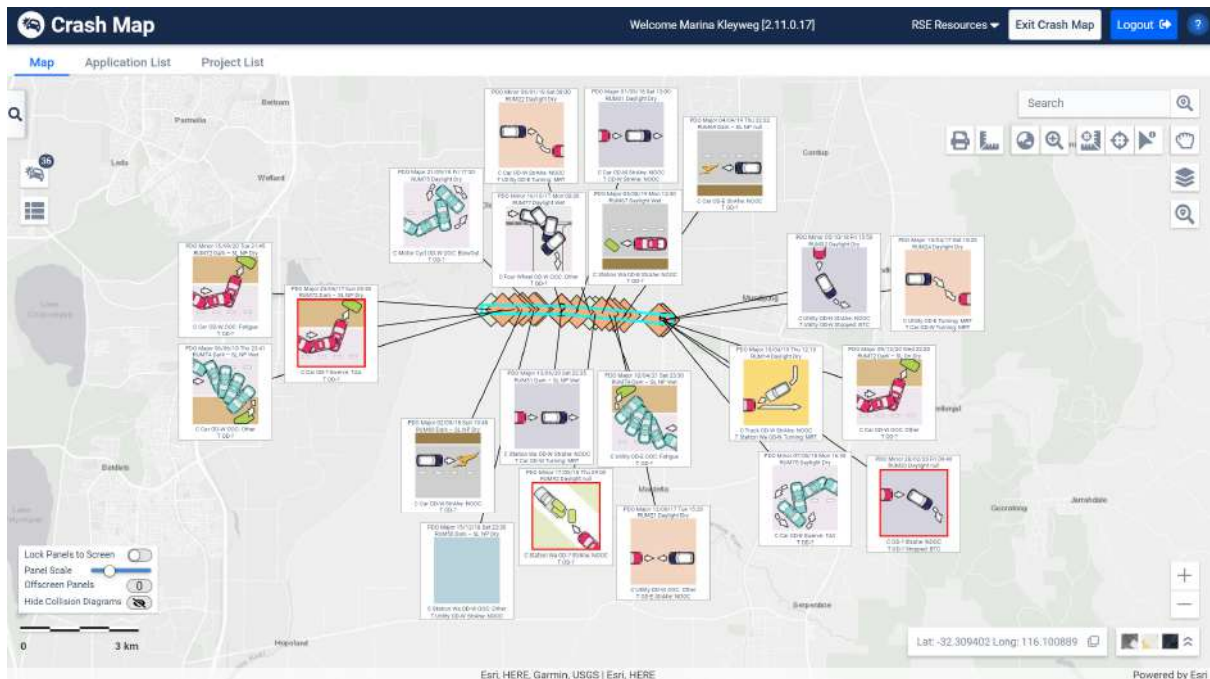


Figure 2 - PDO crashes Mundijong Road (2017-2021)

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2.7. Public Transport Accessibility

How many bus routes are within 400 metres of the subject site? None

How many rail routes are within 800 metres of the subject site? None

Mundijong Train Station and bus line stops are located approximately 3.1km to the east of the subject site. Refer to the available transport options below.

Bus / Rail Route	Description	Peak Frequency	Off-Peak Frequency
252	Armadales Station – Mundijong via Byford	4 times AM peak 5 times PM peak	no service
253	Armadales Station - Jarrahdale via Byford & Mundijong	3 times AM peak	no service
Australind	Perth to Bunbury (stops at Mundijong Train Station*)	Twice a day <i>Note * - Trains only stop at intermediate stations if advance bookings are made</i>	
Is the development in a Greenfields area?			YES

PTA was contacted regarding future plans for the area. Should this area be developed for urban residential, and provided it is connected to the existing urban front, then consideration would be given to connecting it to the existing Transperth network. This would likely be in the form of a connection to Byford Station, and depending on development to the west, that service may connect across to Wellard Station. The introduction of additional routes would require a more detailed development proposal.

West Mundijong Industrial Area District Structure Plan Report outlines the following changes in public transport in the area:

"Possible Intermodal Facility

The West Mundijong area has been identified as a potential intermodal facility site. Associated with this initiative is the proposed realignment of the Kwinana freight rail to adjoin the southern extension of Tonkin Highway (Refer Figure 9 Page 25 - Infrastructure Initiatives).

The Department of Transport and the Department of Planning, in principle, prefer an eastern location for the intermodal facility adjoining the southern extension of Tonkin Highway in association with the possible realignment of the Kwinana freight rail. Nevertheless, the feasibility of the intermodal facility and realignment of the freight line is intended to be subject to more detailed assessment in due course. Furthermore, the forthcoming Perth and Peel Regions Freight and Intermodal Plan, is also likely to have some bearing on the feasibility of the intermodal facility."

According to the Draft Mundijong District Structure Plan the following improvements are expected in the area:

"Rail

Improvements to rail connections in the Mundijong District Structure Plan will be dependent on outcomes of METRONET. It is acknowledged that Stage 1 METRONET proposals are subject to further investigations. As part of this process, the Mundijong District Structure Plan proposes the following:

- *Passenger rail extension from Byford to the Mundijong with a further train station in the Mundijong Town Centre to improve north-south links; and*
- *Identification of rapid transit investigation areas along Mundijong Road and Bishop Road/Gossage Road to provide east-west connections to Rockingham, effectively 'closing the loop'*

All future rail crossings must be grade-separated in line with PTA policy. Throughout the Mundijong Town Centre, the Mundijong District Structure Plan proposes a continuous grade separated section between Mundijong Road and Richardson/Evelyn Street.

Bus

While the passenger rail service to Mundijong is highly desirable it is a long-term proposition. In the short-medium term, High Frequency Transit Corridors will be required. These corridors are likely to include Bus Rapid Transit with the view to include rail long-term. High Frequency Transit Corridors will provide public transport connections

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between the Byford and Mundijong activity centres, population catchments, rail stations and local bus services. These connections will significantly improve the public transport network. The High Frequency Transit Corridors could be established along existing rail corridors; however, they are subject to further investigation with the Department of Transport in order to establish travel patterns. Consideration also needs to be given to the implications of future technological changes in transport including electric and autonomous vehicles, on-demand public transport, car sharing and other changes which could affect the demand for and/or the design of transport infrastructure. Whilst many changes cannot be foreseen, it is extremely important for strategic transport corridors (which are flexible and adaptable) to be established."

Perth Transport Plan for 3.5 million and beyond outlines that better integration of the Australind service should be established with the metropolitan passenger rail service between Perth and Mundijong to improve operational efficiency.

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2.8. Pedestrian and Cyclist Infrastructure

Does the site have existing pedestrian facilities NO

Are there any PBN Routes within an 800m radius of the subject site? NO

It is essential to develop an efficient and connected network of pedestrian paths in order to encourage pedestrian movement. Every major road within the subject site area should have either a shared path or a dedicated cycle lane and a separate pedestrian path. All pedestrian and shared paths should be designed to be accessible by all members of the community.

What is the Walk Score Rating?

0	Car-Dependent. Almost all errands require a car.
---	--

According to the Draft Mundijong District Structure Plan the following improvements are expected in the area:

"Active modes of transport such as walking, and cycling are supported for short distance journeys within urban areas in the Mundijong District Structure Plan. LSP's should support Healthy Active By Design Principles by ensuring that all urban areas provide safe, accessible and interconnected pedestrian and cycle links between residential areas and destinations such as activity centres, schools, public transport stops and parks. This will be essential in encouraging greater pedestrian and cycling activity in the Mundijong District Structure Plan area.

Future detailed planning of the local road network will need to be designed to cater for local trips to support and encourage the use of local businesses and community services. The local road network will need to be easy to use and with direct, safe and well-lit routes to local bus stops and centres. Walking and cycling should be the primary choice for most activities."

Perth Transport Plan for 3.5 million and Beyond 2050 Cycling and Walking Network categorises Mundijong Road as a Strategic On-Road Cycling Route with additional Off-Road Cycling Routes along South Western Highway and future extension of Tonkin Highway.

2.9. RAV Routes

Standard RAVs are those vehicle combinations specified as Category 1 to 10 vehicle combinations under the Prime Mover, Trailer Combinations and Truck, Trailer Combinations Notice.

The standard RAV Categories in the vicinity of the subject site are as follows: -

- Level 1 - RAVs Categories 2-4 (e.g. pocket road train, B-Double, and other RAVs with a maximum length of either 25.0 m or 27.5 m)

Roads being assessed by a Tri-drive Restricted Access Vehicle (RAV) Network are required to meet the requirements under the Standard Restricted Access Vehicle (RAV) Route Assessment Guidelines, with the exception of the structures assessments, gradient assessments and swept path assessments, which must be assessed in accordance with these Tri-drive Route Assessment Guidelines.

The Tri – drive RAV Categories in the vicinity of the subject site are: -

- Level 1 – Tri Dive RAV Category 1 (e.g. a vehicle that would otherwise be a general access vehicle if it was tandem drive, this category has access to the tandem drive RAV Network 2)

A concessional loading road access application should not be considered unless the requested road is already approved on the equivalent base RAV Network. The quantitative limits recommended provide additional safety margins for concessionally loaded RAVs, as the extra mass considerably impacts the vehicle's performance characteristics. For this reason, additional road width, stopping distances etc. are required.

Concessionally loaded RAVs are grouped in the following categories: -

- Level 1 - RAVs operating under a concessional loading scheme allowing up to 17 tonnes on a tandem axle group and 21.5 tonnes on a tri-axle group.

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Restricted Access Vehicle routes in the vicinity of the subject site:

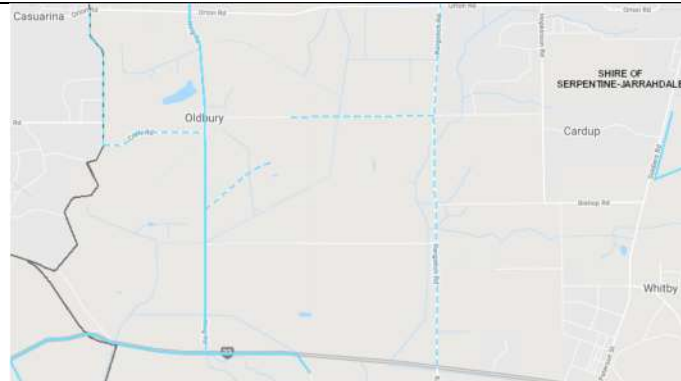


Figure 3 - Tandem Drive Concessional Level 1 - Tandem Drive 3.1

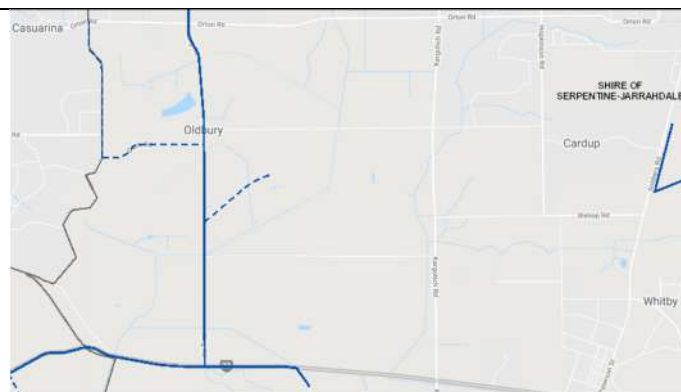


Figure 4 - Tandem Drive Concessional Level 1 - Tandem Drive 4.1

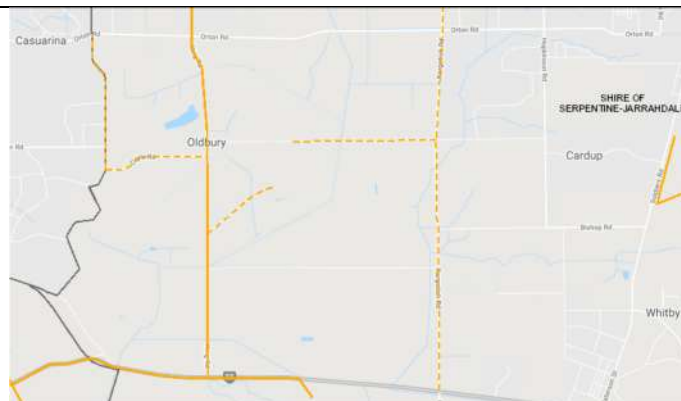


Figure 5 - Tri Drive Concessional Level 1 - Tri Drive 1.1

Note – Routes represented with a dashed line are routes with conditions.

As seen from the images above, currently, three roads within the subject site are a part of the RAV network:

- Mundijong Road - Tri-Drive Concessional Level 1 - Tri-Drive 1.1
- King Road - Tri-Drive Concessional Level 1 - Tri-Drive 1.1
- Kargotich Road - Tri-Drive Concessional Level 1 - Tri-Drive 1.1 (with conditions)

The designation of these existing routes depends on future urbanisation of the area and the provision of new/upgraded transport infrastructure (such as MRWA's Tonkin Highway extension and Westport's Anketell-Thomas Road Freight Corridor concept) may change. This is to be assessed in a later planning stage.

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2.10. Calculation of Development Generated / Attracted Trips

What are the likely hours of operation?	N/A
What are the likely peak hours of operation?	AM 08:00 to 09:00 PM 16:30 to 17:30
Do the development generated peaks coincide with existing road network peaks?	YES – PM peak
<p>Guideline Document Used</p> <p><i>Rates from above document:</i></p>	<p>WAPC Transport Assessment Guidelines for Developments</p> <p>Residential - 0.8 vehicle trips per dwelling for the AM and PM peak hours.</p> <p>A 25% IN / 75% OUT split has been adopted for the AM peak and a 67% IN / 33% OUT split for the PM peak hour;</p> <p>Schools - 1 vehicle trips per dwelling for the AM and PM peak hours.</p> <p>A 50% IN / 50% OUT split has been adopted for both peaks.</p> <p>Retail / Shopping Centres - (with significant food retail component) - 10 vehicular trips per 100m² of GFA for PM Peak and 2.5 trips per 100m² for the AM peak hour.</p> <p>A 50% IN / 50% OUT split has been adopted for the PM peak and an 80% IN / 20% OUT split for the AM peak hour;</p>
<p>Guideline Document Used</p> <p><i>Rates from above document:</i></p>	<p>NSW RTA Guide to Traffic Generating Developments</p> <p>Residential - The NSW RTA Guide to Traffic Generating Developments suggest residential developments of this type in Sydney tend to generate between 4 and 5 vehicular trips per dwelling. In Perth, the Department of Planning and Infrastructure conducted a series of studies in the late 1990's / early 2000's which showed that higher density dwellings tended to average closer to 6.7 vehicle movements per day.</p> <p>Given that the study area is currently rural KCTT propose a more conservative approach by using an average VPD of 9 vehicular trips per day per residence.</p> <p>Retail - (10,000 m²-20,000 m²)-78 vehicular trips per 100m² GFA</p> <p>Factories – 5 VPD per 100 m² GFA, 1 VPH in the PM peak per 100 m² GFA.</p> <p>Warehouses - 4 VPD per 100m² GFA, 0.5 VPH in the AM peak per 100m² GFA</p>

Since there are no available rates, KCTT believe that the Industrial (Factories) rates would appropriately depict the expected traffic generation of rural enterprises.

To assess the traffic impact on the surrounding road network, KCTT included the traffic calculations for the West Mundijong Industrial Area. These calculations are based on the yields provided within the West Mundijong Industrial Area District Structure Plan Report.

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Land Use Type	Rate above	Yield	Daily Traffic Generation	Peak Hour Traffic Generation
Subject Site				
Rural Enterprise	Daily - 5 VPD per 100 m ² GFA, Peak - 1 VPH per 100 m ² GFA	200ha - assumed 5 rural lots with 1,000m ² GFA each	250	50
Residential R20	Daily - 9 VPD per dwelling Peak - 0.8 VPH per dwelling	6500 lots	58,500	5,200
Neighbourhood Centre	Daily -78 VPD per 100m ² of GFA Peak - 10 VPH per 100m ² of GFA	assumed 12,000m ² GFA	1,872 (9,360*)	240 (1,200*)
Primary School	Daily - 2 VPD per student Peak - 1 VPD per student	assumed 4 schools 450 students / school	720 (3600*)	360 (1800*)
Subject Site Total (without reciprocity applied)			71,710	8,250
Subject Site Total (with reciprocity applied)			61,342	5,850

*Note** - Traffic attracted to the neighbourhood centre will be predominantly generated by the residents of the area and is already accounted for in the residential traffic. We have assumed that the primary schools would be a government schools with a limited local intake. That means that the traffic attracted by the primary school and neighbourhood centre is approximately 80% local traffic that has already been accounted for in the residential traffic generation. Further to this, various land uses will peak at different times with little or no overlap.

West Mundijong Industrial Area				
General industry core	Daily - 5 VPD per 100 m ² GFA, Peak - 1 VPH per 100 m ² GFA	279ha - 446 lots ≈2,500m ² GFA per lot	55,750	11,150
Light industry precincts	Daily - 4 VPD per 100 m ² GFA, Peak - 0.5 VPH per 100 m ² GFA	135ha - 432 lots ≈1,200m ² GFA per lot	20,736	2,592
West Mundijong Industrial Area Total (without reciprocity applied)			61,880	11,080
West Mundijong Industrial Area Total (with reciprocity applied)			40,222	7,202

*Note** - West Mundijong Industrial Area is expected to provide approximately 10,000 jobs. Most of the employees are expected to be from the surrounding areas. That means that the traffic attracted WMIA has already been accounted for in the residential traffic generation. It is expected that approximately 35% of traffic is already accounted for.

It should be noted that the calculations above represent a rough estimate of both yields and the traffic volumes. A more accurate estimation of traffic generation can be provided once a precise layout plan of the future structure plan area is provided. WMIA calculations are used to assess surrounding network impact as presented in section 2.14.

Does the site have existing trip generation/attraction? YES - 22 Rural Lots (assumed median building size of 500m² per lot)

No of Daily Trips 500m²/100 m²*5 VPD*22 lots = 550 VPD

No of Peak Hour Trips 500m²/100 m²*1 VPD*22 lots = 110 VPH

What is the total impact of the subject site? The expected additional traffic from the subject site area is 60,792 daily vehicle trips and 5,740 vehicle trips during the peak hour. This is considered to be a high impact on the surrounding road network.

The residential density in areas of the Draft Mundijong District Structure Plan developed thus far is significantly lower than anticipated. As the current development trend is likely to fall short of the original yield estimates, residential development within the subject area can be considered to be within the original DSP estimates (please refer to the planning report for more details).

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2.11. Trip Purposes

Determine the likely percentage share for different trip purposes based on the land usage.

Land Use	Residential	Neighbourhood Centre	Primary School
Employment	40%	20%	20%
Shopping	25%	60%	n/a
Education	17.5%	n/a	80%
Social / Recreational	17.5%	20%	n/a

2.12. Expected Origin / Destination

Name the closest existing major residential generators and non-residential attractors of traffic and the distance from the boundaries of the Subject Site Area.

Residential	Employment (profile.id)	<p>The economic profile in the Shire of Serpentine-Jarrahdale shows that according to the latest census that 74.0% of the shire's resident's travel outside the area for work while 19.3% both live and work within the area (No fixed place of work for 6.8%)</p> <ul style="list-style-type: none"> • Serpentine-Jarrahdale (S) - 19.3% • Armadale (C) - 13.7% • Canning (C) - 9.2% • No Fixed Address (WA) - 6.6% • Cockburn (C) - 6.6% • Gosnells (C) - 6.6% • Perth (C)- 5.3% • Belmont (C) - 4.4% • Rockingham (C) - 3.2% • Melville (C) - 3.2% • Kwinana (C) - 2.4% • Swan (C) - 1.9% • Fremantle (C) - 1.8% • Victoria Park (T) - 1.7% • Stirling (C) - 1.5% • Ashburton (S) - 1.4% • Kalamunda (S) - 1.2% • East Pilbara (S) - 1.1%
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<https://profile.id.com.au/serpentine-jarrahdale/residents>

We, therefore, believe that the following roads will be the key access / egress routes to the future Structure Plan area:

- Mundijong Road
- King Road
- Kargotich Road
- South Western Highway
- Kwinana Freeway

Excluding work from home, working in Neighbourhood Centre and Primary School there are no other sources of employment in the subject site area.

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The West Mundijong Industrial Area development will create an estimated 10,000 jobs, resulting in significant growth in local employment opportunities. The eastern boundary of the Subject Site is located immediately adjacent to the proposed industrial area.

Journey to work data:

- Car - as driver - 68.4%
- Did not go to work - 10.5%
- Worked at home - 4.7%
- Car - as passenger - 3.9%
- Train - 3.3%
- Other - 2.3%
- Truck - 1.9%
- Bus - 1.9%
- Walked only - 1.6%

KCTT strongly believe that passenger cars will be the primary type of transportation vehicle.

Shopping The closest shopping centre to the subject area is Lakeside Plaza Byford – approximately 6.7km to the northwest, while some smaller shops are available in Mundijong (approximately 3.2km to the west)

Education • Mundijong Primary School - approximately 3.2km to the west

Social / Recreational • Banksia Conservation Reserve - approximately 2.5km to the east

Neighbourhood Centre **Employment** The Neighbourhood Centre is not expected to be a large attractor for employment purposes.

Shopping / Social The Neighbourhood Centre is treated as retail premises for the purposes of this report.

Primary School **Employment** The Primary School is not expected to be a large attractor for employment purposes.

Education The Primary School is expected to be a strong attractor for Education purposes.

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2.13. Traffic Flow Distribution onto External Road Networks

How many routes are available for access / egress to the site? 4 routes
 60,856 VPD / 5,580 VPH

Route 1

Provide details for Route No 1 To/from the north via King Road
 Percentage of Vehicular Movements via Route No 1 10% (6,134 VPD / 585 VPH)

Route 2

Provide details for Route No 2 To/from the north via Kargotich Road
 Percentage of Vehicular Movements via Route No 2 10% (6,134 VPD / 585 VPH)

Route 3

Provide details for Route No 2 To/from the east via Mundijong Road
 Percentage of Vehicular Movements via Route No 2 40% (24,537 VPD / 2,340 VPH)

Route 4

Provide details for Route No 2 To/from the west via Mundijong Road
 Percentage of Vehicular Movements via Route No 2 40% (24,537 VPD / 2,340 VPH)

Traffic distribution above takes into consideration the current residents' place of employment for the Shire of Serpentine Jarrahdale as per profile.id. The timeframe for the development of the subject site, future Tonkin Highway Extension, Draft Mundijong District Structure Plan and other planned development projects in the area, have also been accounted for. This is just a rough distribution using the existing road network in the area. Once a structure plan is in place, the movement network can be assessed in greater detail. With multiple routing options, the traffic impact is likely not to be concentrated.

The MRWA intends to extend Tonkin Highway to intersect South Western Highway by 2025. As of the writing of this report, the plans for the extension are not available.

2.14. Analysis of Transport Networks

Nominate the source(s) for obtaining the traffic data	Main Roads website Traffic Data from Shire of Serpentine-Jarrahdale
Annual traffic growth rate used for analysis	3% growth rate per annum for surrounding road network
Determine the year(s) for assessment and the time period(s) for the traffic flow analysis.	2031
Determine additional traffic generated from study area to the surrounding network.	60,792 VPD / 5,740 VPH
Additional information	KCTT have done a rough estimate of the West Mundijong Industrial Area traffic generation and added it to the passing traffic projections with the following distribution: <ul style="list-style-type: none"> • 35% Mundijong Road east • 35% Mundijong Road west • 10% Kargotich Road • 20% Bishop Road

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Determine the total traffic flows on the external road network by adding the development generated traffic to the estimated traffic volumes on these roads in year(s) of assessment.

Road name	Location of TC	Traffic count	Year of TC	Subject Site Traffic	WMIA DSP Traffic	Final year	Passing traffic 2031	Passing + Subject Site + WMIA 2031
Mundijong Road	East of King Road	5,167	2018	24,342	14,078	2031	7,588	46,008
	500m east from Kargotich Road	3,708	2019	24,342	14,078	2031	5,287	43,706
Kargotich Road	South of Orton Road	3,272	2020	6,086	4,022	2031	4,529	14,637
King Road	500m south of Gossage Road	1,351	2020	6,086	402	2031	1,870	8,358
Scott Road	500m west from Taylor Road	17	2018	1,840	4,424	2031	25	6,290
Bishop Road	Midway between Hopkinson Road and Taylor Road	2,483	2019	3,067	8,044	2031	3,540	14,652
Gossage Road	500m west from Kargotich Road	421	2019	3,067	2,011	2031	600	5,678
Coyle Road	500m west from King Road	426	2019	3,681	-	2031	607	4,288

Note - These figures are significantly above the traffic volumes presented in ROM data provided in the transport impact assessment within Draft Mundijong Structure Plan Report. New ROM output should be requested at a later planning stage and information on future developments included in the model.*

It should be noted that the calculations above represent a rough estimate of traffic volumes and distribution. Once a precise layout plan of the future structure plan area is provided, a more accurate estimation of traffic distribution can be provided. It is anticipated that there will be significant portion of reciprocity in traffic volumes between the Subject Area and West Mundijong Industrial Precinct as it is likely that people employed in industrial precinct will seek to live as close as reasonable to their workplace.

The MRWA projections are quoted from the transport study prepared for DSP and LSP for West Mundijong Industrial Area. As the study was prepared in 2012, the ROM24 model at that time did not include the Anketell Freight Link. The current proposal for this link shows a divided carriageway with four to six lanes. It is reasonable to assume this link will carry a significant portion of heavy vehicle traffic which would use Mundijong Road if the link wasn't constructed. Therefore, the more recent ROM24 model is likely to anticipate lower traffic volume on Mundijong Road in future.

As the most recent ROM24 model was not available at the time of writing this report, in the next planning phase, this model should be obtained and referenced for more accurate traffic projections on Mundijong Road.

2.15. Road Safety

Are sight distances adequate at proposed intersections? N/A

Justification

All distances between intersections should be according to Liveable Neighbourhoods. To be reviewed in the next stage of planning when internal network becomes available.

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Are there any proposed interventions to streets surrounding schools, neighbourhood centres, child and aged person day care facilities etc.?

YES

If YES, nominate which:

Some traffic calming methods are desirable, especially near primary schools and neighbourhood centres. Chicanes, speed humps, wombat crossings and/or other methods should be considered when designing streets to lower operating speeds and improve safety. Posted signs with reduced speed limits should be considered for roads near these facilities.

2.16. Proposed Internal Road Network

Guideline Document used as reference

Liveable Neighbourhoods

How many proposed roads are there within the Study Area?

The internal road layout has not been formalised at this stage, however, it will be developed in the next planning stage.

The classification below is reflective of preliminary traffic assessment and minimal traffic requirements. The road reservation widths can be expanded and re-organised to satisfy different types of requirements (e.g. civil engineering, environmental, conservational, urban design etc.), therefore, roads that have lower-order hierarchy according to traffic engineering requirements might have expanded road reservation widths.

Once internal road network is developed, the classification is to be reassessed.

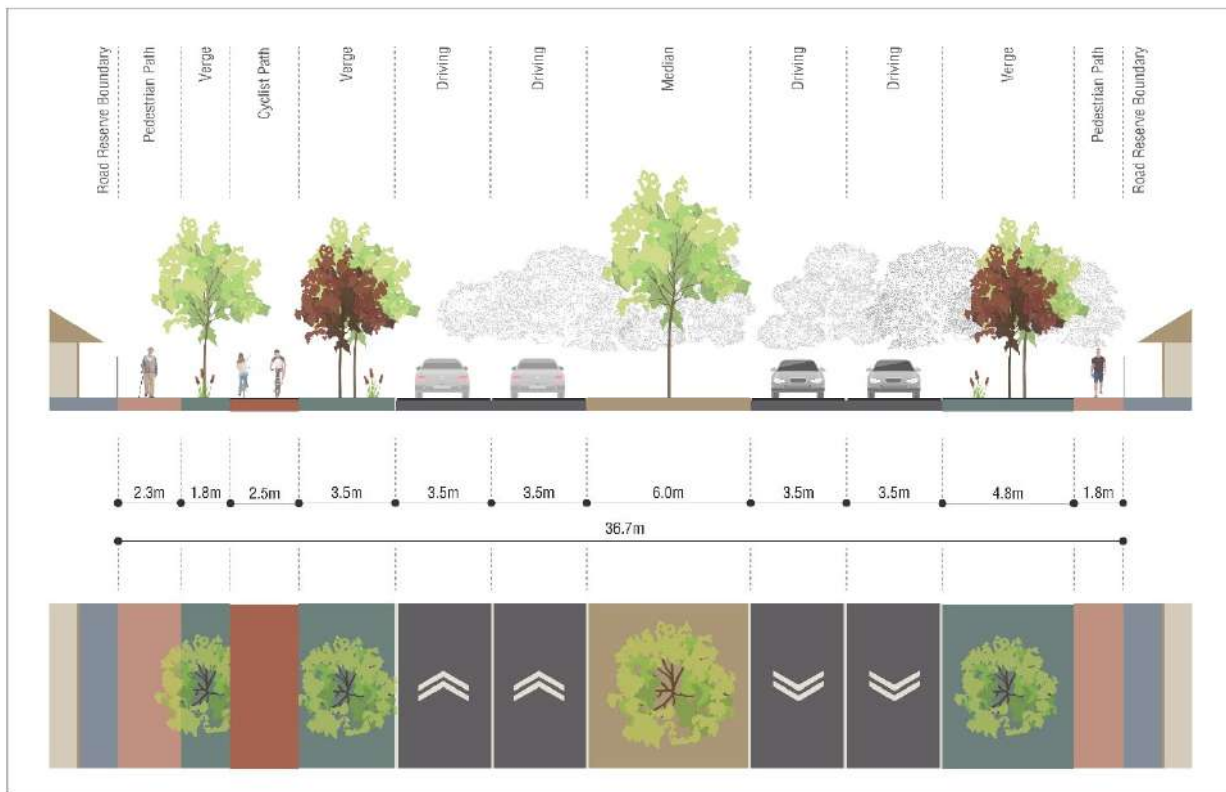
Name of Roads within the Subject Area / Road Classification and Description:

Road 1

Name	Mundijong Road
Projected Traffic Volumes	46,000
Proposed Classification	Primary Distributor
Proposed Number of Lanes	two lanes per direction
Proposed Road Reservation Width	36.7m
Proposed Road Pavement Width	7.0m
Proposed Median Width	6.0m
Proposed Pedestrian / Cyclist / Shared Path Width	1.8m & 2.3m pedestrian path, 2.5m cyclist path
Proposed Speed Limit	n/a
Proposed Bus Route Extension / Introduction	to be confirmed
Proposed On-street parking	NO

Provide graphics of the proposed internal road cross section within the Structure Plan Area (to be determined by MRWA)

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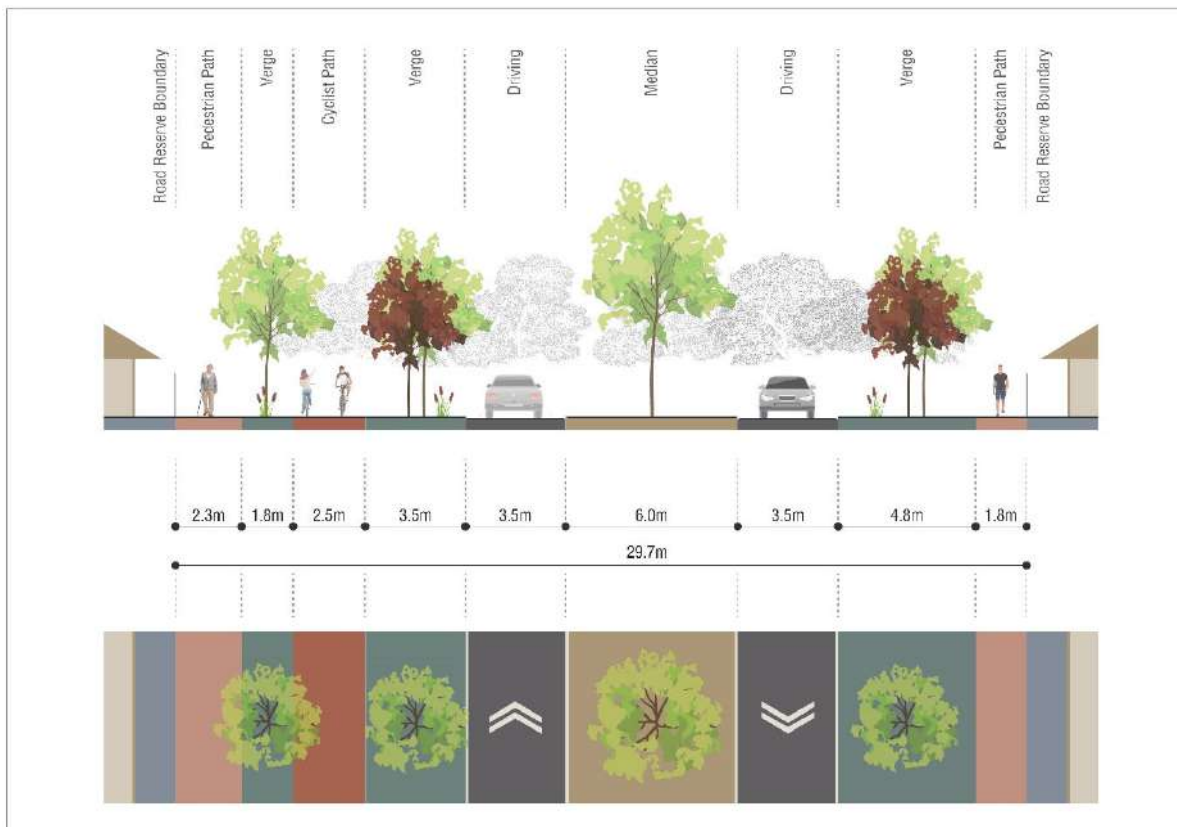
Note: The LSP for West Mundijong Industrial Area shows Mundijong Road as a divided two-lane carriageway (comparable to the Integrator A) with 2.5-3.0m wide shoulders. As Mundijong Road will remain a part of RAV4 network for the foreseeable future, it is recommended that the cycling path is placed in verge and separated from traffic lanes. On-street parking is not required and the property access should not be allowed from Mundijong Road. The speed limit should be reduced to 60-70km/h, as recommended by Liveable Neighbourhoods.

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Road 2

Name	Kargotich Road
Projected Traffic Volumes	15,000
Proposed Number of Lanes	one lane per direction
Proposed Road Reservation Width	29.7m
Proposed Road Pavement Width	3.5m per direction
Proposed Median Width	6.0m
Proposed Pedestrian / Cyclist / Shared Path Width	1.8m & 2.3m pedestrian path, 2.5m cyclist path
Proposed Classification	Integrator B
Proposed Speed Limit	60km/h
Proposed Bus Route Extension / Introduction	to be confirmed
Proposed On-street parking	NO

Provide graphics of the proposed internal road cross section within the Structure Plan Area



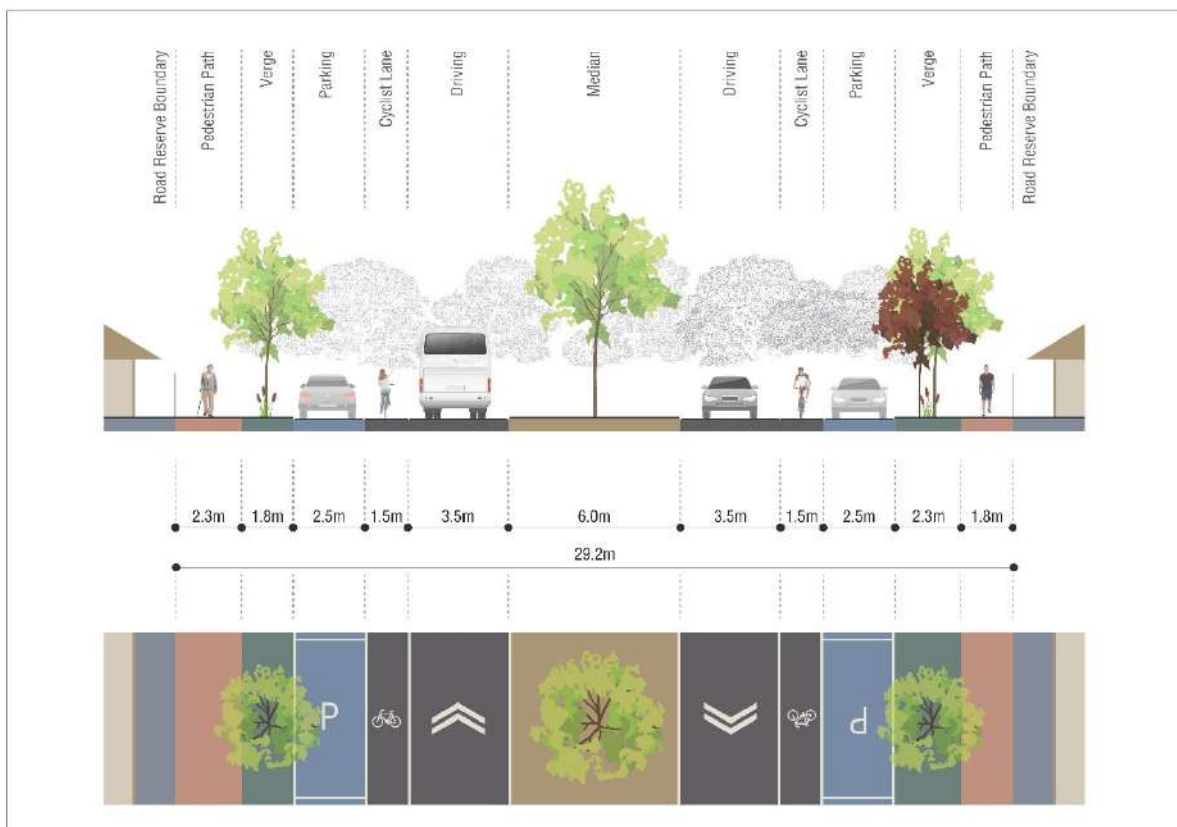
Note: Kargotich Road is to be retained as a part of RAV4 network for the foreseeable future; therefore, the cycling path is recommended to be placed in the verge and separated from trafficable lanes. On-street parking will not be required. Speed limit should be reduced to suit urban environment.

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Road 3

Name	King Road
Projected Traffic Volumes	8,500
Proposed Number of Lanes	one lane per direction
Proposed Road Reservation Width	29.2m
Proposed Road Pavement Width	5.0m per direction (inclusive of traffic and cycling lane)
Proposed Median Width	6.0m
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m cycling lane on both sides of the road reservation 1.8m & 2.3m pedestrian path
Proposed Classification	Integrator B
Proposed Speed Limit	60km/h
Proposed Bus Route Extension / Introduction	to be confirmed
Proposed On-street parking	YES – 2.5m parallel parking on both sides of the road reservation

Provide graphics of the proposed internal road cross section within the Structure Plan Area

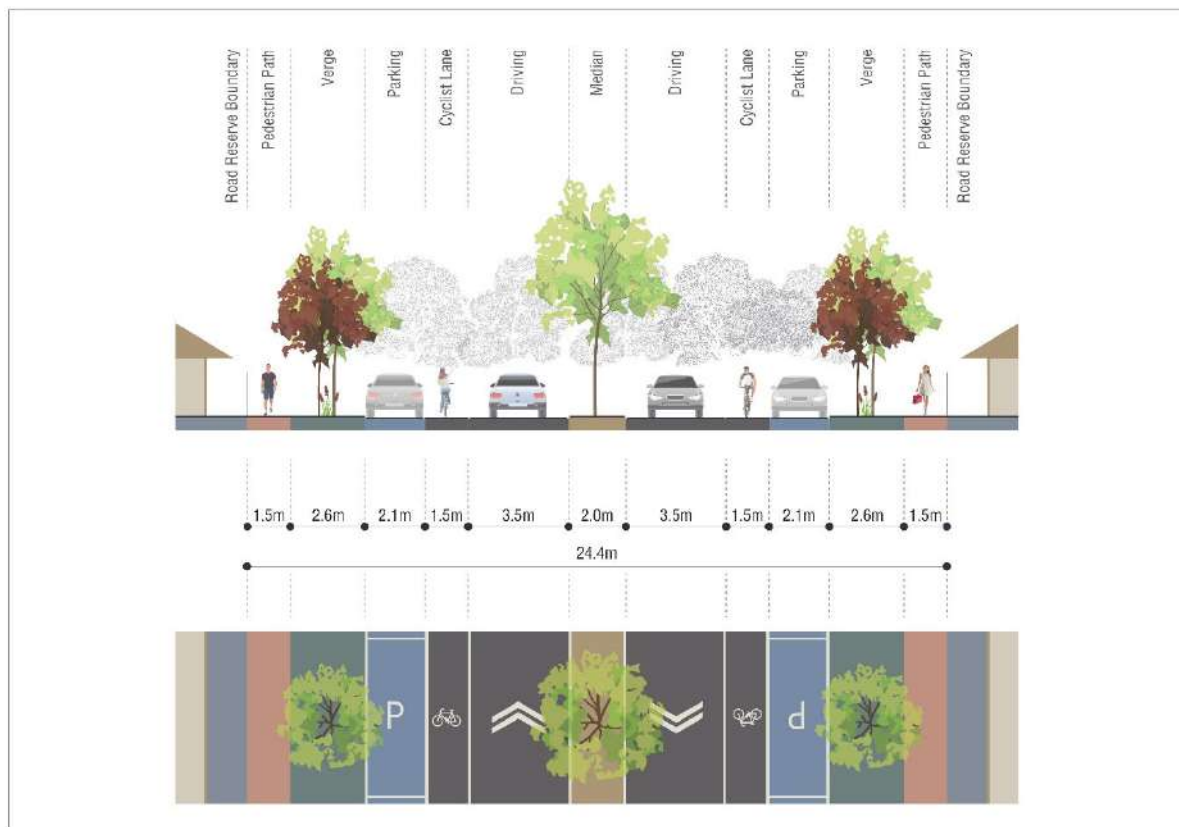


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Road 4

Name	Leipold Road
Projected Traffic Volumes	assumed 6,000
Proposed Number of Lanes	one lane per direction
Proposed Road Reservation Width	24.4m
Proposed Road Pavement Width	5.0m per direction (inclusive of traffic and cycling lane)
Proposed Median Width	2.0m
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m cycling lane on both sides of the road reservation 1.5m pedestrian path on both sides of the road reservation
Proposed Classification	Neighbourhood Connector A
Proposed Speed Limit	50km/h
Proposed Bus Route Extension / Introduction	to be confirmed
Proposed On-street parking	YES – 2.1m parallel parking on both sides of the road reservation

Provide graphics of the proposed internal road cross section within the Structure Plan Area

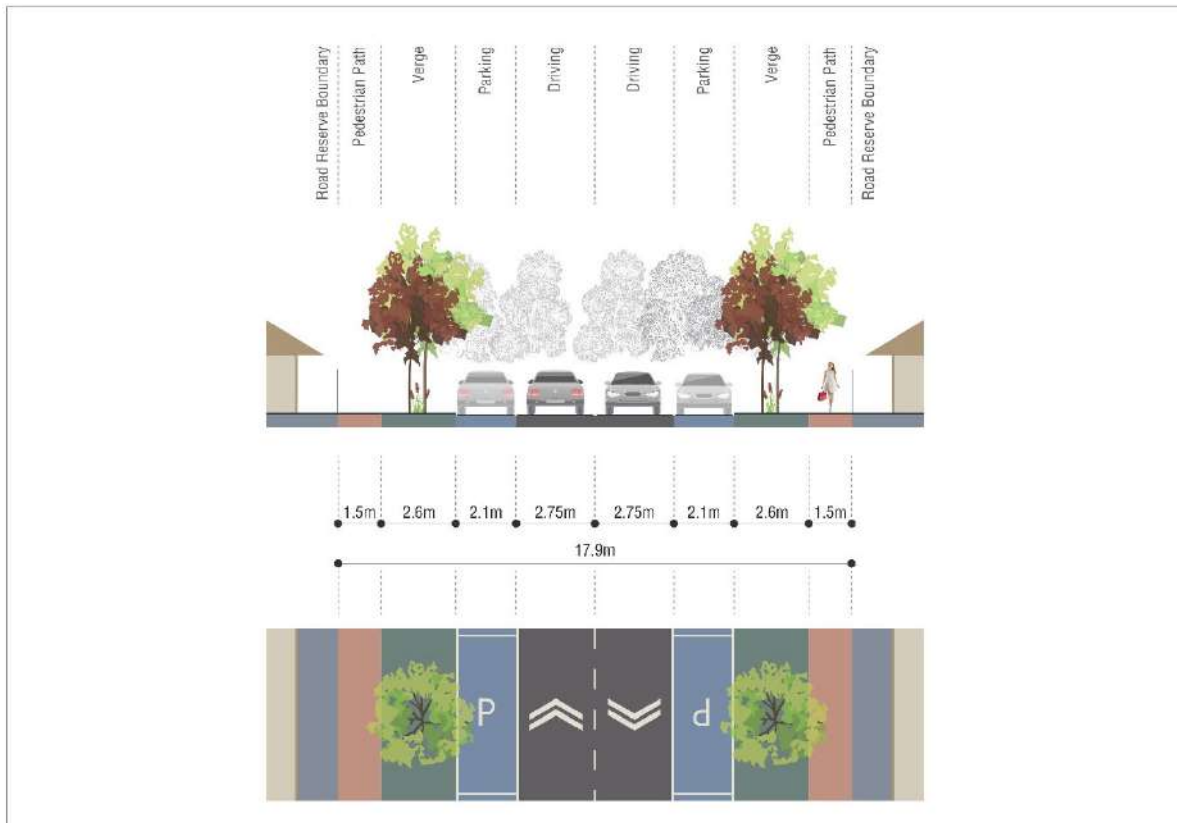


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Road 5

Name	Internal roads fronting schools
Projected Traffic Volumes	< 3,000
Proposed Number of Lanes	one lane per direction
Proposed Road Reservation Width	17.9m
Proposed Road Pavement Width	5.5m
Proposed Median Width	n/a
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m pedestrian path on both sides of the road reservation
Proposed Classification	Access Street B
Proposed Speed Limit	40km/h
Proposed Bus Route Extension / Introduction	NO
Proposed On-street parking	YES – 2.1m parallel parking on both sides of the road reservation

Provide graphics of the proposed internal road cross section within the Structure Plan Area

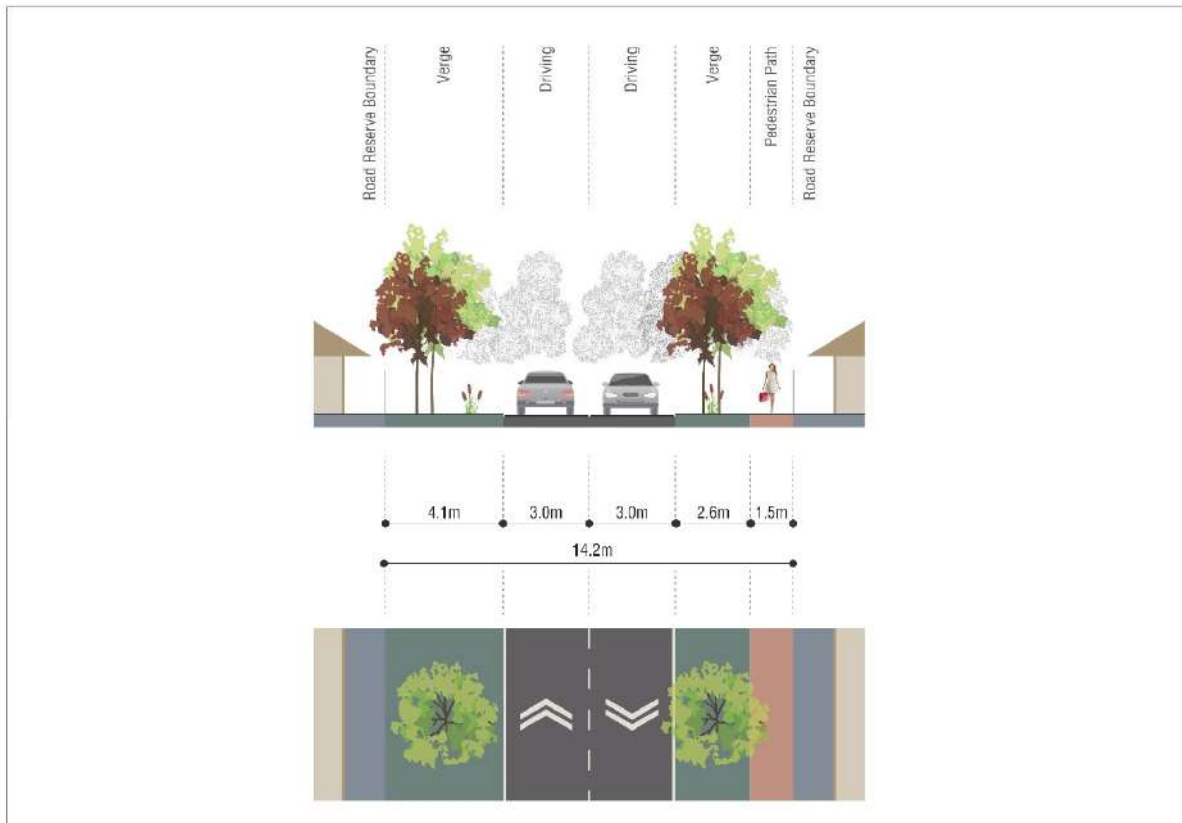


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Road 5

Name	Other internal roads
Projected Traffic Volumes	< 1,000
Proposed Number of Lanes	one lane per direction
Proposed Road Reservation Width	14.2m
Proposed Road Pavement Width	6.0m
Proposed Median Width	n/a
Proposed Pedestrian / Cyclist / Shared Path Width	1.5m pedestrian path
Proposed Classification	Access Street D
Proposed Speed Limit	30km/h
Proposed Bus Route Extension / Introduction	NO
Proposed On-street parking	NO

Provide graphics of the proposed internal road cross section within the Structure Plan Area

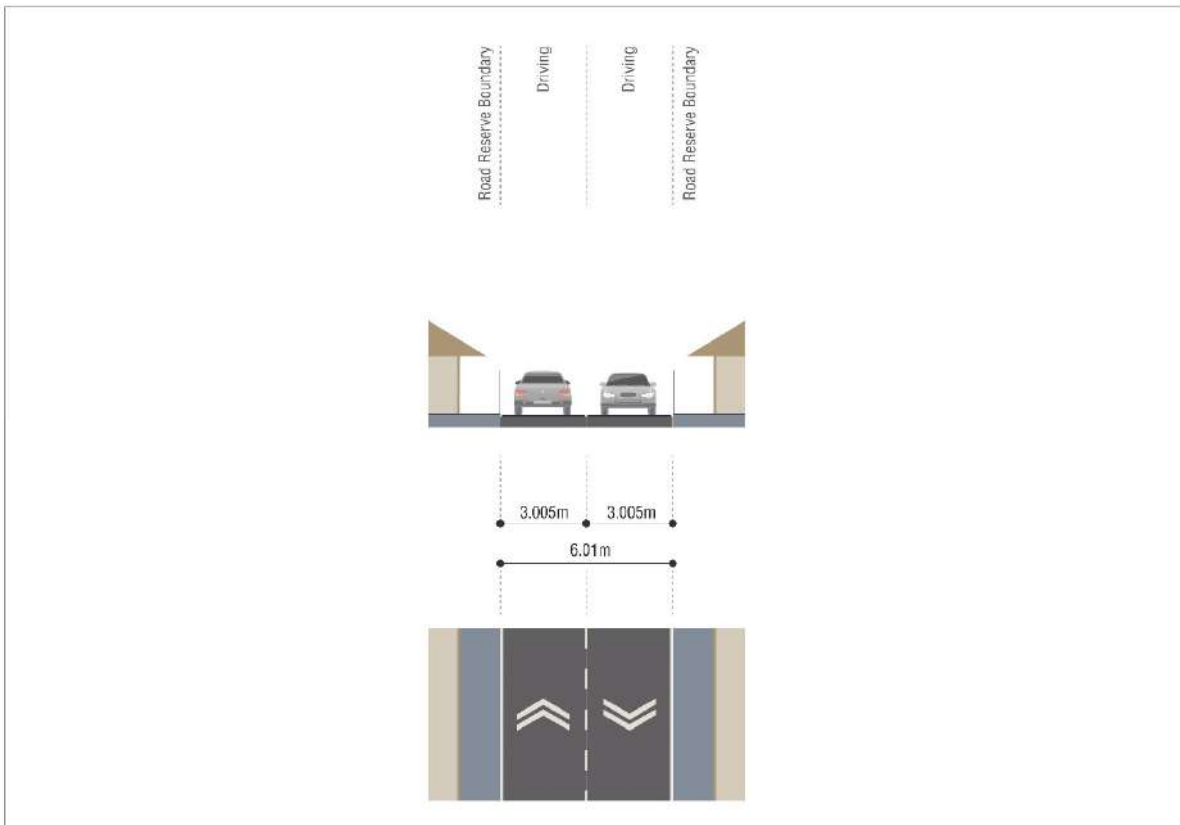


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Road 5

Name	Laneways
Projected Traffic Volumes	< 100
Proposed Number of Lanes	one lane per direction
Proposed Road Reservation Width	6.01m
Proposed Road Pavement Width	6.01m
Proposed Median Width	n/a
Proposed Pedestrian / Cyclist / Shared Path Width	n/a
Proposed Classification	Laneway
Proposed Speed Limit	15km/h
Proposed Bus Route Extension / Introduction	NO
Proposed On-street parking	NO

Provide graphics of the proposed internal road cross section within the Structure Plan Area



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2.17. Proposed Intersection Controls

How many proposed intersections have been proposed? N/A

This proposal for MRS rezoning does not propose further major intersections. Once the LSP is prepared and the internal network is developed, minor intersections can be anticipated along main existing corridors.

Name of Intersections within the Subject Area / Road Classification and Description:

Intersection 1

Name	Mundijong Road (I "A") – King Road (I "B")
Intersection Control	Currently – Stop Controlled T-intersection Proposed – Roundabout or Traffic Lights

Intersection 2

Name	Mundijong Road (Integrator "A") – Kargotich Road (Integrator "B")
Intersection Control	Currently – Roundabout (recently upgraded from four-way stop controlled configuration) Future – Roundabout or Signalised Intersection

Intersection 3

Name	King Road (Integrator "B") – Leipold Road (Neighbourhood Connector "A")
Intersection Control	Currently – Stop Controlled T-intersection Proposed – Roundabout

Intersection 4

Name	Kargotich Road (Integrator "B") – Leipold Road (Neighbourhood Connector "A")
Intersection Control	Currently – Yield T-intersection Proposed - Roundabout

Intersection 5

Name	Leipold Road (Neighbourhood Connector "A") – Gangemi Road (assumed Access Street "B" - to be confirmed)
Intersection Control	Currently – uncontrolled T-intersection

Additional observations and recommendations

King Road and Kargotich Road currently have at-grade fully controlled railway crossings north of the subject site. DMDSP and WMIADSP outline proposals for several signalised intersections in the area such as: Kargotich Road/Bishop Road, Industrial North-South Spine/Mundijong Road, Industrial North South Spine/Bishop Road etc. DMDSP outlines several grade separation projects associated with Tonkin Highway extension to South Western Highway, however MRWA states the current project scope does not make provision for grade separations at Thomas Road, Orton Road, Mundijong Road or South Western Highway. At present, the freight rail bisecting Mundijog Town Centre is likely to be realigned to Tonkin Highway extension. No timeframe is associated with this realignment as this project is in an early planning phase.

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Although the transport study for West Mundijong Industrial Area outlines a number of signalised intersections, the MRWA's current preference are roundabouts over signalised intersections.

The existing intersections above and any future intersections are to be designed to meet the change in traffic conditions as a result of the urbanisation of the subject site area.

Intersection control principles should be applied from Liveable Neighbourhoods as per below:

"Arterial routes will have signalised intersections, and these may be relatively closely spaced, especially in locations such as neighbourhood and town centres to provide pedestrian safety and convenience. Medians allow staged pedestrian crossing of the arterial routes.

Traffic signals have significant capital and recurrent costs but can be a cheaper alternative to pedestrian underpasses. MRWA is responsible for all traffic signals and allocates priority for their installation. The WAPC considers that the full cost associated with the advancement in priority for signals should be borne by the developer (refer to Development Control Policy 1.7 General Road Planning and WAPC Planning Bulletin 18 Developer Contributions for Infrastructure).

The WAPC considers that the use of roundabouts on arterials should be minimised, as they are less conducive to pedestrians and cyclists, as well as providing fewer breaks in flow to support vehicle access into and out of side streets. Roundabouts may be considered on arterials where pedestrian and cyclist volume are very low, or as an interim treatment before a dual carriageway is constructed.

Proposals that contemplate intersection control using traffic signals should be discussed with MRWA at an early stage."

2.18. Proposed Internal Transport Networks

Are there any changes/additions to the existing road network?

YES – Several new roads will be constructed to service the future structure plan development area. The precise number, locations and alignments will be determined at a later planning stage.

Were there any discussions / agreements with MRWA regarding intersections with, or direct access onto roads under their jurisdiction?

Not at this stage.

Are there any pedestrian / cycle networks and crossing facilities proposed for the roads within the Subject Site Area?

The future Structure Plan should propose constructing a pedestrian paths network to cater to pedestrian needs in the area. Most streets in the area will have pedestrian paths on one or both sides of the road. Roads with higher hierarchy level will have shared paths on one side of the road reservation.

Were there any discussions / agreements with the local authority over local road networks and pedestrian and cycle facilities?

Not at the date of this report, however discussions will be necessary in a later planning stage.

Were there any discussions / agreements with PTA / Transperth on new bus services or extensions / alterations to existing bus services to serve the Subject Site Area?

YES

PTA confirmed there are no new routes planned unless there are likely to be significant changes in residential development.

Subject to increased residential density, the existing routes may be improved over time.

The introduction of additional routes would require more detailed plan of the development.

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2.19. Changes to External Transport Networks

Are there any proposed changes of the road network? YES

Perth Transport Plan at 3.5 million and Beyond:

"Additional linkages will be provided between road networks proposed in the existing Byford and Mundijong district structure plans and will include extension of Doley Road and realignment of the southern portion of Malarkey Road. Some refinement of east-west connections may be appropriate, including westward extension of Norman Road to connect to Bishop Road.

Realignment of the freight railway that currently passes through Mundijong, to the western side of the future urban area, to improve the amenity of Mundijong and ameliorate severance effects."

Perth and Peel at 3.5million The Transport Network 2050:

- Mundijong Road is proposed to be classified as Primary Distributor and become a primary freight route.
- Tonkin Highway is to be extended to Pinjarra and become a primary freight route.
- South Western Highway is classified as a secondary freight route.
- There are indications that Mundijong Road could be extended beyond South Western Highway, however this is not considered a realistic prospect in the short-medium term and, in any event, is not expected to materially impact the proposed Urban zoning of the subject land.
- Nicholson Road is to be extended to Mundijong Road and classified as Integrator arterial.
- An east-west corridor between Kwinana and Mundijong is to be established and classified as Integrator arterial.

According to the Draft Mundijong District Structure Plan the following improvements are expected in the area:

"Good access to and from key distributor roads is an important focus of the Mundijong District Structure Plan and a major consideration for people moving to and within the Mundijong District Structure Plan. New or improved connections to South Western Highway, Tonkin Highway, and Mundijong Road are essential. Some of the proposed road network changes include:

- *Adams Street will be upgraded to a local distributor and a new connection will be provided to Mundijong Road to improve north-south links;*
- *Evelyn Street upgraded to local distributor to provide an east-west connection between Richardson Street and Keirnan Street. This will provide a defined connection between Adams Street and South Western Highway through the Mundijong Town Centre;*
- *New east-west local distributor road will be provided between Taylor Road and South Western Highway connecting to the Whitby District Centre;*
- *New north-south local distributor road (west of South Western Highway) to provide connections between Mundijong Road and the new east-west local distributor;*
- *New north-south local distributor between Bishop Road and Mundijong Road through the Mundijong Industrial Precinct;*
- *New north-south local distributor to provide eventual extension and connection to Orton Road. Facilitating better connectivity into the Mundijong District Structure Plan area*
- *New grade separated intersections on Tonkin Highway at Bishop Road and Mundijong Road;*
- *Grade separated rail between Mundijong Road and Richardson Street to facilitate better east-west links for vehicles and pedestrians;*
- *Grade separated rail crossing at the new east-west distributor road;*
- *Soldiers Road & Town Centre Distributor Road grade separation constructed as one project, with road bridge structures over the single rail line; and*
- *Upgrading the Mundijong / Watkins Road existing rail crossing with a future crossing at Galvin Street with grade separation achieved by a rail bridge over the two road crossings.*

In addition to the above, a number of existing roads will be upgraded to increase their network capacity. All new connections and upgrades will be funded through the Mundijong Development Contribution Plan."

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West Mundijong Industrial Area District Structure Plan:

"4.4 Transport

Road Network

The structure plan provides for two east / west distributor roads and one north / south distributor road. The network is intended to:

- Allow for ease of movement of commercial vehicles within the estate and moving to and from the estate;
- Provide strong connection to adjoining road network, notably Kargotich Road, Mundijong Road and Bishop Road; and
- Assist in defining precincts or local structure plan areas.

Table 5 - Road Upgrades

- Kargotich Road - 29.7m eastern side - Light control at intersection with Mundijong Rd and slip lane
- Mundijong Road - 36.7m northern side - Light control at intersection with Kargotich Rd and slip lane
- Bishop Road - 26.2m southern and northern sides - Light control intersection to proposed north / south distributor road and slip lane"

MRWA (<https://www.mainroads.wa.gov.au/projects-initiatives/projects/metropolitan/tonkin-highway-extension/>)

"The preliminary concept includes:

- approximately 14 kilometres of four lane dual carriageway;
 - construction and/or upgrades of intersections at Thomas Road, Orton Road, Bishop Road, Mundijong Road and South Western Highway;
 - bridges over the existing freight rail line and Perth to Bunbury rail line;
 - a shared path along the eastern side of the corridor, with planned connections to local path networks; and an equine rider and pedestrian underpass under Tonkin Highway at Abernethy Road.
- The project's construction schedule is subject to the findings of site investigations and regulatory approvals, with a more refined project delivery schedule being determined as the planning and development works progress through 2020.
- The current project scope does not make provision for grade separations at Thomas Road, Orton Road, Mundijong Road or South Western Highway.
- An equine underpass is planned under Tonkin Highway at Abernethy Road.
- A shared-use path is planned on the east side of the highway with planned connections where local paths are provided on local roads.
- A planning study is underway to determine a reservation for any proposed realignment of the Kwinana South Western freight rail. The study will also consider if the proposed freight rail alignment in Mundijong is constructed at the same time as the highway extension.
- If the rail realignment is undertaken simultaneously, Bishop Road may become an at-grade intersection, however Mundijong Road may then need to be grade separated to cater for the realigned rail."

Although Perth and Peel @ 3.5million anticipates Mundijong Road as a primary freight link, the most recent Westport proposal positions Anketell Road as the primary freight link as it will provide a direct connection to the new harbour. Although Mundijong Road will remain as a freight link and important east-west connection, the introduction of Anketell Road as the primary freight link is likely to reduce the volume of traffic anticipated on Mundijong Road in future.

Are there any proposed changes of the intersection controls? YES – As per Section 2.16 of this report

Are there any proposed changes of the pedestrian / cycle networks and crossing facilities? YES – As per Section 2.8 of this report.

Are there any proposed changes of the public transport services? YES – As per Section 2.7 of this report.

These changes could be those committed or proposed by others, MRWA or local authority, or by the proponent as part of the structure plan.

Transport Impact Assessment
KC01182.000 Oldbury-Mundijong MRS Amendment

2.20. Integration with Surrounding Area

Are there any existing major residential generators of traffic within a minimum of 800 metres from the boundaries of the Subject Site Area?

YES

If YES, nominate:

- Mundijong and Whitby to the east
- Wellard and Casuarina to the west
- Cardup to the northeast

Are there any existing major non-residential attractors of traffic within a minimum of 800 metres from the boundaries of the Subject Site Area?

NO - mostly rural surroundings

Identify any proposals for major changes to the land uses within 800 metres of the boundaries of the Subject Site Area.

West Mundijong District Structure Plan to the east of the subject site

What are the main desire lines between the structure plan land uses and these external attractors / generators?

- Mundijong Road
- King Road
- Kargotich Road

Will the existing transport networks, plus any proposed changes, adequately match these desire lines, particularly for pedestrians, cyclist and public transport users?

KCTT believe that proposed major changes to the surrounding area and network will be able to successfully cater for the expected traffic volumes and distribution.

Upon the proposed MRS amendment, the key will be to monitor the traffic volumes and intersections performance and upgrade them as necessary, and as timely as possible.

Identify any deficiencies or areas for improvement in the surrounding transport networks and/or areas where improvements could be made.

N/A

2.21. Site-Specific Issues and Proposed Remedial Measures

How many site-specific issues need to be discussed?

One

Site Specific Issue No 1

Remedial Measure / Response

Integration of the subject area to MDSP

The expected additional traffic from the subject site area is 60,792 daily vehicle trips and 5,740 vehicle trips in the peak hour. This is considered to be a high impact on the surrounding road network.

Should the lots located west of Gangemi Road, within a Subject Site area, be rezoned from "Rural" to "Urban" under the MRS amendment, it can be expected that traffic impact would disperse throughout the surrounding road network.

Transport Impact Assessment
KC01182.000 Oldbury-Mundijong MRS Amendment

KCTT believe that proposed major changes to the surrounding area and network will be able to successfully cater for the expected traffic volumes and distribution. Upon the proposed MRS amendment, the key will be to monitor the traffic volumes and intersections performance and upgrade them as necessary and as timely as possible.

Therefore, assuming the planned road network upgrades will take place, there are no major traffic issues regarding the proposed rezoning from "Rural" to "Urban".

**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 2.3
Economic Impact Assessment



West Mundijong Urban Precinct

Economic impact assessment

Prepared by **macroplan**
For **WPG Landholdings Pty Ltd**

May 2022



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macroplan staff responsible for this report

Gordon Yoon, Senior Consultant

Stuart McKnight, General Manager – WA

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Contact

(08) 9225 7200

info@macroplan.com.au

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Executive Summary

Overview

- This assessment considers the economic impacts of developing the West Mundijong Urban Precinct and considers how it aligns with State and local government economic development priorities and long-term benefits to the Mundijong community.
- Due to development constraints and market demand factors, there is a risk that the Mundijong District Structure Plan will not achieve the projected dwelling or population yields. Nor is it likely to capture the full stimulus benefits from the Tonkin Highway extension, METRONET, or the Westport project. This could have significant flow-on impacts for activity centre/retail viability, labour force growth and planned community services in Mundijong and the Shire of Serpentine-Jarrahdale.
- The development of West Mundijong for residential uses will contribute to the threshold population required to attract State Government investment in key infrastructure, such as extension of the Byford passenger rail line as part of METRONET, future radial links west to the strategic regional centre of Rockingham, and a gateway to a potential very fast transit southwards. The same applies to services and retail facilities provided by the private sector which require a threshold population to achieve viability.
- As the urbanisation of the West Mundijong area for around 6,500 dwellings would provide additional household expenditure and demand for goods and services, it would help to support additional employment in the area including supporting the viability of the existing and planned activity centres. However, it may also raise challenges to achieving employment self-sufficiency targets in the short term.
- The Agricultural Land Capability – Mundijong DSP study prepared by Land Assessment Pty Ltd, demonstrates that the proposed West Mundijong Urban Precinct would not result in the loss of land that is a “key agricultural asset” or “highly productive rural land”.

Future economic growth

- The Shire's *Economic Development Strategy 2018-2023* outlines its desire to support the existing equine industry and agricultural production. These sectors will not be threatened by the urbanisation of West Mundijong because the subject land does not currently host such industry to any significant degree.
- Many of the competitive advantages identified in the Economic Development Strategy (such as affordability, good transport connections and natural environment), also make it very attractive as a residential location for people that work in major employment zones outside of the Shire.
- The development of the 449-hectare West Mundijong Industrial Precinct to its full potential of up to 880 lots and accommodating 10,000 jobs will require access to a sufficiently large labour force with a wide range of skills. Without a workforce within the area, the growth of new businesses will likely be slower than if a local workforce were available. With the proposed realignment of the freight rail line and the potential for an intermodal terminal, this provides the opportunity to develop logistics and distribution businesses.
- The 14-kilometre extension of the Tonkin Highway to connect with the South Western Highway south-east of Mundijong represents a major trigger for future investment. Planning and development works are currently underway, and the \$505 million project is funded for construction completion by early 2024.
- Major investment in projects such as Westport and the Western Trade Coast could have significant benefit if the West Mundijong Industrial Area develops an intermodal terminal.

Economic benefits

- An urban development of 6,500 dwellings would produce a total economic output of around \$4.6 billion through the subdivision works, construction of dwellings and associated community services.
- The West Mundijong Urban Precinct would also offset the risk of the draft Mundijong District Structure Plan (MDSP) not achieving its assumed dwelling and population yields. Unless Mundijong is able to grow to its full potential, it may not be able to generate sufficient household expenditure and local demand for services to justify a range of activity/retail centre services and businesses. It may also struggle to justify the level of demand for investment in community facilities and services.
- The West Mundijong Urban Precinct would have around 9,750 working residents (based on the Census ratio). Of these residents, around 5,950 are forecast to either work within the sub-region or to be FIFO/DIDO workers. Around 3,800 workers would commute from West Mundijong to other sub-regions of Perth and the Peel region, based on jobs 'balance sheet' in this assessment.
- Economic benefits have significant impact at the local and district level because most of the expenditure benefits and jobs would be available to residents and workers within the Shire of Serpentine-Jarrahdale. In addition, any businesses that support interstate or overseas exports provide a net benefit to the State by attracting investment and expenditure from outside Western Australia.
- State Government commitment to the economic development of the Peel Region and the Peel Food Zone means that the Shire of Serpentine-Jarrahdale is ideally placed to benefit from major economic investment in the surrounding areas.

1_Introduction

Key points

- This report assesses the economic impacts of developing the West Mundijong Urban Precinct and considers how it aligns with State and local government economic development priorities and long-term benefits to the Mundijong community.
- Due to development constraints and market demand factors, there is a very likely risk that the draft Mundijong District Structure Plan (MDSP) in its current form will not achieve the projected dwelling or population yields. Factors include hard environmental constraints which limit the development yield of the land identified for urbanisation and the market demand in this location for larger lots than those identified in the DSP. These factors would have significant flow-on impacts for activity centre and retail viability, labour force constraints and planned community services in Mundijong and the Shire of Serpentine-Jarrahdale.
- Investment in the West Mundijong development will also attract a 'clustering' of investment, better utilisation of major infrastructure and raise confidence in the long-term future of the area, thus attracting complementary investment.
- The Shire of Serpentine-Jarrahdale is part of the Perth Metropolitan Region and is also included as part of the Peel Development Commission Region. This highlights its dual nature being both an extension of the south-east metropolitan urban corridor as well as its rural/regional characteristics.
- Future employment growth in both the Perth and Peel regions will make the area more attractive for residents. This will be amplified by the improved connectivity via METRONET and the Tonkin Highway extension.
- The regional status of Tonkin Highway and Mundijong Road and the West Mundijong Industrial Precinct provide the foundation infrastructure and economic triggers for Mundijong's future economic and employment growth.

1.1 Mundijong DSP and West Mundijong

Map 1.1 Mundijong District Structure Plan and proposed West Mundijong Urban Precinct

Proposed West Mundijong Urban Precinct

The MDSP provides for the urban development of Mundijong around two transit nodes and plans for 20,367 dwellings and an estimated population of 58,250 by 2050.

A detailed analysis by Dynamic Planning and Developments (DPD) indicates that these assumed yields may not properly consider:

- appropriateness of assuming an average residential lot size of 350 square metres across the DSP area, which is unlikely to match the demand from homebuyers in this area. An average lot size of 450 square metres is a more appropriate assumption for Mundijong/West Mundijong (even though these larger lots may require additional fill).
- development constraints including fragmented land holdings, tree cover, noise buffers, threatened and priority fauna, and conservation category wetland buffers.

The DPD analysis highlights that due to these constraints, the total yield could be nearly 5,600 dwellings lower than assumed by the MDSP. If so, this would have significant impacts on the viability of proposed retail/commercial developments in the area due to the shortfall in household expenditure in the locality. It would also cause issues with the provision of community infrastructure (schools, healthcare, etc) and also reduce the locally-available workforce needed to support businesses in the Shire.

The draft Mundijong-Whitby Development Contribution Plan will address the funding and timing of the infrastructure and community facilities requirements in detail. One of the additional benefits of urban development in West Mundijong will be the economy of scale of spreading infrastructure costs across a larger population.



Sources: Dynamic Planning and Developments (2022) and Shire of Serpentine-Jarrahdale, *Mundijong District Structure Plan* (July 2021)

1.2 Shire of Serpentine-Jarrahdale

Economic overview

The Shire of Serpentine-Jarrahdale is set to be the fastest growing sector of the Peel Region over the next 30 years. Due to the Shire's historically high sustained level of population growth, the economy has tripled between 2001 and 2016.

The Shire acknowledges the opportunity future growth will create, and its *Economic Development Strategy 2018 – 2023* states that it must be “embraced, nourished and facilitated” as growth will not “just happen” (p. 11).

The Shire's Economic Development Strategy raises a concern about a 'jobs deficit', and notes that the 2016 Census indicated 79 per cent of the working population had to travel outside the Shire to their place of work. This Census data show there was one local job for every three local resident workers.

With the Shire's location between the Peel and Perth metropolitan regions, the Serpentine-Jarrahdale area can leverage its geographic location to access the high jobs growth in both of those regions.

As Serpentine-Jarrahdale is 40 minutes from Perth CBD, 25 minutes from Rockingham and 35 minutes from Mandurah, the area allows residents to live the country lifestyle whilst being close to the strategic activity centres.

As at the 2016 Census, the Shire had 4,549 local jobs, of which 2,473 (54.4%) were filled by people who also lived within the Shire. This left another 2,076 positions (45.6%) that were filled by people commuting into the Shire from other local government areas.

Most workers that commute outside of the area to their place of employment tend to work in relatively nearby locations or in major employment nodes in the Perth South sub-region (including strategic and specialised metropolitan centres and major industrial areas).

In 2016, 174 workers living in the Mundijong Statistical Area 2 (5.9% of all resident workers) travelled to the Perth CBD for work.

The West Mundijong Industrial Area will boost local employment opportunities and encourage value-adding to existing agricultural production and activities and attract new industry sectors. The Shire of Serpentine-Jarrahdale estimates when fully-occupied, it will create 10,000 jobs, \$600 million in annual exports, and have a total economic output of \$5.5 billion per year.

Major industry sectors are education & training, construction, agriculture, and tourism & hospitality.

The education and training, and the construction industry the two most significant sectors in terms of economic output. The National Institute of Economic and Industry Research (NIEIR) estimated these sectors to be worth \$138.8M and \$114.2M respectively in economic value add for 2020/21. Of the employed residents in the Shire in 2020/21, more than 2,000 worked in education and training and more than 1,000 worked in construction.

The most recent available data from the ABS for agricultural production in the Shire of Serpentine-Jarrahdale shows that the three largest commodities were:

- nurseries and cut flowers -- 28.4% of total production
- livestock slaughtering -- 25.6% of total production
- vegetables -- 21.3% of total production

Fruits, hay crops and milk combined made up another 23.2% of total agricultural production.

Tourism and hospitality produced an estimated \$15.18m to the economy through direct and indirect value-added and generated and estimated 160 FTE jobs as at 2018/19.

2_Regional and district economic context

Key points

- The Tonkin Highway extension is a 'game changer' as it means Mundijong will become the gateway into, and out of, the State's South West and Greater Southern regions and create the potential for an intermodal freight nexus. Mundijong is also a potential hub for a future very fast transit link.
- The Shire of Serpentine-Jarrahdale is part of the Perth Metropolitan Region and is also included as part of the Peel Development Commission Region. This highlights its dual nature being both an extension of the south-east metropolitan urban corridor as well as its rural/regional characteristics.
- The State Government's *Diversify WA* economic development framework is relevant to Mundijong and the Shire of Serpentine-Jarrahdale, particularly through the tourism and primary industry initiatives.
- As part of the Peel Region, the Shire has a critical role in supporting the economic development opportunities across the Region including the West Mundijong Industrial Area, the Peel Food Zone and the mining industry.
- State Government commitment to the economic development of the Peel Region as well as *Diversify WA*, means that the Shire of Serpentine-Jarrahdale is ideally placed to benefit from major economic investment in the surrounding areas, even if that investment is not necessarily within the Shire itself.
- The Shire's Economic Development Strategy 2018-2023 outlines its desire to support the existing equine industry and agricultural production. These sectors will not be threatened by the urbanisation of West Mundijong.
- The West Mundijong Industrial Area provides a significant opportunity, however realising its potential will depend on attracting business investment and a labour force.
- Many of Mundijong's competitive advantages such as affordability, good transport connections and natural environment also make it very attractive as a residential location for people that work in major employment zones outside of the Shire.

2.1 Diversify WA

The *Diversify WA* framework introduced in July 2019, embodies the Government’s focus on creating jobs and economic growth. This sets the high-level priorities of Government across the State’s economy and represents an intention to broaden Western Australia’s economic base.

The *Diversify WA* economic development framework outlines how the Government, industry and community will work together across six priority sectors, energy; tourism, events and creative industries; international education; mining and mining equipment, technology and services (METS); technology and advanced manufacturing; and primary industries.

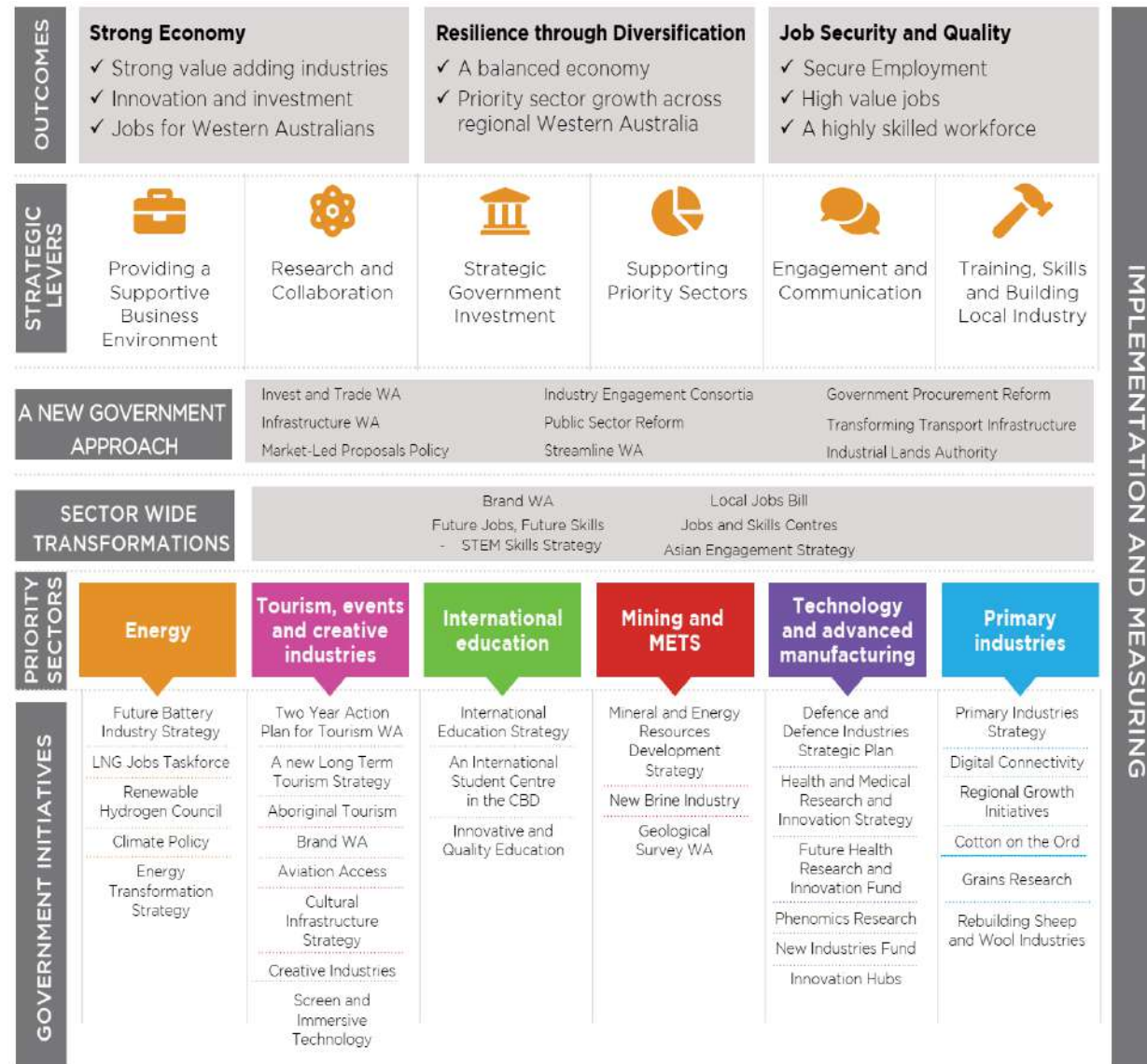
Diversify WA has several initiatives that are directly relevant to Mundijong and the Shire of Serpentine-Jarradale particularly through the primary industries and tourism sectors.

While COVID-19 has meant a reset on some of these sectors – particularly tourism and international education – the more important outcome has been to highlight the importance of having a diverse economy across several sectors so that other parts of the economy can function when others are disrupted.

While this may not directly affect the West Mundijong development, the point of considering these high-level factors is that the economic opportunities available to future residents of Mundijong will be shaped and created by these Government initiatives. It also means that specific investments made to support these industry sectors may have a direct benefit to Mundijong businesses and residents. Any Shire economic development strategies should therefore ‘hook’ into these higher-level Government initiatives.

One such opportunity for Mundijong is the potential to combine agriculture and advanced phenomics research as part of an agri-science innovation hub.

Figure 2.1 Diversify WA Vision



Source: WA Government (2019) *Diversify WA*

2.2 Peel region economic opportunities

The Peel region is home to 130,339 people and is one of the fastest growing areas in the west, with population expected to rise to 444,000 by 2050.

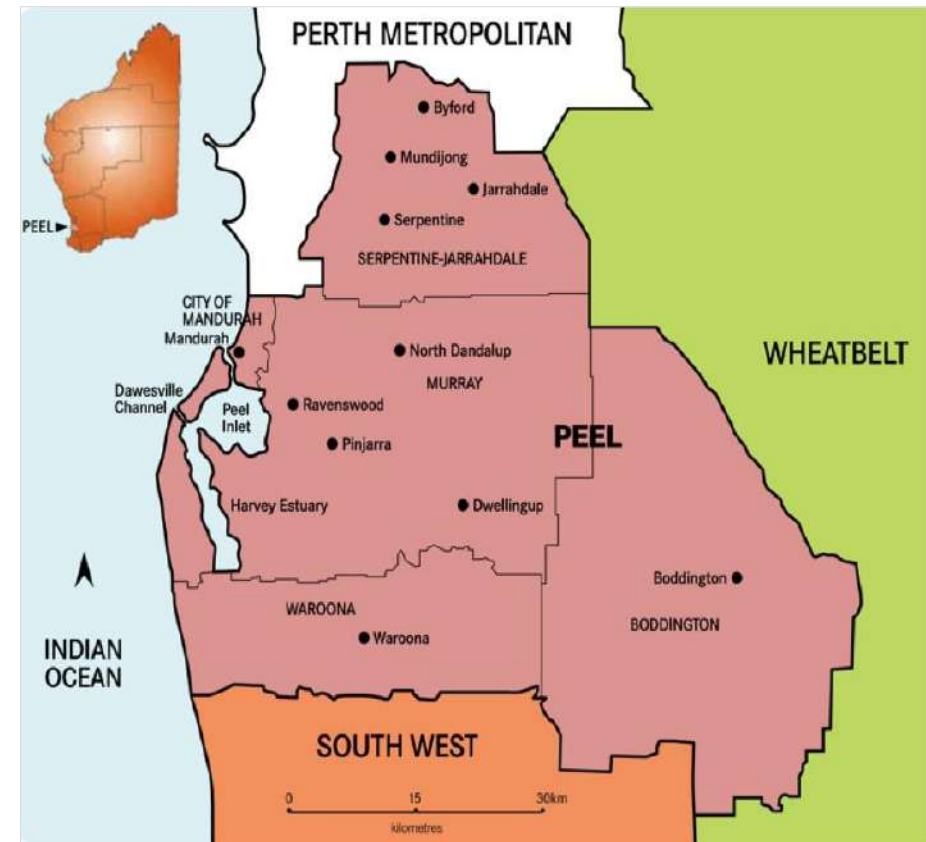
The Peel Region comprises of five local government areas: Boddington, Mandurah, Murray, Serpentine-Jarrahdale and Waroona.

The Transform Peel initiative is a 35 year program being delivered by the Peel Development Commission, supported by State government funding. The overall plan to 2050 comprises of three major parts to create employment as well as encouraging sustainable growth and economic development:

- Peel Business Park
- Peel Food Zone
- Peel Integrated Water Initiative.

This report (West Mundijong Urban Precinct Economic Impact Assessment) considers the impact of the project on employment in the region, as well as presenting an argument for the opportunity to create residential living nearby to the zones, outlining the benefits to surrounding activity centres and the real value of a locally-based labour force to the Shire of Serpentine-Jarrahdale.

Map 2.1 Map of the Peel Development Commission Region



Source: Peel Development Commission

2.3 Economic resources

The Shire of Serpentine-Jarrahdale has several economic resources to help generate employment, including:

- Keysbrook mineral sands
- Cardup Brick (Austral Brickworks)
- Wineries in an around Jarrahdale
- Arts and crafts in Jarrahdale.

Austral Bricks is proposing major new investment in the Cardup facility, including replacing some of the ageing equipment and expanding production capacity from 200,000 to 250,000 tonnes per annum.

Mundijong has an important role to support the:

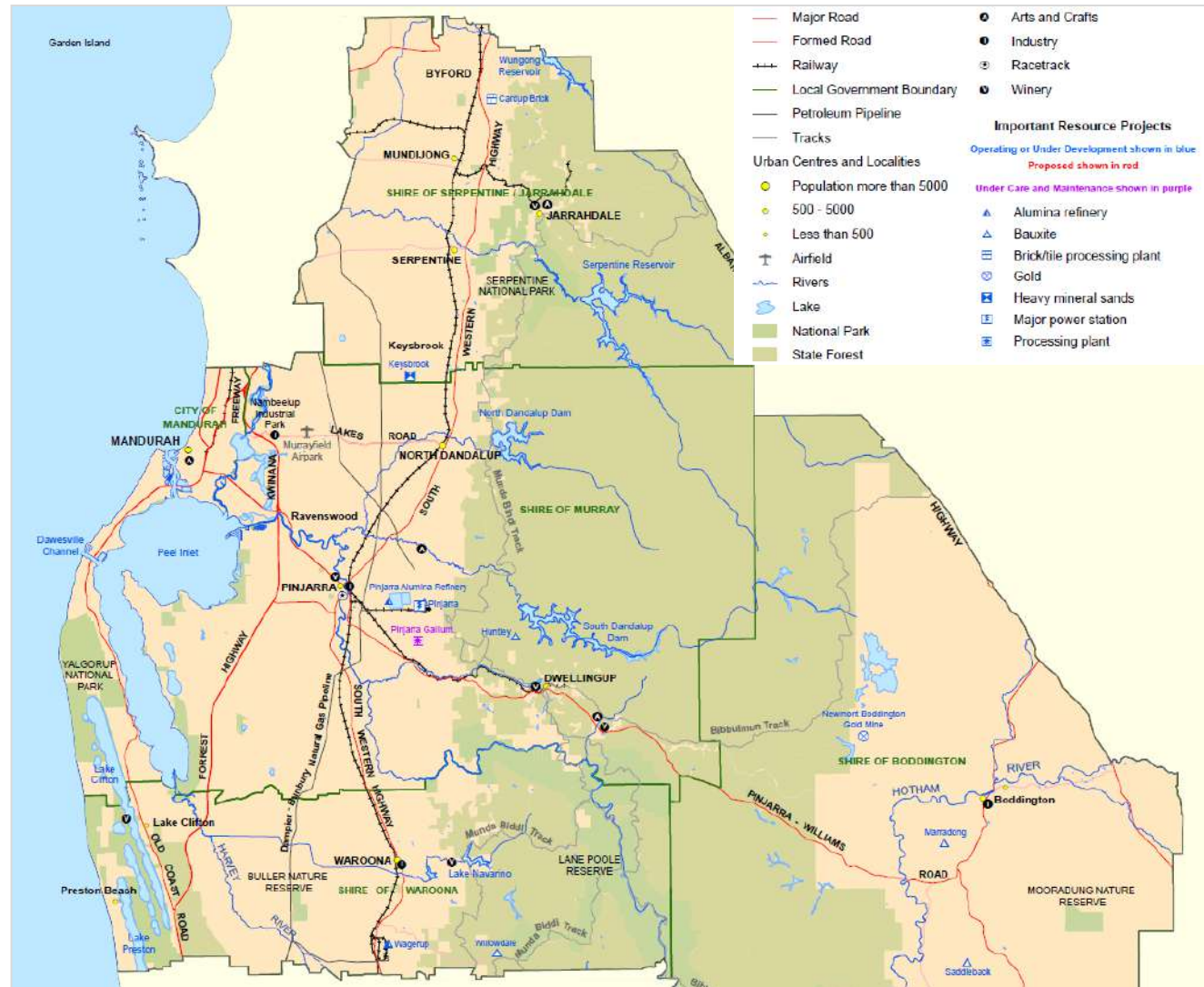
- Housing and commercial construction sectors drawing on supply-chain connectivity
- Competitive equine activities
- Primary productivity and related research and development.

Further to the south, there are additional economic activities and opportunities, including extensive mineral resources.

The future economic growth for the Peel Region will depend on the capacity to value-add to existing construction, mineral and agricultural production as well as growing the services sector in agri-research and tourism. It can also leverage future opportunities including logistics and freight potential from Westport, an intermodal terminal, and the Tonkin Highway extension. Then, in the longer term, Mundijong is a potential gateway and interchange for very fast transit southwards.

The West Mundijong Industrial Area will leverage these economic resources and facilitate additional value-adding industries.

Map 2.2 Economic activities and resources in the Peel Region



Source: Peel Development Commission

2.4 Transform Peel

Transform Peel aims to create an industry hub, the initiative setting out with a target to create 33,100 jobs and an annual economic output by 2050 of \$16 billion. In July 2017 the Peel Development Commission unveiled the *Peel Workforce and Skills Needs Analysis* which outlined potential opportunities in:

1. Mixed industry and food: a range of light industry with some food production and processing
2. Food-based cluster: specialised food production, processing and marketing
3. Technology-based cluster
4. Game changer: an alternative specialist hub

The most likely scenario for this is a food-based cluster in the region, promoting world-class production and processing methods to become world leaders in agribusiness.

The West Mundijong Industrial Area is ideally located near (but outside of) the Peel food cluster. This triggers the opportunity for value-adding agribusinesses to invest in Mundijong to service local and export markets.

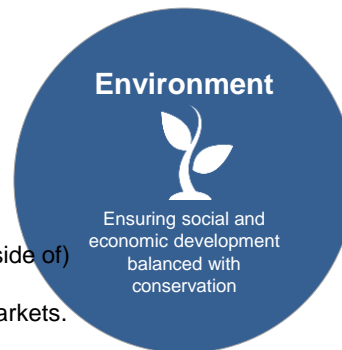


Table 2.1 Potential employment outcomes from opportunities

Labour force	Mixed industry	Food cluster	Technology hub	Game changer
Unskilled labour	8,250	4,950	3,300	5,280
Semi-skilled labour	9,900	13,200	9,900	3,300
Semi-skilled specialised / micro-credentialed employees	990	2,970	4,950	9,900
Apprentices / Trainees	660	1,320	1,980	1,650
Professional employees	2,640	2,640	2,640	3,300
Self-employed entrepreneurs	8,250	4,950	4,950	3,300
Tertiary educated employees	1,650	1,650	2,640	3,960
Highly specialised employees	660	1,320	2,640	2,310
Total	33,000	33,000	33,000	33,000

Source: Peel Development Commission

Thriving Industry

New and expanded market opportunities

Integrated network of prosperous regional communities

Agricultural Innovation

Peri urban food zone

Innovative and sustainable agriculture and food practices

Tourism Excellence

Network of diverse adventures

Tourism growth through investment

Capable People

Boosting productivity

Pathways to employment

Resilient Communities

Sport & recreation
Arts and culture

Secure housing, age friendly communities and targeted services

2.5 The Peel Food Zone

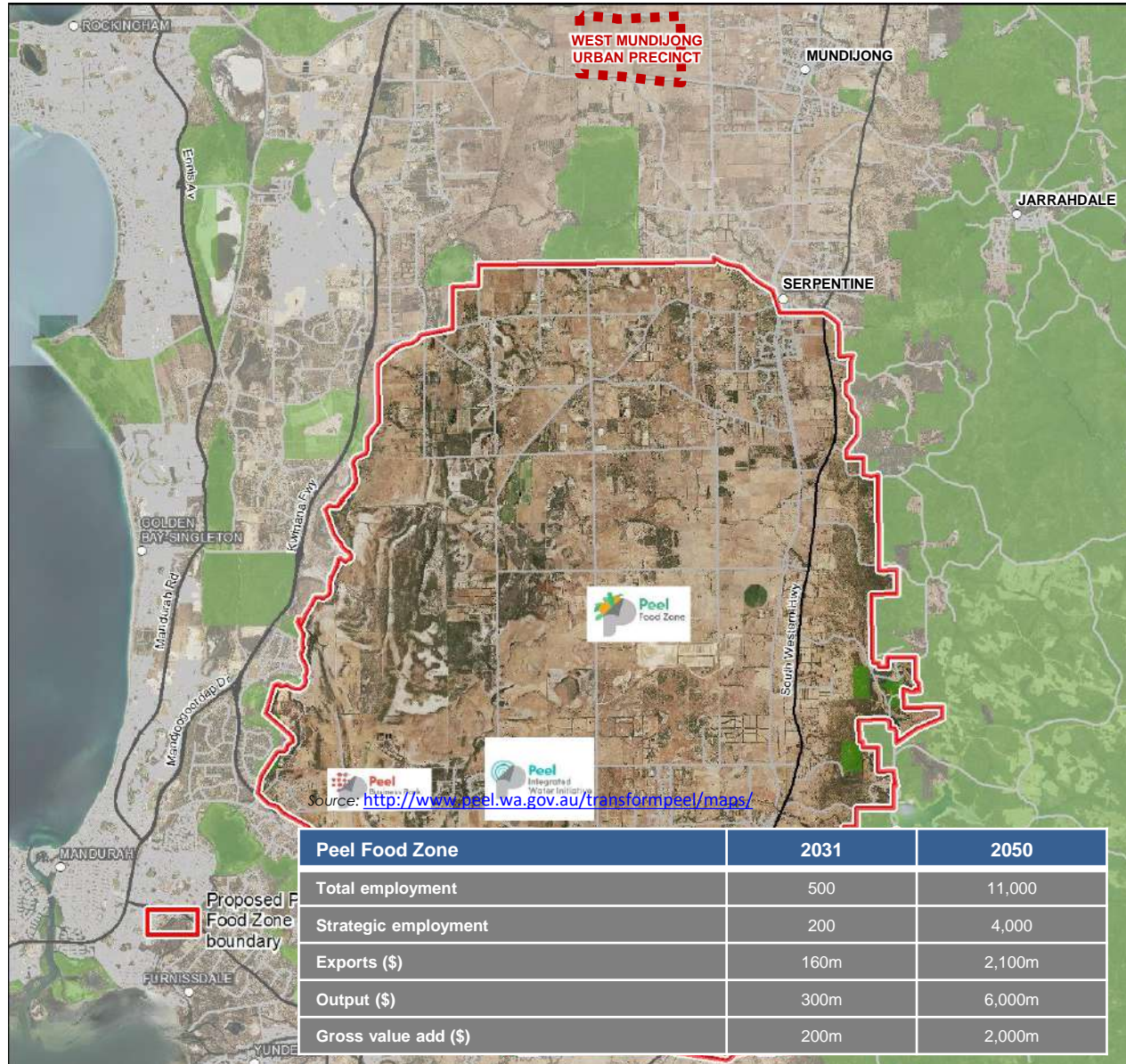
The Peel Food Zone is a 28,000-hectare development encouraging innovative food processing technology to become national leaders in agribusiness. Incorporating research hubs with food production and processing plants, the area aims to maintain Western Australia's world-renowned reputation in biosecurity to allow the production and distribution of premium produce to both domestic and international markets.

The Peel Food Zone recognises the most valuable land in the region for agricultural production that should be protected from encroachment and non-agricultural uses.

The Mundijong area is well suited (as are Serpentine and Jarrahdale) to provide a future workforce for the Peel Food Zone.

Mundijong is also well-placed to provide value-adding (such as food processing) to agricultural products from the Food Zone which may otherwise be exported as raw products.

Map 2.3 Peel Food Zone and Peel Business Park in relation to Mundijong



Source Department of Agriculture and Food

2.5 The Peel Food Zone (cont.)

Key features of the Peel Food Zone are:

- One of the major foundations of this project is a study that began in 2017 to assess the aquifers in the area, hoping to establish a way to capture ground water and treat it. The aim is to then develop the ability to store that water in a deep aquifer, and recover it when required.
- The real 2050 vision though is the creation of an area that is no longer dependent on the natural elements and instead has the ability sustain production year-round, eliminating the seasonal nature of agri-business and moving the agricultural industry to become a well-established part of the modern on-demand world.
- A significant amount of planning has gone into the food zone over the last few years in order to properly identify which types of industries could flourish in the intended environment. The supporting studies for the *Planning for Proposed Peel Food Zone Report 2017* considered “soil type, nutrient export risk, groundwater availability, land zoning and environmental impacts” finding the east part of the development can viably be used for a variety of crops and pastures, while the west side is best suited to closed agricultural systems like glasshouses.
- In 2020, the Department of Primary Industries and Regional Development (DPIRD) released the *Planning for the Peel Food Zone 2020* report, which included the following recommendation: “DPIRD works with DevelopmentWA, PDC [Peel Development Commission] and local government to implement the food transition strategy to attract and support food processing and manufacturing businesses into the PBP [Peel Business Park] or the West Mundijong Industrial Area.”

Table 2.2 Potential employment outcomes – Peel Food Zone

Peel Food Zone	2031	2050
Total employment	500	11,000
Strategic employment	200	4,000
Exports (\$)	160m	2,100m
Output (\$)	300m	6,000m
Gross value add (\$)	200m	2,000m

Source: Peel Development Commission

2.6 Shire of Serpentine-Jarrahdale Economic Development Strategy 2018-2023

Competitive advantages

The Shire of Serpentine-Jarrahdale Economic Development Strategy 2018-2023 recognises several competitive economic advantages, including:

- Population growth: with a projected doubling of the resident population to 2030 and a quadrupling by 2050, there will be a significant increase in household expenditure and demand for goods and services for the community. The Strategy notes that 'the Shire of Serpentine Jarrahdale is the fastest growing LGA in the country and will remain one of the fastest growing Local Government Areas for the foreseeable future'.
- Large workforce catchment: Businesses locating within Serpentine-Jarrahdale have access to a workforce of almost 270,000 people within a 30-minute drive catchment.
- Pro-business investment environment: the Shire of Serpentine-Jarrahdale promotes its 'business-friendly environment' and notes that it seeks to work in partnership with major business investors.

Weaknesses

The Strategy identifies a current 'jobs deficit' and concludes that it needs to focus on creating new jobs within the Shire. The Strategy states this conclusion is based on:

- 2016 Census data found 79% of local resident workers (10,181 people) work outside of the Shire. This outflow of workers costs the local economy \$31 million in local expenditure and 411 jobs. This cost will continue to increase until more local jobs are provided.
- While many local residents work in adjoining LGAs, many more travel north to Perth for work. Analysis of recent Census data show that there are 12,871 local resident workers that live in the Serpentine Jarrahdale Shire and at the same time only 4,569 local jobs in the Shire, creating a deficit of 8,302 local jobs.
- Based on the 2016 Census data, there is only one local job per every three local resident workers.

Sections 3 and 4 of this report provide responses to this 'jobs deficit' and address how the West Mundijong Urban Precinct can help to broaden the local economic base and employment opportunities.

Focus on creating jobs

The Strategy concludes that the Shire should aim to create 45,000 new jobs by 2050.

The Strategy states:

"Without additional local jobs, the Shire risks becoming a dormitory suburb, which would create future issues around traffic congestion and numerous negative economic and community impacts. Challenges exist and must be overcome, the path will be difficult but can be travelled and the opportunity for future economic wealth, vibrancy and a better standard of living for every family is clear and worthy of the task."

To address this challenge, the Strategy notes eight competitive advantages that it can leverage to create jobs and economic growth for the Shire.

Maximising these opportunities will require attracting businesses and investment to the West Mundijong Industrial Area. This should be addressed comprehensively in the next iteration of the Shire's Economic Development Strategy.

2.6 Shire of Serpentine-Jarrahdale Economic Development Strategy 2018-2023 (cont.)

Competitive advantages

- *Affordable industrial land* which is 46% less expensive than the traditional industrial areas of Perth (i.e. Kewdale, Canning Vale, Welshpool, etc.).
- *Excellent transportation connections*: including road, rail connections and proximity to the Perth, Perth Airport, Jandakot Airport, Kwinana Industrial Area, Western Trade Coast, future Westport in Kwinana. These connections will be enhanced with the budget commitments to the Tonkin Highway extension south to Mundijong. It would may also benefit from better east-west arterials.
- *Utilities gas, power, water, waste water capacity*: all major utilities are available within the Shire of Serpentine Jarrahdale, particularly for all future potential commercial and industrial users, including reticulated gas, power, water and waste water infrastructure.
- *High-value natural amenity*: with about half of the Shire made up of National Parks, State Forests and nature reserves. This facilitates tourism and recreation activities, including swimming, mountain biking, hiking and other outdoor activities.
- *Emerging tourism markets*: an estimated 200,000 people visit the Shire annually.

- *Existing equine industry*: the equine industry includes trotting, the training of pacers, and a variety of support industries and numerous recreational opportunities. In total, the local equine industry supports an estimated 548 jobs locally and contributes around \$72 million to the local economy.
- *Existing agricultural sector*: Agriculture contributes around \$95 million to the local economy annually and generated an estimated 5,032 jobs in 2017. Major agricultural activities are chicken/poultry, nurseries, hay and a variety of fruit and vegetables. The Shire currently produces an estimated 3.2 million chickens (61% of the total estimated production for the State).
- *Soils and water*: the Shire notes it has a range of good soils and access to water for a diverse variety of agricultural crops. In total, there are more than 15,000 hectares of agricultural holdings within the Shire, making up 17% of the Shire's total area.

The West Mundijong Industrial Area with its excellent road infrastructure (and potential future intermodal terminal), provides can leverage from the Peel economic development and deliver high value-adding industry opportunities. The Shire of Serpentine-Jarrahdale estimates when fully-occupied, it will create 10,000 jobs, \$600 million in annual exports, and have a total economic output of \$5.5 billion per year.

Relationship to West Mundijong Urban Precinct

The Shire's *Economic Development Strategy 2018-2023* outlines its desire to support the existing equine industry and agricultural production, which means also protecting the land that generates those outcomes.

Many of the competitive advantages such as affordability, good transport connections and natural environment also make it very attractive as a residential location for people that work in major employment zones outside of the Shire.

The Agricultural Land Capability – Mundijong DSP study shows that the economic opportunities identified by the Shire will not be threatened or weakened by the urbanisation of West Mundijong. As the subject site is not part of the Peel Food Zone, its urbanisation will not limit future economic opportunities.

The Australian Government has forecast the employment the agricultural sector in the Perth South Employment Region to decline over the five years from 2019 to 2024. This is despite the initiatives and investment in the sector. It indicates that the Shire needs to reconsider its reliance on this sector for direct employment and move to higher-value adding activities in the longer term.

3_Employment and journey to work analysis

Key points

- Employment growth forecasts published by the Department of Education, Skills and Employment for the Perth South Employment Region show:
 - Strong growth in healthcare & social assistance, accommodation & food services, education & training, mining, and professional services.
 - Employment decline in agriculture, forestry & fishing and in finance & insurance services.
- Education and training, and construction are the largest single employment sectors in the Shire of Serpentine-Jarrahdale and job opportunities would be boosted significantly by increased urban development in the Shire.
- The geography of the Perth and Peel regions mean that the major employment opportunities surrounding Mundijong are along the coastal corridor (including Fremantle, Rockingham and Mandurah Strategic Metropolitan Centres, Murdoch Specialised Centre, Western Trade Coast, Kwinana Strategic Industrial Area).
- Although a relatively high proportion of people commute outside of the local area for employment, the vast majority work in relatively nearby locations and relatively few workers commute to the Perth CBD (5.9%).
- The West Mundijong Urban Precinct would support business investment in the West Mundijong Industrial Area by increasing the local workforce pool and by increasing local household expenditure and demand for goods and services.

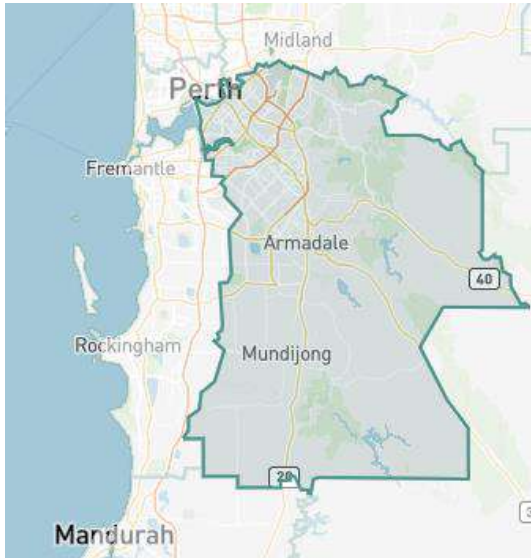
3.1 Employment projections by industry

The Australian Department of Education, Skills and Employment provides five-year employment forecasts by industry. These were used to inform the Shire of Serpentine-Jarrahdale’s Economic Development Strategy 2018-2023.

Mundijong is central to the Perth South-East Employment Region and therefore the forecasts for this region provide a good indication of the future opportunities for workers living and/or working on the area.

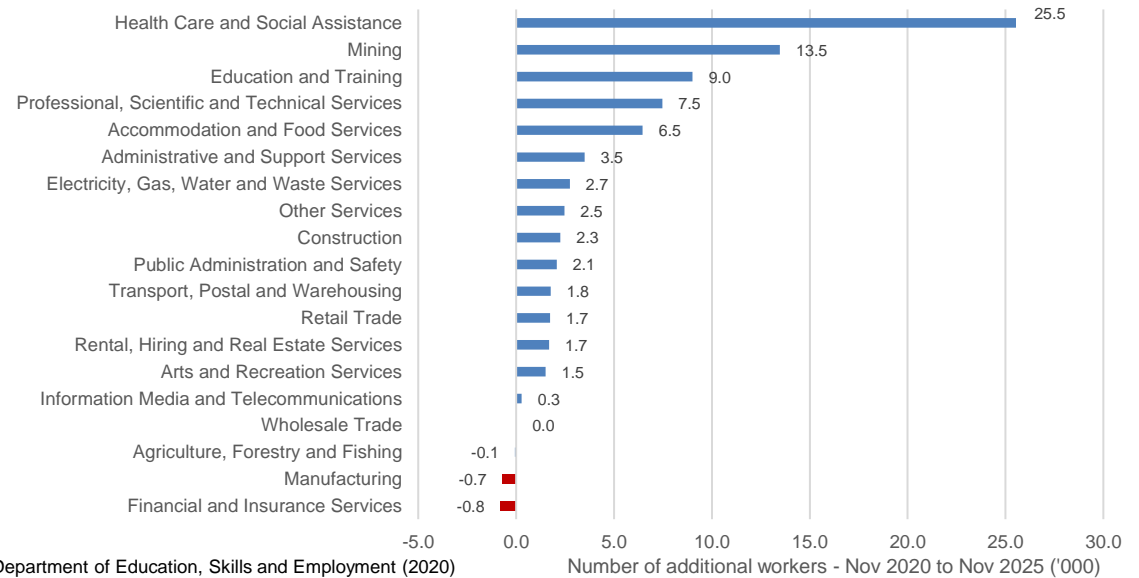
All sectors are forecast to increase in employment over the five years to 2025, except for agriculture, forestry & fishing, finance & insurance services manufacturing and wholesale trade. The strongest growth is forecast in human services (healthcare, education), tourism/accommodation, mining and professional services.

Map 3. Perth South-East Employment Region



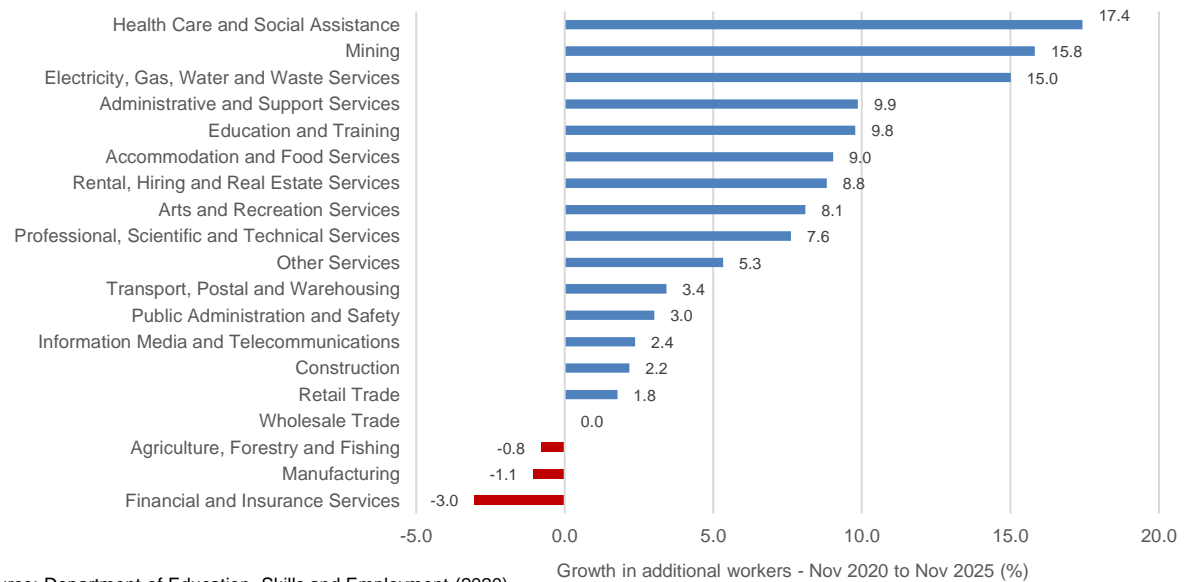
Source: Department of Education, Skills and Employment

Figure 3.1 Employment growth (no.) in Perth South Employment Region 2019-2024



Source: Department of Education, Skills and Employment (2020)

Figure 3.2 Employment growth (%) in Perth South Employment Region 2019-2024



Source: Department of Education, Skills and Employment (2020)

3.2 Future employment opportunities

The Shire's *Economic Development Strategy 2018-2023* identifies the competitive advantages and strengths of the employment sectors.

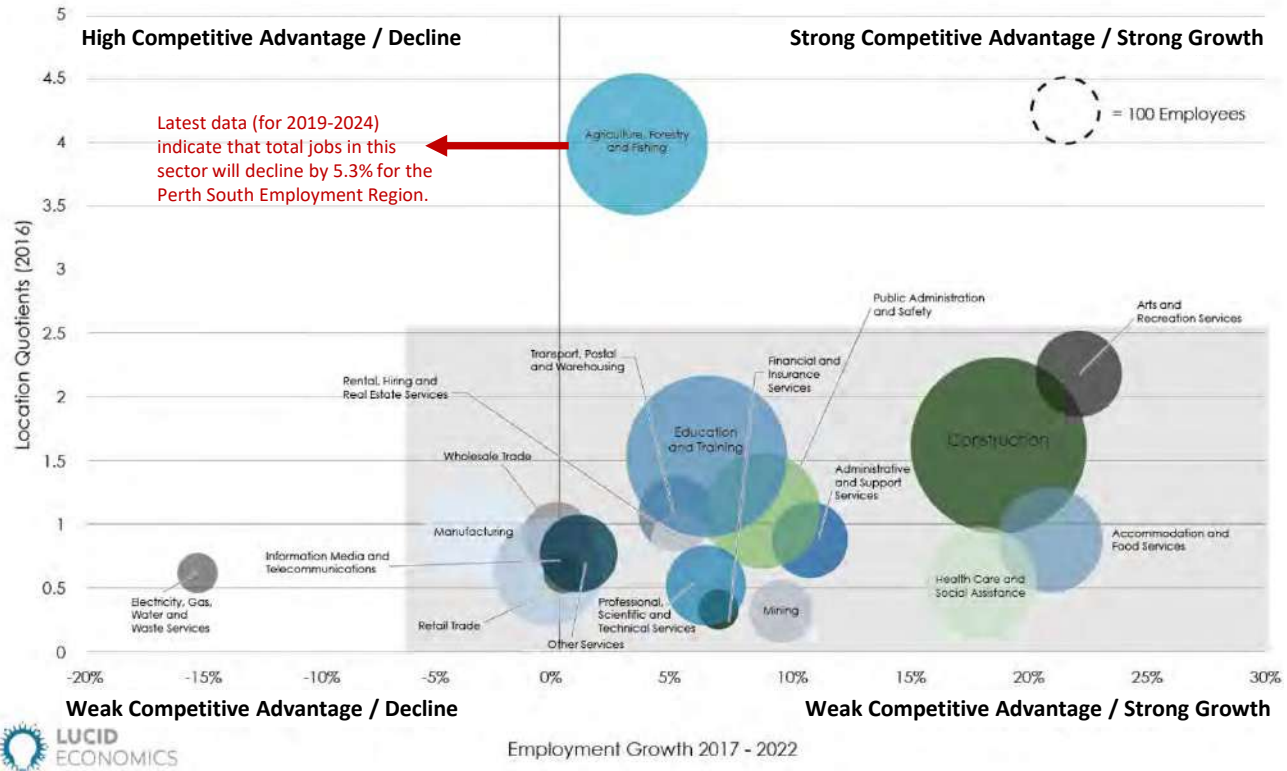
In the chart to the right, the horizontal axis indicates total projected growth of the employment sector – industries to the left are in decline in the region and industries to the right are growing. The vertical axis compares the Shire's labour force to the average and indicates whether there are relatively more (location quotient > 1.0) or less (< 1.0) than average.

The analysis shows that the Shire has relatively high proportion of people working in the agriculture, forestry and fishing sector and that it was supposed to be increasing in employment. However, the latest data Department Education, Skills and Employment show that the sector is in decline and for the Perth South Employment Region, it will contract by 5.3% over the five-year period to 2024.

Construction is the largest component of the workforce (indicated by the size of the bubble) and demonstrates strong growth. This sector would be boosted by increased urban development within the Shire.

Other initiatives, such as the extension of the Tonkin Highway and the construction phase of the Westport project offer additional opportunities. These could trigger the development of an intermodal terminal development in West Mundijong Industrial Area.

Table 3.1 Competitive advantages for the Shire of Serpentine-Jarrahdale labour force



Source: Shire of Serpentine-Jarrahdale Economic Development Strategy 2018-2023
 Note: Additional labelling added by macroplan 2020

3.3 Journey to work

The reality of work is that people commute to workplaces that are outside of the immediate area where they live. The following tables show the number of people who commute out of, and into, the Mundijong Statistical Area 2 (SA2) for work.

Table 3.1 Commuting OUT: Place of work for residents - Mundijong SA 2

Place of work - 2016	Workers	Proportion of working residents	Cumulative proportion of workers
Mundijong	612	20.8%	20.8%
Armadale - Wungong - Brookdale	184	6.2%	27.0%
Perth City	174	5.9%	32.9%
Byford	117	4.0%	36.9%
Canning Vale Commercial	103	3.5%	40.4%
Kelmscott	81	2.8%	43.2%
Maddington - Orange Grove - Martin	64	2.2%	45.3%
Welshpool	63	2.1%	47.5%
Rockingham	62	2.1%	49.6%
Murdoch - Kardinya	58	2.0%	51.5%
Jandakot	56	1.9%	53.4%
Kwinana Industrial	54	1.8%	55.3%
Serpentine - Jarrahdale	54	1.8%	57.1%
Bibra Industrial	52	1.8%	58.9%
Fremantle	44	1.5%	60.4%
Baldivis	43	1.5%	61.8%
Forrestdale - Harrisdale - Piara Waters	39	1.3%	63.2%
Mount Nasura - Mount Richon - Bedforddale	39	1.3%	64.5%
Henderson	38	1.3%	65.8%
Canning Vale - East	36	1.2%	67.0%

Source: Australian Bureau of Statistics 2016 Census

These tables show that:

1. On the whole, most of the people commuting in or out are from surrounding areas and thus have relatively short commute distances.
2. Some areas have people 'cross-commuting' (ie. Byford, Serpentine-Jarrahdale, Rockingham, Baldivis).

Table 3.2 Commuting IN: Place of residence for workers - Mundijong SA2

Place of residence - 2016	Workers	Proportion of workers	Cumulative proportion of workers
Mundijong	612	38.0%	38.0%
Byford	100	6.2%	44.2%
Serpentine - Jarrahdale	55	3.4%	47.6%
Baldivis	48	3.0%	50.6%
Armadale - Wungong - Brookdale	41	2.5%	53.1%
Forrestdale - Harrisdale - Piara Waters	31	1.9%	55.1%
Bertram - Wellard (West)	26	1.6%	56.7%
Singleton - Golden Bay - Secret Harbour	21	1.3%	58.0%
Banjup	20	1.2%	59.2%
Rockingham	19	1.2%	60.4%
Parmelia - Orelia	18	1.1%	61.5%
Canning Vale - East	18	1.1%	62.6%
Mount Nasura - Mount Richon - Bedforddale	18	1.1%	63.7%
Port Kennedy	17	1.1%	64.8%
Safety Bay - Shoalwater	17	1.1%	65.9%
Waikiki	17	1.1%	66.9%
Casuarina - Wandii	16	1.0%	67.9%
Huntingdale - Southern River	15	0.9%	68.8%
Gosnells	15	0.9%	69.8%
Pinjarra	14	0.9%	70.6%

4_Employment and economic benefit summary

Key points

- The assessment concludes that the West Mundijong Urban Precinct would have around 9,750 working residents (or approximately 50% of the total population, based on the Census ratio). Of these residents, around 5,950 are forecast to either work within the sub-region or to be FIFO/DIDO workers. That leaves around 3,800 workers that are the 'daily commuters' from West Mundijong to other sub-regions of Perth and the Peel region.
- An urban development of 6,500 dwellings would produce a total economic output of around \$4.6 billion (\$1.7 b in direct economic benefits and \$2.9 b in flow-on benefits) through the subdivision works, infrastructure/services, and construction of dwelling and associated other buildings.
- The West Mundijong Urban Precinct will bring additional household expenditure to the Shire and generate demand for goods and services. It will also provide a local workforce for the 10,000 workers the Shire estimates will be employed in the West Mundijong Industrial Area. Although this proposal also has the potential to impact employment self-sufficiency and self-containment in the short term if the urban precinct is developed ahead of the West Mundijong Industrial Area.
- The development of the West Mundijong Urban Precinct will contribute to the threshold population required to attract State Government investment in key infrastructure, such as extension of the Byford passenger rail line as part of Metronet. The same applies to services and retail facilities provided by the private sector which require a threshold population to achieve viability.

4.1_Economic benefits

Quantifiable development benefits

This assessment of economic benefits of developing the West Mundijong Urban Precinct covers the economic benefits throughout all stages of the development from initial subdivision through to the construction and occupation of dwellings and other buildings.

The economic benefits from this assessment are directly related to the financial investment at each stage of the development pipeline (see Figure 4.1) and therefore are relatively proportional to the dollar expenditure and labour component at each major stage. Therefore, the civil works and servicing stage delivers an early significant benefit because it is the single-most capital-intensive stage of the whole pipeline. This will deliver an early benefit to the Shire of Serpentine-Jarrahdale and create jobs.

The dwelling construction phase is the most labour intensive and this generates significant local jobs and expenditure. As much of the money paid in wages is then 're-spent' on goods and services in the economy, this stage also produces significant flow-on benefits.

A 2020 AHURI study, *Responding to the pandemic, can building homes rebuild Australia*, found that: "Stimulating the housing industry is an effective way of boosting an economic recovery. This research demonstrates that non-residential construction, followed by residential construction, and then infrastructure spending has the highest multiplier effect to those industry sectors hardest hit by the pandemic." (p. 1).

Macroplan has assessed this economic benefit from the entire development pipeline and the assumptions and results are summarised in section 4.2 of this report. This assessment is based on the input-output tables published by the Australian Bureau of Statistics in the *Australian National Accounts*.

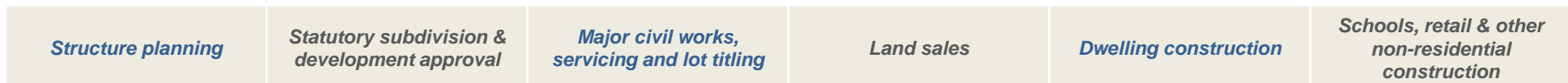
Long-term benefits

In the longer term, the West Mundijong Urban Precinct would create long-term benefits through the demand created by the additional households. These benefits include:

- Jobs created within the precinct itself to service local households and residents.
- Jobs supported in nearby Mundijong Town Centre stimulated by household expenditure.
- Other economic benefits from bringing additional rates revenues, household expenditure and population to the area which all contribute to attract local businesses and services needed to support a sustainable community.

Sections 4.3 and 4.4 of this report covers these benefits in more detail.

Figure 4.1 Conceptual development pipeline as basis for economic benefit assessment



4.2 Economic benefits - financial

The benefits component of this assessment shows that the project can generate significant economic outputs, primarily in the construction sector.

This assessment assumes that the West Mundijong Urban Precinct is developed progressively over 15 years and that the precinct yields a total 6,500 dwellings, three primary schools and three childcare centres. In addition, it would support activity centres which would further create local employment.

The staging and yields are all indicative to provide a ‘first-order’ assessment of the economic benefits from an urban development of around 6,500 dwellings.

The economic impacts are calculated from an input-output model based on the Australian National Accounts, published by the Australian Bureau of Statistics (2019).

For the economic impact, the initial effect is the payment for the construction work. This payment is used by the prime contractor to pay subcontractors for their services, and providers of materials are also paid. This second round of income is used by the subcontractors to pay their staff and for the materials they use. These payments become income in the hands of the suppliers of services and materials who, in turn, use the income to pay for their business and household needs. The process of successive waves of income and expenditure go on until they are exhausted.

The impacts for the economy of the successive rounds of incomes and expenditures are cumulative and the final total of these effects is the “multiplier” of the original change.

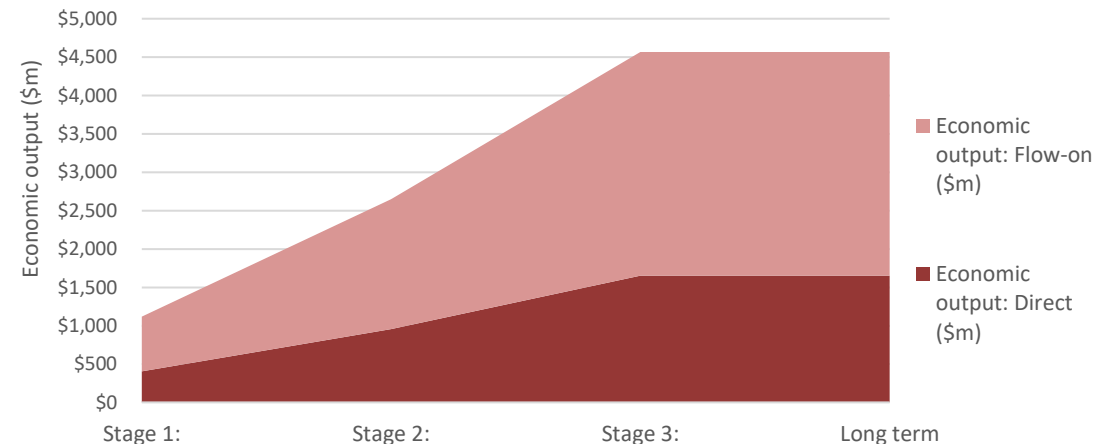
Table 4.1 Indicative development staging and economic benefit assessment for West Mundijong

Land uses	Stage 1: Yrs. 1-5	Stage 2: Yrs. 6 - 10	Stage 3: Yrs. 11 - 15	Total: All stages
Dwellings constructed	1,500	2,250	2,750	6,500
Residents	4,270	6,400	7,830	18,500
Economic output: Direct (\$m)	\$405	\$552	\$695	\$1,652
Economic output: Flow-on (\$m)	\$715	\$976	\$1,224	\$2,915
Economic output: Total (\$m)	\$1,119	\$1,528	\$1,919	\$4,566
Flow-on multiplier (ratio)	2.8	2.8	2.8	2.8

Source: macroplan 2020

Notes: Economic output refers to the gross value of economic production, including direct and flow-on outputs. Economic multiplier is the ratio of economic output to expenditure.

Figure 4.2 Cumulative economic benefit from development of the West Mundijong Urban Precinct



Source: macroplan 2020

4.3 Economic benefits – population-servicing jobs

The West Mundijong Urban Precinct would generate demand for 'population-servicing' jobs in the Mundijong area. These include education, healthcare, retail, personal services, and safety & security. These jobs would be driven by local household and individual expenditure.

Mundijong has a very high proportion of people that work from home. In 2016, 7.5 per cent of all workers were working at home, compared to the WA average of 4.3 per cent. Other employment can be boosted by developing co-workspaces and encouraging flexible working days.

Macroplan estimates the West Mundijong Urban Precinct would generate around 1,601 direct jobs to service the population. These jobs would be located within the precinct itself.

The West Mundijong Urban Precinct is subject to detailed planning. The figures in the table on the right are based on Macroplan's ratios for an urban development of around 6,500 dwellings. These figures assume the precinct is fully developed.

The development of West Mundijong for residential uses will contribute to the threshold population required to attract State Government investment in key infrastructure, such as extension of the Byford passenger rail line as part of Metronet. The same applies to services and retail facilities provided by the private sector which require a threshold population to achieve viability.

The Shire estimates the West Mundijong Industrial Area will generate 10,000 jobs and notes that there is a total workforce of 270,000 within 30 minutes' drive.

Additional jobs in the surrounding area, such as those in West Mundijong Industrial Area, are discussed in the following section.

Table 4.2 Indicative population-servicing jobs within the West Mundijong Urban Precinct

Sector	Number of sites / FTE (each site / facilities facility)		Total employment
Education			
Childcare (full day care and before/after school care)	4	10	40
Primary school	3	42	126
Secondary school	1	80	80
Total education			246
Health			
Retirement (120 units)	1	36	36
Aged care (80 beds)	1	45	45
Allied health	5	4	20
Total health			101
Activity centres			
Neighbourhood centre (8,000 sqm)	1	320	320
Local centre (2,000 sqm)	1	80	80
Total activity centres			400
Service and convenience shops (not in activity centre)			
Convenience (service stations, other convenience)	2	5	10
Food	5	8	40
Non-food	5	4	20
Total Service Retail			70
Urban employment			
Emergency	4	12	48
Transport	76	1	76
Human services (gyms, trainers, hairdressers, beauticians)	60	4	240
Total regional distribution			364
Work at/from home			
Home-based employment	350	1.2	420
Total direct jobs			1,601
Indirect jobs		x 0.3	480
Total direct and indirect jobs			2,081
Other employment			
Display village	1	5	5
Shared workplaces	1	80	80

Source: macroplan 2020

4.4 Economic benefits: job demand/supply balance

The table on the following page provides a jobs 'balance sheet' to show:

1. *Job demand* – the number of jobs that would be required to meet the employment needs of residents living the West Mundijong Urban Precinct.
2. *Job supply* – to account for where residents that live in West Mundijong are likely to live. This assessment uses the information in Table 4.1 as well as data from the 2016 Census of population and housing to determine the likely distribution of jobs.

The four components of the assessment cover:

Group 1 employment – population-servicing jobs: These jobs are addressed in detail in Table 4.2 of this report showing the total employment that would be generated by the population living in the area. This is based on actual employment numbers from similar greenfield developments. It demonstrates that at capacity, the West Mundijong area would have around 1,601 local jobs including those in the activity centre(s), schools and healthcare sectors, as well as jobs that are more mobile, but still generated and located within the local area (human services, emergency services, home-based aged care, etc).

Group 2 employment – workers elsewhere in the sub-region: These jobs include a wide range of employment opportunities in the sub-region, particularly within the Armadale Strategic Metropolitan Centre for the higher-level jobs (health and medical services, professional services, higher-level education, etc) and in strategic industrial employment nodes.

Group 3 employment – FIFO/DIDO workers: These jobs primarily involve travel to Perth Airport and it is infrequent (ie. one trip every two to four weeks, depending on the rota). Therefore, these workers do not put an undue strain on the transport network on a daily/weekly basis. It also includes a component of workers that would drive to work further away including Wagerup and Boddington.

Group 4 employment – workers commuting outside of the sub-region: These workers are the 'daily commuters' that travel outside of the South-east Sub-region for work. While a small number of these workers would have jobs in the Perth CBD (and thus could use the train service), the 2016 Census data show that many of these workers travel to major employment centres including Mandurah, Rockingham and the Kwinana industrial Area.

The assessment concludes that the West Mundijong Urban Precinct would have around 9,750 working residents. Of these residents, around 5,950 are forecast to either work within the sub-region or to be FIFO/DIDO workers (ie. Group 1 + Group 2 + Group 3). That leaves around 3,800 workers (Group 4) that are the 'daily commuters' from West Mundijong to other sub-regions of Perth and the Peel region.

These figures demonstrate how the West Mundijong development can contribute to the need for a local workforce and still meet the employment self-sufficiency target for the sub-region.

Source: macroplan 2020

Table 4.3 Indicative job demand-supply assessment for West Mundijong Urban Precinct

West Mundijong Urban Precinct		Stage 1:	Stage 2:	Stage 3:	Capacity
Assumption		Yrs. 1-5	Yrs. 6 - 10	Yrs. 11 - 15	
<u>Job demand from residents living in West Mundijong</u>					
Dwellings (cumulative)	Estimated	1,500	3,750	6,500	6,500
Population	3.0 persons per dwelling	4,500	11,250	19,500	19,500
Workers	50% of population	2,250	5,625	9,750	9,750
Self-sufficiency target (within sub-region)	61% of all workers	1,373	3,431	5,948	5,948
<u>Job supply to meet demand from workers living in West Mundijong</u>					
Group 1: Workers within West Mundijong UP		450	1,125	1,950	1,601
Group 2: Workers elsewhere in sub-region					
Strategic activity centres (and other activity centres in the sub-region)		225	563	975	975
West Mundijong Industrial Area and other industrial employment centres		228	571	990	1,321
Construction workers		338	844	1,463	1,463
Other workers in Sub-region (transport, maintenance, etc)		42	104	180	198
Group 2 Subtotal:		833	2,081	3,608	3,957
Group 3: FIFO/DIDO workers		90	225	390	390
Total Group 1-3		1,373	3,431	5,948	5,948
Group 4: Workers working elsewhere in the Perth Metropolitan Region (other sub-regions)		15% of all workers living in West Mundijong	878	2,194	3,803
Total workers (residents of West Mundijong)		2,250	5,625	9,750	9,750

Source: macroplan 2020 using data from DPLH (South Metropolitan Peel Sub-regional Planning Framework), WAPC (Land Use and Employment Survey) and ABS (Census)

4.5_Other economic benefits

In understanding the economic importance of the West Mundijong development, it is relevant to highlight the strong correlation of economic infrastructure with output growth, productivity, expenditure and private sector investment, in this developed local economy. With consideration to the above, the following economic indicators were identified:

- Investment impact
- Household expenditure
- Employment.

Investment impact: the development of the site and the improvements to the area will lead to a long term increase in the value of land in the locality as the area becomes recognised as a major asset in the community.

Household expenditure: the new population will support existing retail centres in the locality and contribute to the sustainability of these centres.

Employment: The development of the area will create employment over the estimated 15-year development time frame. The main economic benefits of developing this area will come from:

- Supporting existing businesses including retail, entertainment and trades
- Additional community contributing to the Shire's local rates providing greater capacity to fund new services and infrastructure from a community that is not generating demand for new infrastructure.
- Build greater capacity to attract State Government investment in new infrastructure due to the larger resident population contributed by West Mundijong.

The Shire of Serpentine-Jarrahdale's draft Mundijong-Whitby Developer Contributions Plan will set out a funding mechanism and timeframe for the provision of the community infrastructure and facilities. This helps to share the public cost of providing these facilities and therefore acts to improve the cost-benefit impact of community services.

Social benefits

Social considerations of the proposed development have been based on potential benefits such as housing opportunities, actual and perceived levels of safety, amenities of the area and accessibility. The social indicators include:

Health and exercise: e.g. a design that promotes activity:

- Accessibility: e.g. walkability within the site, linkages between precincts, etc.;
- Community cohesion: i.e. extent of community interaction, etc.; and
- Safety: e.g. level/ perceptions of crime, pedestrian and vehicle accidents.

The following highlights the key features of the proposed development:

Health and exercise: The development has access to regional open space and in addition to the local community and recreation facilities.

Community cohesion: This also provides potential for significant health and community cohesion benefits as people have the opportunity for formal and informal meeting.

Recreation and leisure: The site has the opportunity to offer a range of recreation opportunities to cater for residents.

Education: The indicative development includes three primary schools.

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Technical note on calculation of economic benefits

Australian Bureau of Statistics, Australian National Accounts: Input-Output Tables 2017-2018, Table 5. Industry by industry flow table (direct allocation of imports), (released 29 May 2020):

- This provides the basis for the input-output modelling to determine the economic value of an input in terms of its capacity to generate economic outputs to various parts of the economy. It utilises 114 industry categories and shows the allocation of Australian produced industry outputs to industries and to all final use categories.
- In this table, imports are directly allocated meaning they are allocated to the industries which use them and are included with the primary inputs to these industries in deriving the total production. With this method the intermediate and final use contain only the use of the domestic production and so the intermediate use matrix does not reflect the full input structure of industries.

Australian Bureau of Statistics 2016 Census by place of work (released 2018 and accessed via Table Builder):

- This provides the employment by industry category (ANZSIC) which has been matched to the 114 industry categories from the ABS input-output table.
- Individual incomes for each industry and the number of employees by industry in each local government area and region.
- Employment to population ratio which allows an estimation of the total population that is 'supported by' the economic activity (e.g. the wage earner that is supported by the expenditure, subsequently uses that income to support other members of the family and household).

MELBOURNE

(03) 9600 0500

SYDNEY

(02) 9221 5211

BRISBANE

(07) 3221 8166

PERTH

(08) 9225 7200

**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 2.4
Infrastructure and Engineering Assessment





**INFRASTRUCTURE AND
SERVICING ASSESSMENT**

**Proposed Mundijong West
Development**

Porter



REPORT PREPARED FOR
WPG LANDHOLDINGS PTY LTD

Prepared by	Porter Consulting Engineers
Postal address	PO Box 1036 Canning Bridge WA 6153
Phone	(08) 9315 9955
Email	office@portereng.com.au

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1.0 INTRODUCTION

Porter Consulting Engineers was commissioned by WPG Landholdings Pty Ltd to complete an infrastructure and servicing assessment on a parcel of land that falls outside of the proposed Mundijong District Structure Plan. The intent being to ultimately rezone the land to facilitate urban development.

The following are the outcomes of our investigation.

2.0 SITE DETAILS

2.1 Landform

The site is located approximately 3km west of the Mundijong town site. It is bordered by Leipold Road to the north, Kargotich Road to the east, Mundijong Road to the south and King Road to the west. Refer the below for the site location.

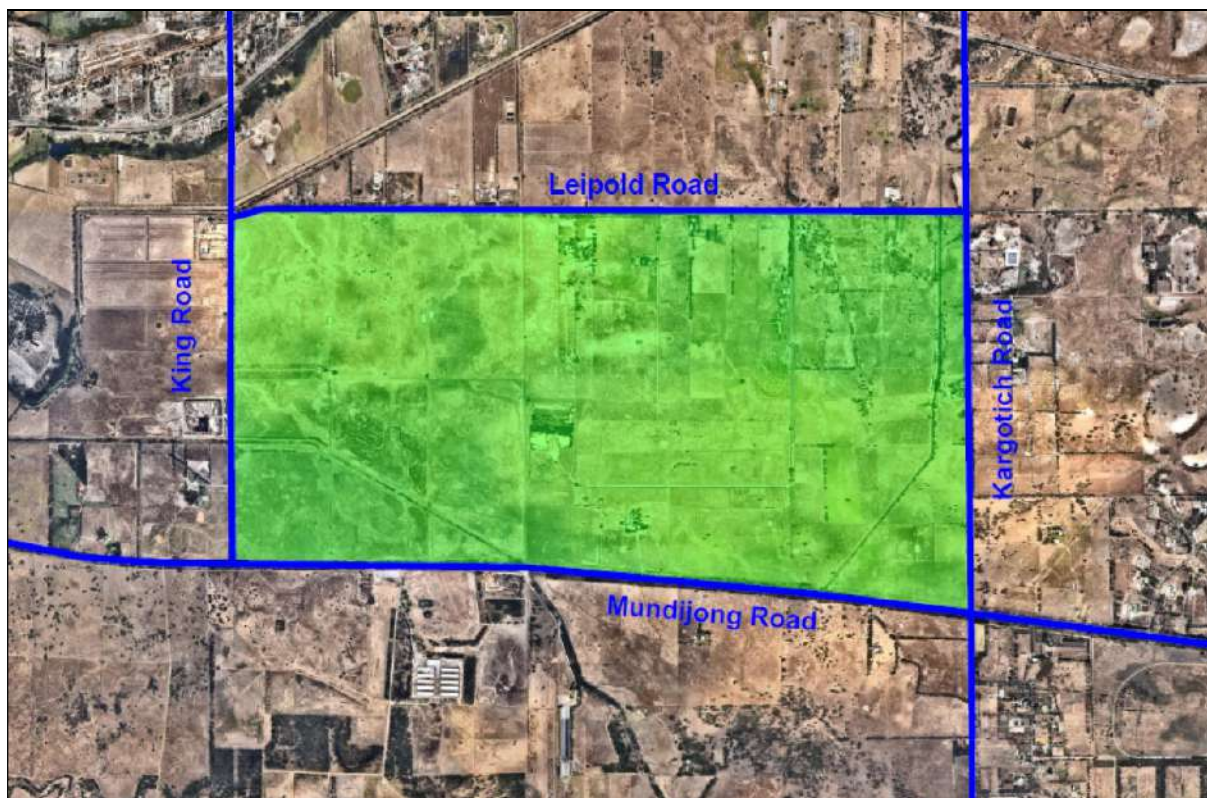


Figure 1 – Site Layout

While our investigation relates to the overall Site Area depicted in **Figure 1**, it is noted that it is only proposed to rezone land west of Gangemi Road to Urban under the Metropolitan Region Scheme.

The site is approximately 860 hectares in size and has a gradual fall from the south east down to the north west. The site is predominantly vacant farmland with houses and sheds scattered throughout. There is sparse vegetation.

For its size, the site has a very small number of individual properties.

There is a formal Water Corporation open drain (Oakland Drain) that flows south along Kargotich Road before turning west and running parallel to Mundijong Road. It crosses King Road approximately 700m north of Mundijong Road. There are other shallow farm drains throughout that connect into the Oakland drain. There are also various drainage structures at the road crossings.

The Tonkin Highway extension will pass the site approximately 1.8km to the east. It is understood that the Shire of Serpentine Jarrahdale are progressing the planning of the West Mundijong Industrial Development in between the highway and Kargotich Road.

2.2 Ground Conditions

Mapping suggest the ground consists of sandy clay to depth and is commonly defined as Guildford Formation. It is expected a layer of topsoil will be present. The western portion of the Water Corporation open drain falls within a clay sandy silt zone defined as alluvial origin. These ground conditions are relatively common in regions along the bottom of the Darling Scarp.

Detailed geotechnical investigations will be required throughout the detailed planning and design phases to verify the ground profile.

Detailed groundwater investigations will be completed during the local structure planning phase to establish the profile. This profile will be used to establish drainage arrangements and ultimately finished lot levels. Due to the Guildford Formation, it is expected groundwater will be shallow.

Acid Sulphate Soil (ASS) mapping indicates that the site falls within a moderate to low risk of ASS occurring within 3m of natural source surface but high to moderate risk of ASS beyond 3m. It is expected that any dewatering will require a preliminary ASS investigation and where required, an ASS Management Plan. It is expected standard construction methods will be utilised to manage the ASS.

It appears the existing ground conditions do not prohibit urban development.

3.0 ENVIRONMENTAL

Aurora Environmental have been engaged to complete a Desktop Environmental Assessment of the site. An environmental review and assessment was not completed as part of this investigation, please refer to Aurora's report for further details.

4.0 URBAN DEVELOPMENT

There are multiple landowners within the western portion of the site (west of Gangemi Road) and it is understood all are in support of its urban development. This support will assist in the planning of the infrastructure and ensure efficiencies in delivering the project.

5.0 SITEWORKS AND EARTHWORKS

The site is generally feature free apart from the various open drains and a borrow pit that appears to have been formed in the 1970's. It is expected the borrow pit will be backfilled and compacted as part of the development works.

Pending the outcomes of the geotechnical investigations, it is expected topsoil will be stripped prior to the placement of structural fill to establish the finished surface level. The filling specifics will be considered during the design process. Techniques such as topsoil screening and blending would need to be investigated as it presents an opportunity to reduce the quantity of imported fill. It is expected excess topsoil will be reused across the development where appropriate.

Some clay layer shaping may be required pending the outcomes of the drainage studies and the detailed engineering designs.

The above works are typical for a development of this nature and we do not foresee any issues that would prohibit urban development.

6.0 WASTEWATER

6.1 External to the Site

There is no existing wastewater infrastructure in the surrounding area. The Water Corporation's current wastewater planning extends from the scarp and stops at the future Tonkin Highway reserve. As expected, there is no wastewater planning over this site due to its current planning status.

Water Corporation have confirmed that the nearest wastewater pumping station will be located on Scott Street, approximately 1.8 km to the north east. This pumping station (type 90) services land to the East of the Tonkin Highway extension. This pumping station is on the Water Corporation Capital Investment Programmed with funding scheduled for the fifth year. Refer the green linework in Appendix 1 for details.

The Water Corporation confirmed its long term ultimate planning for the region details a large Type 1000 relay pumping station on Scott Street. This will convey effluent west to either Rockingham or Kwinana treatment plants. The timing of this is unknown. The pumping station will service a significant area, likely to include suburbs from Byford to Serpentine. Its catchment is expected to cover this site due to its very close proximity. The Water Corporation has secured a parcel of land to the west of the Tonkin Highway extension

for this Type 1000 pumping station. A service corridor will be required along Mundijong Road for its pressure main. Refer to the blue linework in Appendix 1 for the Type 1000 details.

6.2 Wastewater Servicing

As the planning phases progress for this site, the Water Corporation will prepare wastewater servicing concepts. It is expected the site will have one wastewater pumping station which will receive gravity inflow from the site and will pump the effluent east towards Scott Street. Due to the limited number of individual properties, it is expected the placement of the pumping station, pressure main and the associated incoming infrastructure will be easy to plan resulting in an efficient design. A suggested pumping station location and pressure main layout is shown in red in Appendix 1.

The pressure main servicing this pumping station will take a direct route to a Scott Street site via the existing road reserves. The future Water Corporation planning will nominate this pressure mains discharge location. We have notionally shown this into the future Type 1000 (blue in Appendix 1).

A standard wastewater gravity network will be established within this site as typical for an urban development. A concept wastewater servicing layout is shown in maroon as presented in **Appendix 1**.

7.0 WATER RETICULATION

7.1 Primary Mains

The Water Corporation's Serpentine Trunk Main (Ø1370 and Ø1220) runs north-south through the centre of the site and conveys water into the metropolitan area. These are primary Water Corporation assets and are located within a dedicated service corridor. The Water Corporation also has an Ø1065 steel water main that extends west from the Serpentine Trunk Main along Mundijong Road. It is expected these mains will remain. Refer the below extract from Water Corporations database for details.



Figure 2 – Primary Water Infrastructure

7.2 Water Servicing

There are no water distribution or reticulation mains of suitable size in the surrounding area that can be connected to provide a supply point for this site. This is expected for an existing rural zone.

As the site falls outside of the current planning area, the Water Corporation does not have any formal water supply concepts. As the planning phases progress for this site (LSP process), the Water Corporation will consider concepts to facilitate development.

Discussions with the Water Corporation confirmed there are two potential options to provide a water supply for the site. Those being a connection to the existing large water mains or establishing a tank on the scarp to supply the greater area. The Corporation acknowledged the tank option is more likely. As part of the tank option, it is expected a distribution main will extend to the site with reticulation connections servicing the development. It is also likely this distribution main will connect into the existing Mundijong network to reinforce its water supply plus service the proposed Industrial land development cell.

A normal water main network will be established within this site as typical for an urban development. A concept water servicing plan is presented in **Appendix 2**.

It is expected the Corporations water supply planning can be extended over this site as part of the amendment to the Metropolitan Region Scheme.

8.0 DRAINAGE

Oversby Consulting have been appointed to prepare the District Water Management Strategy (DWMS) for this site. Refer to the DWMS for a description of the site, the operation of the existing drainage network, ground water advice, modelling outcomes and post development arrangements.

In summary, the outcomes of the DWMS are as follows:

- the Oakland Water Corporation open drain will retain current flow capacity and storage;
- the existing on site flood storage volumes will be maintained;
- corridors to manage flood water to pass through will be established;
- fill will be placed to manage ground water and flood separation;
- living streams will be established to attenuate post development runoff and allow for conveyance of stormwater generated onsite;
- vegetated swales will assist with controlling groundwater rise; and
- standard street and lot drainage will be installed.

In conjunction with the earthwork requirements as noted in Section 5 of this report, the above are typical for a development of this nature and we do not foresee any issues that would prohibit urban development

9.0 ROADS

The four roads that border the site are controlled by the Shire of Serpentine Jarrahdale. Mundijong Road provides primary access to the Kwinana Freeway and South Western Highway, with King Road and Kargotich Road extending north to Thomas Road. Leopold Road is along the northern boundary of the site linking King and Kargotich Roads

KCTT have been appointed to undertake the Transport Impact Assessment (TIA) for this site. Please refer to the TIA for further details. In summary, it considered the following to enable comment on road safety, the internal road network and intersection controls as well as provide road sections based on liveable neighbourhoods

- land use,
- road network information,
- traffic volumes,
- crash information,
- public transport,
- pedestrian/cyclist infrastructure,
- RAV routes,
- trip generation, and
- analysis of networks

The existing intersections on the four corners of the site are either stop or give way controlled. It appears all intersections have sufficient lines of sight. The TIA notes it is likely intersection upgrades will be required pending traffic volumes and distribution. Based on our assessment, we do not foresee any constraints that would prohibit the upgrade of these intersections.

Each of the perimeter roads will have intersections to allow access into the site. It is not expected the geometry or profile of these existing roads will impact on the locations of these future intersections. It is expected any intersections off Mundijong Road will require a bridge or culvert arrangement to allow the road to pass over the existing Oakland Drain.

The site will have an internal road network with varying road hierarchies as typical with a development of this nature.

The Main Roads WA Restricted Access Vehicle (RAV) mapping confirms King Road and the Western portion of Mundijong Road are RAV 4 compliant with Kargotich Road being RAV 3 compliant. It is noted RAV access is typically not required for a residential development. Although possible, it is expected that internal RAV access will not be required for this development.

Main Roads WA plan to extend Tonkin Highway past Mundijong Road to the South West Highway. The Main Roads WA website confirms development works are continuing throughout 2022. A Construction program is not available however informal advice suggests construction may commence in 2024. It is expected the extension will cross Mundijong Road approximately 1.8km east of the site. It is understood the road reserve for the future Tonkin Highway exists and federal funding has been committed. The Tonkin Highway extension will not impact on the development of this site.

The TIA (Section 2.19) notes Nicholson Road is to be extended to Mundijong Road and classified as Integrator Arterial. The TIA's "Proposed Changes in the Surround Road and Rail Network Plan" shows Nicholson diverting down to Boomerang and onto King. We are of the opinion this arrangement is likely as it minimises the number of rail and drain crossings plus reduces the number of intersections on Mundijong Road.

There is a rail corridor running parallel to Leipold Road. The King and Kargotich Road crossings are at grade and fully controlled (boom and light). The rail crosses King Road about 700m north of Leipold Road and crosses Kargotich Road about 1,000m north of Leipold Road. Refer the below for further details.

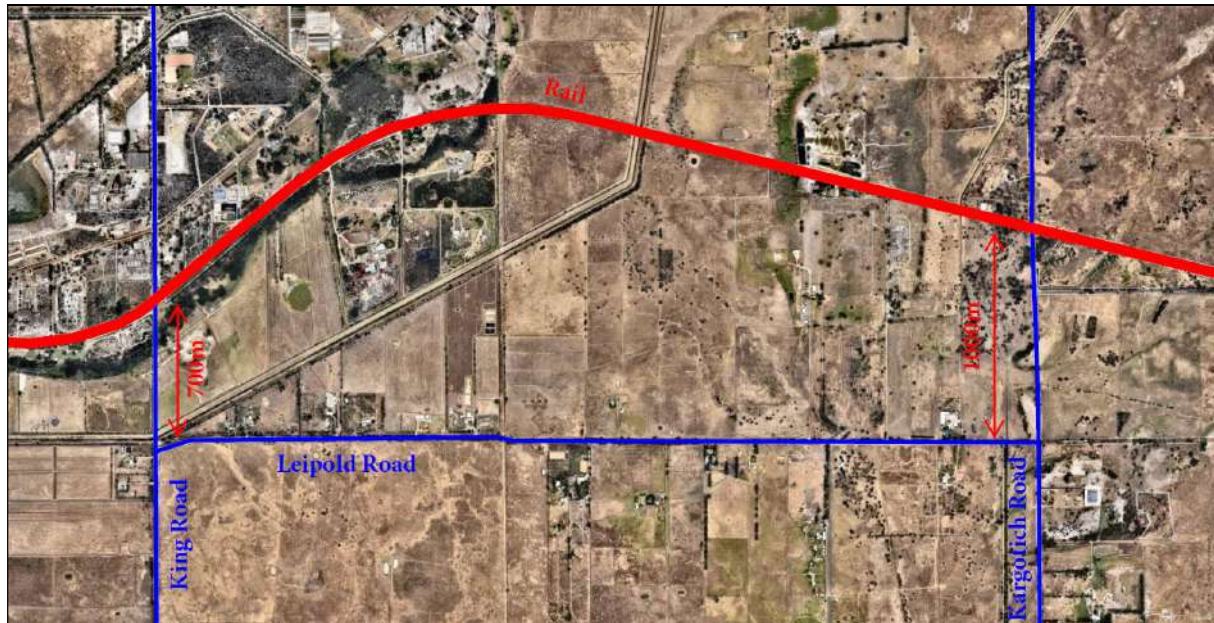


Figure 3 – Proximity of Rail Infrastructure

Due to Mundijong Road's connectivity, primary vehicle access to the site will be from the south. Due to the separation, the rail's impact on this development is expected to be negligible.

Based on the outcomes of our investigations, we do not foresee any issues that would prohibit urban development.

10.0 POWER

A review of the Western Power database shows two high voltage transmission lines running north-south through the site. One appears to be contained within Serpentine Trunk Main corridor and the other is approximately 500m west of Kargotich Road (contained in its own service corridor). It is expected these transmissions lines will remain. There are existing high voltage distribution lines along portions of the existing road reserves as typically expected.

A review of the Western Power mapping (2026) confirms the south western corner of the site has approximately 15 to 20 MVA spare capacity whereas the balance of the site has less than 5 MVA spare capacity. Previous Western Power advice indicated reinforcing works are required on their Byford Station to increase the supply in the broader area. These reinforcing works will increase available power to not only this site but also the greater Serpentine Jarrahdale district. It is likely a high voltage feeder extension is needed to provide a point of supply to the site as expected with all large scale developments.

Early engagement with Western Power is recommended to progress the power supply discussions. This will outline the scope of any feeder works as well as emphasize to Western Power the importance of upgrading supply to their Byford Station. It is expected this process will take time to complete however this can be undertaken concurrently with the planning phase. It is expected a resolution on the power supply arrangements for the site will be achieved.

Once a point of supply has been established, it is expected the site will have a traditional high and low voltage network, as is typical with a development of this nature.

11.0 COMMUNICATIONS

There are existing communication networks in the surrounding road reserves. Due to the size and scale of development, it is expected NBN be the default communications provider. There are other providers who can offer a point of difference to NBN. Due to the size of this site, it is expected all would be interested in this project. Early engagement with the communications provider is recommended to ensure connections are available when required.

We do not foresee any communications issues that would prohibit urban development.

12.0 GAS SUPPLY

ATCO Gas' distribution mapping confirms they have a high pressure feeder that runs south along Soldiers Road terminating at Mundijong. There is a feeder that heads west along Bishop Road that terminates approximately 4 km from the north eastern corner of the site. If a gas supply is required for this development, it is likely an extension from Bishop Road is needed. A standard gas reticulation network would be established from this extension to service each of the lots.

It is recommended early engagement with ATCO is arranged to manage this gas service if required.

The Australia Gas Infrastructure Group have advised the Dampier Bunbury Natural Gas Pipeline corridor is positioned well clear of the site, some 7km to the south west.

We do not foresee any gas supply issues that would prohibit urban development.

13.0 SUMMARY

The size of the site and limited number of individual lots simplifies the rezoning and development process resulting in shorter timeframes and efficient designs (road, POS and infrastructure).

The expected ground conditions for this site are not dissimilar to other residential areas within close proximity to the bottom of the Darling Scarp. The findings of the DWMS, as summarised in Section 8 of this report, are typical for a development of this nature.

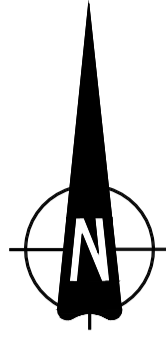
There is minimal services planning for the site due to its current zoning. When the rezoning application is initiated, each of the service authorities will consider how they can establish a point of supply. Our investigations confirm this site is no different to others that are on the fringe of development and points of supply for each can be provided by the various service authorities.

It is recommended continual discussions are held with the service authorities to ensure their planning and the provision of their infrastructure aligns with the development of this site.

Primary access to the site is via Mundijong Road. This intersects with both Kwinana Freeway and South Western Highway as well as the future Tonkin Highway interchange. Access into the site can be off Mundijong Road or any of the other three bounding roads.

No engineering or servicing constraints have been identified that would prohibit urban development of this site.

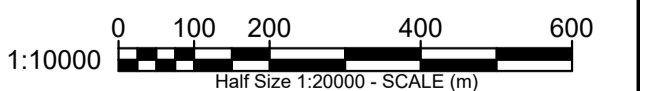
APPENDIX 1 – Concept Wastewater Servicing Plan



LEGEND

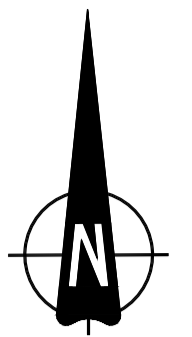
- RETICULATION BOUNDARY
- PROPOSED GRAVITY SEWER
- PROPOSED WASTE WATER PUMP STATION AND PRESSURE MAIN
- FUTURE WASTE WATER PUMP STATION "50-086" AND PRESSURE MAIN
- PROPOSED PRIMARY SUBDIVISION ROADS
- PROPOSED POS ADJACENT TO PRIMARY INFRASTRUCTURE
- INTERIM SCOTT ROAD WFPS TYPE 90

PROPOSED WFPS A
 CATCHMENT AREA = 420 ha
 GSDP = 92 l/s
 PUMPED FLOW = 123l/s

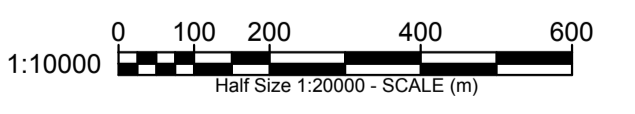


<p>PROJECT:</p> <h2 style="text-align: center;">MUNDIJONG WEST MUNDIJONG</h2>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="font-size: 8px;">C</td> <td style="font-size: 8px;">22-3-2022</td> <td style="font-size: 8px;">EXTERNAL WATER CORPORATION INFRASTRUCTURE ADDED</td> </tr> <tr> <td style="font-size: 8px;">B</td> <td style="font-size: 8px;">16-11-2020</td> <td style="font-size: 8px;">LAYOUT ALTERED</td> </tr> <tr> <td style="font-size: 8px;">A</td> <td style="font-size: 8px;">3-7-2020</td> <td style="font-size: 8px;">ISSUED FOR APPROVAL</td> </tr> <tr> <td style="font-size: 8px;">No.</td> <td style="font-size: 8px;">DATE</td> <td style="font-size: 8px;">REVISION</td> </tr> </table>	C	22-3-2022	EXTERNAL WATER CORPORATION INFRASTRUCTURE ADDED	B	16-11-2020	LAYOUT ALTERED	A	3-7-2020	ISSUED FOR APPROVAL	No.	DATE	REVISION	<p style="font-size: 8px; text-align: center;">COPYRIGHT</p> <p style="font-size: 8px;">COPYRIGHT IN THIS DRAWING IS THE PROPERTY OF THE CONSULTANT. THE CLIENT HAS LICENSE TO USE THIS DRAWING FOR THE PROJECT ONLY. THE USER SHALL BE RESPONSIBLE FOR "SITE CHECKING" ALL DIMENSIONS BEFORE COMMENCEMENT OF WORK. CAD DRAWING OR NOT MANUALLY ALTER.</p> <p style="font-size: 8px;">ONLY PLANS WITH NUMERICAL REVISION (REV '1' OR HIGHER) AND SIGNED AS APPROVED SHALL BE USED FOR CONSTRUCTION.</p>	<p style="font-size: 8px;">Level 2 Kishorn Court 58 Kishorn Road HQ Pleasant 6153 WA PO Box 1836 Canning Bridge 6153 WA Tel (08) 9315 9955 Email office@portereng.com.au www.portereng.com.au</p> <p style="font-size: 8px;">T2090 Pty Ltd ACN 078 971 748 is a trustee for the Consulting Engineering Unit Trading as Porter Consulting Engineers ABN 78 638 295 981</p>	<p>CLIENT:</p> <h3 style="text-align: center;">WPG LANDHOLDINGS PTY LTD</h3>	<p>DRAWING:</p> <h3 style="text-align: center;">CONCEPT SEWER SERVICING PLAN</h3> <p>STATUS: FOR APPROVAL</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="font-size: 8px;">SCALE</td> <td style="font-size: 8px;">1:10000</td> <td style="font-size: 8px;">DRAWING No.</td> <td style="font-size: 8px;">REV No.</td> <td style="font-size: 8px;">ORIGINAL DRAWING SIZE</td> </tr> <tr> <td style="font-size: 8px;">DATE</td> <td style="font-size: 8px;">JULY 2020</td> <td style="font-size: 12px; text-align: center;">19-1-10/200</td> <td style="font-size: 12px; text-align: center;">C</td> <td style="font-size: 12px; text-align: center;">A1</td> </tr> <tr> <td style="font-size: 8px;">DESIGN</td> <td style="font-size: 8px;">SCH</td> <td colspan="3" style="font-size: 8px;">FILE NAME S:\ACTIVE PROJECTS\19-01-010\ACAD\1910-200.dwg</td> </tr> <tr> <td style="font-size: 8px;">DRAWN</td> <td style="font-size: 8px;">MEG</td> <td style="font-size: 8px;">CHECK</td> <td style="font-size: 8px;">APPD</td> <td style="font-size: 8px;"></td> </tr> </table>	SCALE	1:10000	DRAWING No.	REV No.	ORIGINAL DRAWING SIZE	DATE	JULY 2020	19-1-10/200	C	A1	DESIGN	SCH	FILE NAME S:\ACTIVE PROJECTS\19-01-010\ACAD\1910-200.dwg			DRAWN	MEG	CHECK	APPD	
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APPENDIX 2 - Concept Water Servicing Plan



- LEGEND**
- RETICULATION BOUNDARY
 - PROPOSED WATER RETICULATION #200
 - PROPOSED WATER DISTRIBUTION MAIN
 - EXISTING WATER RETICULATION
 - PROPOSED PRIMARY SUBDIVISION ROADS
 - WATER CORPORATION DN1370, DN1220 AND DN1065 WATER MAINS
 - PROPOSED POS ADJACENT TO PRIMARY INFRASTRUCTURE



PROJECT: **MUNDIJONG ROAD MUNDIJONG**

B	16-11-2020	LAYOUT CHANGES	MEG
A	3-7-2020	ISSUED FOR APPROVAL	MEG
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Porter
 Consulting Engineers
 Level 2 Kishorn Court
 58 Kishorn Road
 Mt Pleasant 6153 WA
 PO Box 1836
 Canning Bridge 6153 WA
 Tel (08) 9315 9955
 Email office@portereng.com.au
 www.portereng.com.au
T19060 Pty Ltd AIN 018 991 748 as trustee for the Consulting Engineers Unit Trust trading as Porter Consulting Engineers AIN 78 638 296 391

CLIENT: **WPG LANDHOLDINGS PTY LTD**

DRAWING: **CONCEPT WATER SERVICING PLAN**
 STATUS: **FOR APPROVAL**

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Level 2 Kishorn Court
58 Kishorn Road
Mount Pleasant 6153
Western Australia

PO Box 1036
Canning Bridge 6153
Western Australia

Tel: (08) 9315 9955
Email: office@portereng.com.au

www.portereng.com.au

**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 2.5

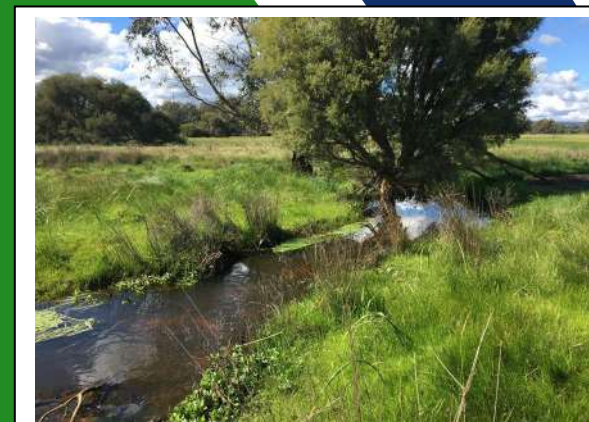
District Water Management Strategy





West Mundijong Urban Precinct DISTRICT WATER MANAGEMENT STRATEGY

For the land bound by Mundijong Road, King Road, Leipold Road and Gangemi Road



DOCUMENT QUALITY CONTROL

Project Reference		B20011
Ver No.	Purpose	Date
Draft	Client Review	November 2020
Draft V2	Updated with Project team comments	December 2020
Draft V3	Updated with Project team comments	February 2021
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Oversby Consulting

Water and Environmental Management

Brendan Oversby

Director

 0447 614 411
 brendan@oversbyconsulting.com.au
 www.oversbyconsulting.com.au
 PO Box 369 DARDANUP WA 6236



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1 EXECUTIVE SUMMARY

This District Water Management Strategy (DWMS) has been prepared to support the landowners' proposal for the future development of the Mundijong West Urban Precinct.

The objective of this DWMS is to detail the best management practices approach to water management that will be undertaken for this future development, while considering its former landuses and nearby waterways. This will include managing, protecting and conserving the total water cycle of the DSP area and the greater catchment. These strategies respond to the area's drying climate, accessible water resources, Water Corporation drainage network and site landforms.

The site is connected to and is influenced by two Water Corporation main drains (Oakford and Berriga). The management strategies work with these structures and their current flood regimes. The strategies also take into account the high groundwater and relatively flat landscape, by using systems that both manage stormwater and groundwater within Multiple Use Corridors.

The proponents are committed to the concepts and outcomes outlined within this report. This includes providing a framework to assist with the future implementation, monitoring and maintenance of the best management practices designed specifically for this development.

The effectiveness, efficiency and benefits provided by the best management practices outlined, require a longterm collaborative effort between the Shire of Serpentine Jarradale, Water Corporation, future developers and other relevant regulatory authorities. This will include negotiated transfers as relevant for local drainage networks to the Shire, while allowing Water Corporation to manage the larger main drains as required. Through this collaboration, the strategies will allow the water management on site to complement the proposed residential uses by providing sustainable water servicing and stormwater management and enhancement of environmental attributes of the subject land and its surrounds. The practices utilised are summarised in more detail in the Key Elements Section.

Table 1 Details of subject land lots

Lot No.	No	Street	Vol / Folio	Plan	Area (sqm)
275	1087	Mundijong Road	1404 / 934	152839	46.7163 Ha
725		Mundijong Road	1276 / 108	3484	56.3297 Ha
726		Mundijong Road	1456 / 960	3484	58.9930 Ha
727	771	King Road	1456 / 961	3484	58.9576 Ha
724	729	King Road	1771 / 700	3484	158.5245 Ha
2	467	Leipold Road	1486 / 108	52159	21.1682 Ha
800	457	Leipold Road	2590 / 716	44854	10.5894 Ha
801	447	Leipold Road	2590 / 717	44854	10.5821 Ha
264	409	Leipold Road	1275 / 455	152837	46.9005 Ha
265		Leipold Road	1275 / 454	152837	22.5840 Ha
123	289	Leipold Road	1299/789	9965	22.1970 Ha
2	365	Leipold Road	1449 / 938	51048	24.3378 Ha
1	331	Leipold Road	1449 / 938	51048	20.3312 Ha
272		Mundijong Road	1672 / 100	152839	31.3328 Ha
273		Mundijong Road	1672 / 100	152839	13.3749 Ha
274		Mundijong Road	1016 / 707	152839	44.1082 Ha

PLANNING SUMMARY

The DWMS supports a Metropolitan Region Scheme (MRS) amendment to rezone the subject land from 'Rural' to 'Urban'. The subject land comprises of the properties listed in Table 1 and is bound by Mundijong Road, Gangemi Road, Leipold Road and Kind Road. Land to the east of Gangemi Road between the subject land and Kargotich Road is to remain as Rural. This will act as an effective 1km buffer between the West Mundijong Industrial Area and the proposed 'Urban' development on the subject land, should the MRS amendment be approved. Other land to the north, west and south of the subject land is also proposed to remain 'Rural'. The DWMS investigation includes the land between Gangemi Road and Kargotich Road, so that the effect on the subject land from stormwater and flood management in this area is considered.

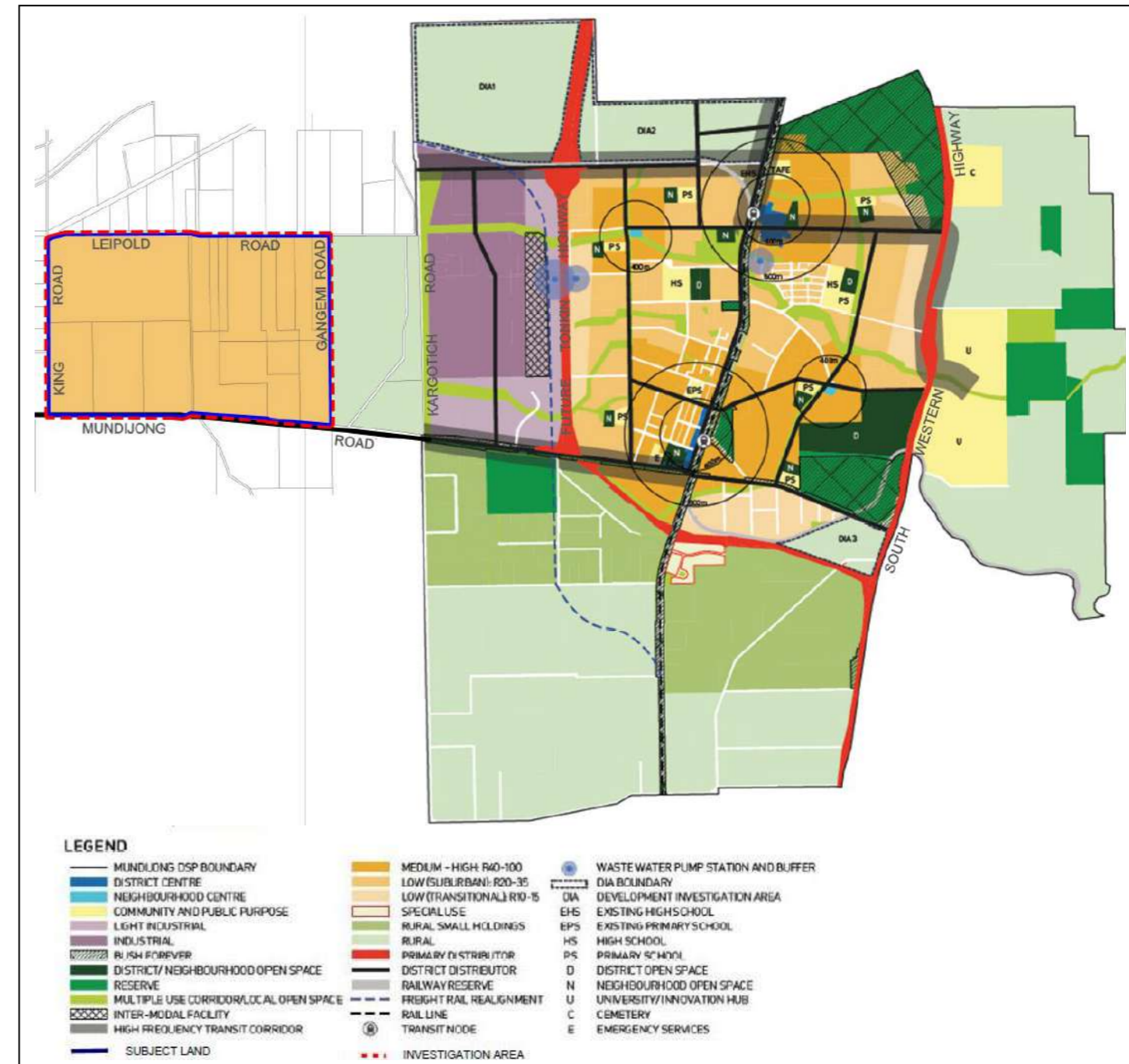


Figure 1 Zoning Plan

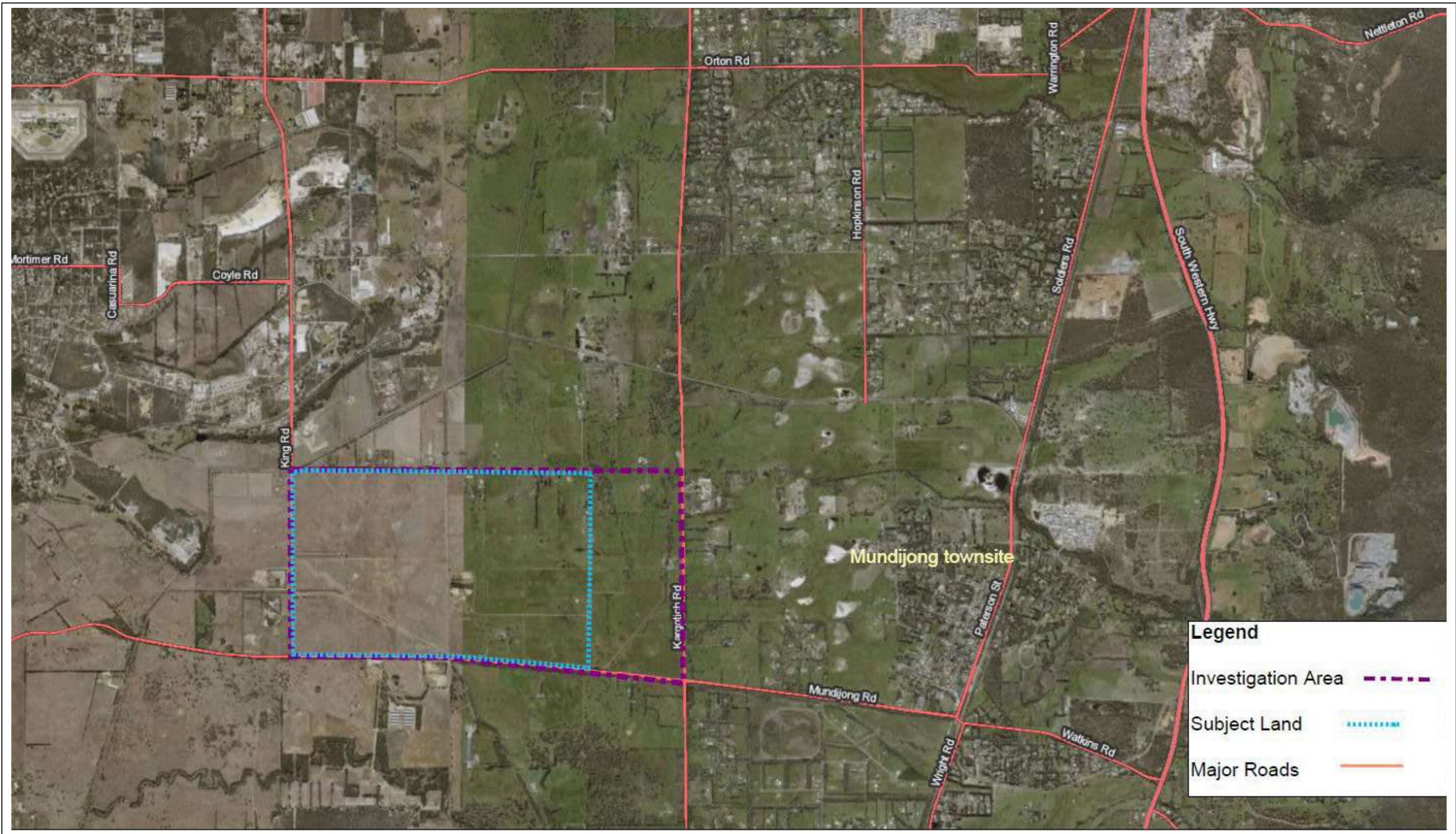


Figure 2 Location plan

2 KEY ELEMENTS

The water management strategies for the subject land are based on best practice water sensitive urban design that integrates sustainability and the provision of functional residential areas. The strategies will be achieved through the synthesis of planning and design, with long-term collaborative management of the total water cycle. The plans and design for the development are appropriate for the subject land's development constraints, surrounding environment and proposed land use. They also allow for sustainable longterm management of the assets so as to maintain their intended function.

A summary of the Water Sensitive Urban Design (WSUD) elements that will be implemented within the development to achieve best management practices are outlined below, and visually represented in Figure 3. These strategies are to be further refined throughout the more detailed planning of the relevant Structure Plans and subdivision processes.

DRAINAGE AND FLOOD MANAGEMENT STRATEGY

- On lot and off lot detention systems, combined with treatment systems such as swales and POS based bioretention gardens will capture and treat stormwater flows.
- On lot storage is to be in accordance with the Shire's guidelines. Where required and subject to detailed design, small lots may have a direct connection to the road network storm water system, after storage is exceeded on the lot.
- A swale network within the road reserves and Multiple Use Corridors will direct and hold flows up to and including the 1% Annual Event Probability (AEP).
- All flows leaving the site up to the 1% AEP event are to match the pre development rate.
- The current flood storage volume is to be retained principally within areas left at the same level. These will be used for non-intensive land uses including Public Open Space (POS). There will also be some minor storage within Multiple Use Corridors.

All storage is to have an outlet at the base to allow systems to drain completely, minimising any standing water.

- As per state policy, current all finished floor levels will be designed to maintain a clear separation of 300mm between the habitable floor level and the 1% AEP event flood level, generated on site.
- As per state policy, all finished floor levels will be designed to maintain a clear separation of 500mm between the habitable floor levels and the modelled 1% AEP event flood level of the Oakland and Birrega Main Drains and any other relevant large waterway/flowline.

GROUNDWATER MANAGEMENT STRATEGY

- Inflows to the groundwater are to be treated through bioretention media and plants within the basins and swales, to improve the quality of water prior to it entering the groundwater.
- The swale network, along with subsoil systems, where required are to be used to control the groundwater level under road infrastructure, houses and other sensitive infrastructure.

SUSTAINABLE WATER SERVICING

- Residential houses are to be encouraged to incorporate rainwater storage devices where practical.
- All lots are to be connected to a potable reticulated water main to provide security of supply.
- Lots to be connected to mains sewage.
- Awareness raising material on water saving measures is to be provided to lot purchasers.
- Landscaping of the POS areas is to utilise waterwise practices. These include basins/swales etc directly watered by stormwater, minimal lawn areas and low/no irrigation areas planted with suitable native flora species. Minimal sporting field areas are envisaged, further minimising required water use.

WATER DEPENDENT ECOSYSTEM MANAGEMENT

- New habitat will be created within the vegetated swales and bioretention systems that mimic ephemeral wetlands and seasonal waterways.
- The Wetland system on Mundijong Road is to be protected by managing the stormwater, groundwater and access within the subject land. The protection will reflect its final classification at the time of development
- The WSUD elements used on site will treat stormwater and groundwater, improving the water quality prior to it entering downstream sensitive ecosystems.
- Flows rates to downstream sensitive ecosystems will be managed to predevelopment rates.

Liaison with relevant agencies including Peel Harvey Catchment Council is to be undertaken to achieve suitable outcomes for onsite and downstream ecosystems.

MONITORING AND MAINTENANCE

- Pre development monitoring of groundwater is to be undertaken as part of the Local Water Management Strategy (LWMS) and reviewed in relation to other nearby studies and groundwater records.
- Monitoring is to be undertaken through the construction phase of each stage for surface water and potentially groundwater in relation to possible contamination.
- Post development monitoring is to consider surface and groundwater quality, ecosystem enhancement and WSUD structural performance

IMPLEMENTATION AND GOVERNANCE

- Developers are to undertake detailed LWMS's and Urban Water Management Plan's (UWMP's) to provide the necessary information for management of water across the site.
- The Shire, Water Corporation and Department of Water are to continue to provide guidance, direction and assistance so that the targets outlined in this report are able to be realised.

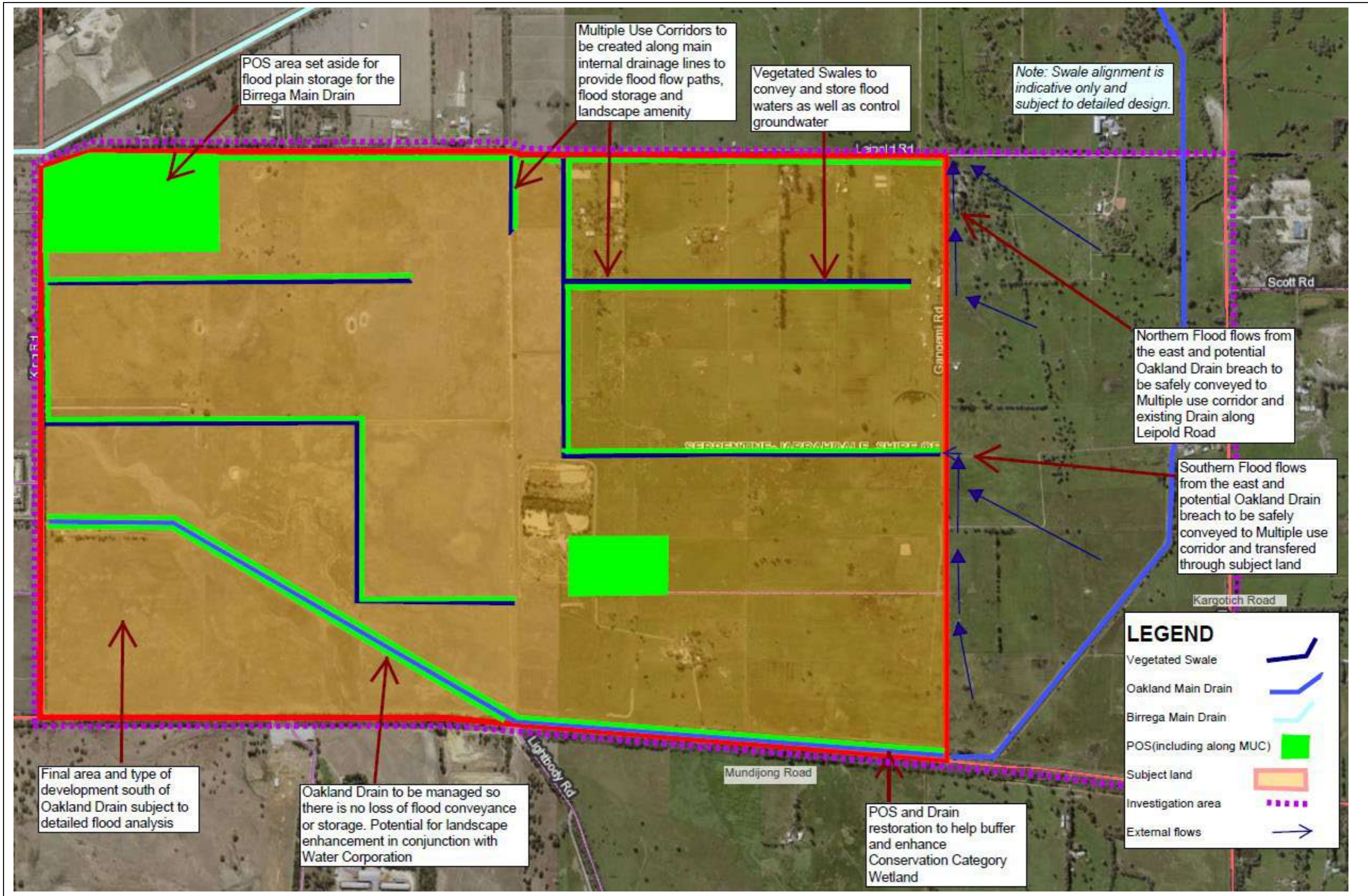


Figure 3 Key Elements Plan

3 GENERAL SITE CHARACTERISTICS

LANDFORM

The subject land is located on the eastern portion of the Swan Coastal Plain. As such the majority of the site is considered Pinjarra Plain, which is generally relatively flat. A small area of the Bassendean Sand Dune system occurs in the north east corner of the site.

Site topography can be characterised as relatively flat with a slope gradient of around 1 in 680 for the Pinjarra Plain areas. The slope increases to approximately 1 in 400 on the sides of the small sand dune areas. The general fall is to the west – north west with a high point of approximately 14m AHD in the south east corner (as well as isolated areas along the Oakland Drain bund) and a low point of approximately 10m AHD in the north west corner

There are some small shallow trapped lots that fill with surface water after winter rains. The historical clay pits are currently being backfilled with suitable material.

There are numerous small farm drains and sub main internal Water Corporation Drains. The other major water feature is the large Water Corporation Oakland Drain, which effectively forms a barrier to overland flow in all but extreme rainfall events.

These features can be seen in Figure 4.

CLIMATE

The subject area is within a temperate Mediterranean climate of cool wet winters and hot dry summers. Average rainfall since 1975, is approximately 830mm, with annual evaporation around 2080mm.

The effect of this climate, in conjunction with the terrain, means that there is a yearly seasonal rise in groundwater during winter and early spring. There is also likely to be more flow in the on-site drains and pooling surface water in isolated areas during the winter/spring period. Sporadic flows may also occur during summer storm activity during warmer months

SURFACE GEOLOGY AND ACID SULPHATE SOIL CHARACTERISTICS

Soil Types

Due to being located on the eastern side of the Swan Coastal Plain the site is underlain predominately with Guilford Formation Sandy Clays of alluvial origin. A small area in the north-east corner of the site is considered to be Bassendean Sand (aeolian origin) over the Guildford Formation.

A more detailed assessment of the soils is as follows:

Seven of the sub-units belong to the Pinjarra Landscape Zone and two are associated with the Bassendean Landscape Zone (Plate 3).

Pinjarra Landscape Zone

- 213Pj_P1d – Flat to very gently undulating plain with deep acidic mottled (or effectively duplex) soils. Shallow pale sand to sandy loam over clay, imperfect to poorly drained and moderately susceptible to salinity.

- 213Pj_P2 – Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan layer at 1- 2m. Desktop Environmental Assessment – Various Lots Bounded by Mundijong Road, Kargotich Road, Leipold Road and King Road, Oldbury Aurora Environmental WPL2019-001-ENVA-001_at_V2 Page 12 of 44 13 March 2019

- 213Pj_P3 – Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.

- 213Pj_P4 – Poorly drained flats, sometimes with gilgai micro-relief and with moderately deep to deep black, olive grey and some yellowish brown cracking clays and less commonly noncracking friable clays with generally acidic sub-soils.

- 213Pj_P5 – Poorly drained flats, commonly with gilgai micro-relief and with deep black-grey to olive-brown cracking clays with subsoils becoming alkaline.

- 213Pj_SWP6b – Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well-drained soils associated with prior stream deposits. Soils are uniform brownish sands.

- 213Pj_P7 – Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and grey sandy duplex and effective duplex soils.

Bassendean Landscape Zone

- 212Bs_B1 – Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands, sometimes with a pale yellow B horizon or a weak iron organic hardpan at depths generally greater than 2m, Banksia dominant.

- 212Bs_B4 – Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain greater at depths generally greater than 1.5m by clay or less frequently a strong iron-organic hardpan.

Phosphorus Retention Index

The Phosphorus Retention Index for the sites soils is likely to be low to moderate in the thin Bassendean sand and high in the Guilford soils.

Infiltration/Permeability

The saturated permeability has not been tested for the subject land. The Guilford soil usually has a low permeability and a perched high groundwater. The Bassendean sands usually display a high permeability, with the groundwater sitting as a lens over the underlying Guilford soils.

Acid Sulphate Soils

The Acid Sulphate Soil (ASS) Risk Mapping shows that there is a moderate to low risk of ASS occurring within 3m of natural soil surface but high to moderate risk of ASS beyond 3m of natural soil surface

CONTAMINATED SITES

There are no contaminated sites registered within the subject land. Works associated with backfilling the clay pits is being carried out under guidance from DWER, with approval provided in 2018. The remainder of the site's long history of low intensity rural uses means the risk of widespread contamination is low.

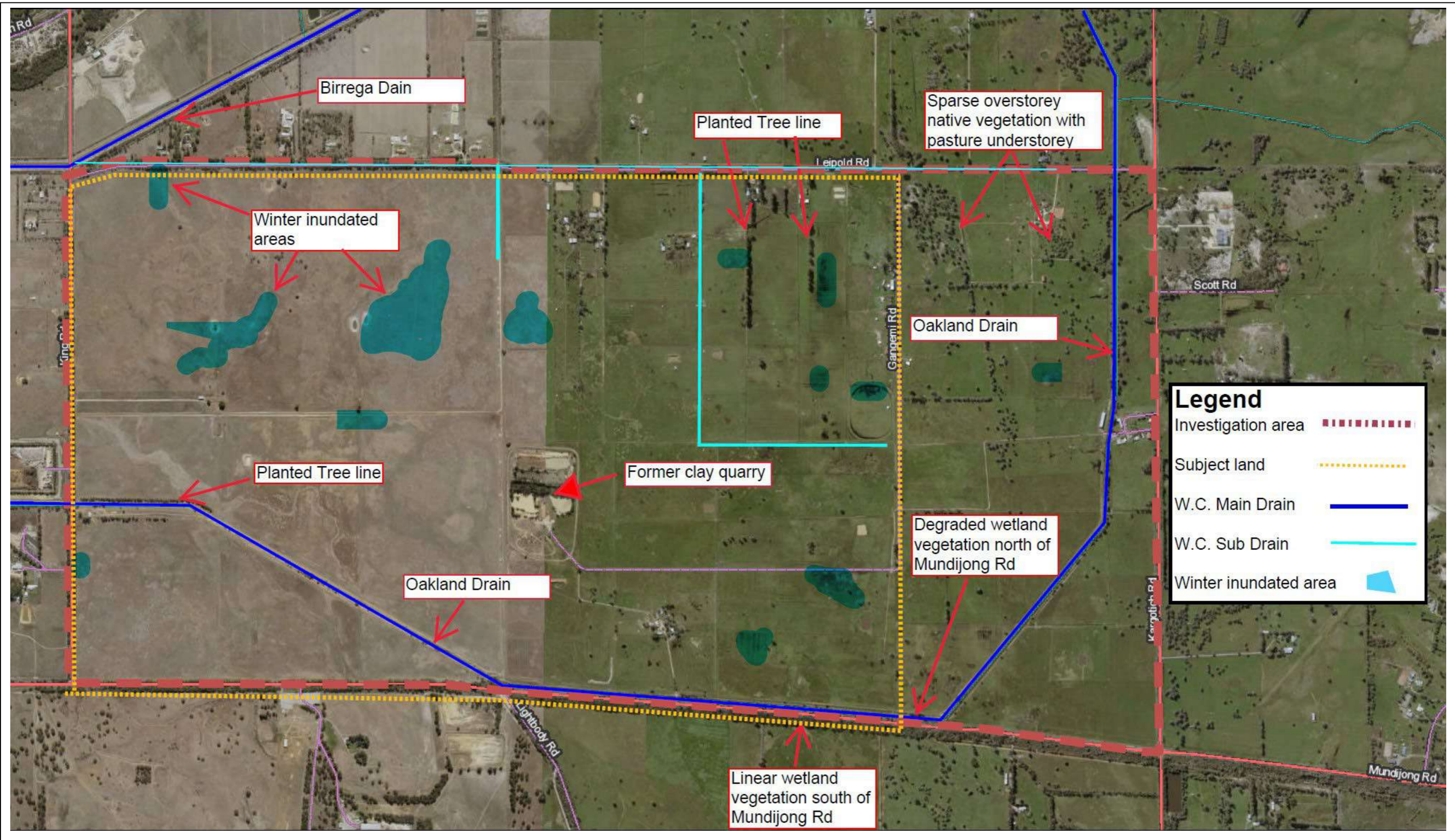


Figure 4 General Site Characteristics

4 ENVIRONMENT

WETLANDS AND WATERWAYS ECOLOGY

The entire site is considered a Multiple Use Wetland (UFI 16021). Along the southern boundary a Conservation Category Wetland (14817) sits within the Mundijong Road Reserve. This CCW extends along all of the southern boundary except for a small portion on the western end.

While CCW are generally considered to be of high ecological value, much of this vegetation has been degraded and contains a heavy weed load to the north of the Mundijong road pavement. The Oakland Drain is also likely to have affected the wetland function north of the pavement, as well as increased the level of disturbance. South of the road pavement, the vegetation tends to be of a higher quality. An investigation is being undertaken to determine the potential for reclassification for the area north of Mundijong Road, given the current degraded nature.

While there are no significant natural waterways remaining within the site, there are a number of drains that transport stormwater flow across the site. The main system is the Oakland Drain. This is generally banded on the western and northern side however does receive flows from both sides. Based on a site visit by Oversby Consulting in September 2020, the Oakland Drain is generally devoid of significant native vegetation, however in some areas there is a sparse covering of native tree species, predominately *Casuarina obesa*, *Eucalyptus rudis* and *Melaleuca raphiophylla*. There have also been some basic tree plantings along the top of the earth spoil banks using a range of Eucalyptus species. The base of the drain is predominately covered with pasture species and *Watsonia bulbifera*.

There are also a number of other smaller drains (see Figure 4), with some of these flowing north and eventually into the Berriga Main Drain, which lies just to the north west of the subject land. These smaller drains are generally covered with pasture grasses and environmental weed species. Where the drains are within the road reserves, they do sometimes contain *Casuarina obesa*, *Xanthorea* species and other isolated native species and area of tree plantings.

OTHER NATIVE VEGETATION

The only other native species within the subject land are scattered native trees including *Eucalyptus rudis*, *Casuarina obesa*, *Melaleuca raphiophylla* and *Corymbia calophylla*. Most of the paddock/laneway trees are non-local Eucalyptus species.

There is a small area of the southern boundary, where it adjoins Mundijong Road, that is mapped as Bush Forever.

There are no Threatened Ecological Communities within the subject land due to historical clearing and agricultural activities. There are some mapped TEC's on the southern side of the adjoining Mundijong Road Reserve.

FAUNA

Due to the lack of good quality wetlands and waterways within the subject land, there is unlikely to be fauna species that specifically require this habitat type. There may be some sporadic use of the site by wetland/waterway dependent fauna across the site to access the native vegetation within adjoining road reserves.

5 GROUNDWATER HYDROLOGY

GROUNDWATER INVESTIGATIONS

The Department of Water and Environmental Regulation (DWER) has undertaken broad scale analysis of the regions groundwater levels as part of Perth Regional Aquifer Modelling Systems (PRAMS) model development. Hydrology and groundwater modelling, with a focus on the Lower Serpentine Regional Model (2008) has also been undertaken. A review of DWER's minimum contours as depicted in Figure 8 was also considered, to confirm general flow direction.

This information was analysed, in conjunction with LIDAR as well as analysis of groundwater levels in DWER nearby bores and indicative groundwater contours produced as part of the adjoining industrial DWMS. There are four bores in or near the study area that have groundwater level information which were also analysed. These are:

- 61410148 - located on the southern border of the study area, near the south east corner;
- 61410130 - located 400m west of the south west corner of the study area;
- 61410131 - located approximately 800m north of the northwest corner of the study area; and
- 61410151 - located 750m north of the northeast corner of the study area.

Bore 41410148 had a 2020 peak of 7.427mAHD with a maximum of 14mAHD. The bore however is likely highly influenced by the adjoining Oakland Drain and its drawdown affect., Bore 61410151, showed a 2020 level of 16.9mAHD which is close to the maximum recorded of 17.18mAHD and also matches with the regional PRAMS modelling. Generally, over much of the subject land, it is likely that the superficial groundwater will rise until it is intercepted by the drainage network or the low areas of the surface then runs off. This limits further rise.

From this information, and visual site investigation during August 2020, indicative groundwater conditions for the site were determined. To be conservative, the site is assumed to have groundwater at approximately 200 -400mm below the surface, except in the areas indicated blue in Figure 4. This highlights the inundated areas. There may also be small areas of greater separation due to the low sand dunes and localised effects of the drainage network. The groundwater is moving generally in a westerly to north westerly direction, in keeping with the general fall of the land. There is likely to be localised drawdown around the onsite drains. Groundwater levels are to be obtained as part of the development of the LWMS for the subject land, allowing for refinement of maximum groundwater levels.

Groundwater quality has not been analysed in detail for the subject land. Due to the current land use and soil types present, it is likely that the nutrient levels of the groundwater will be elevated compared to forested catchment areas. This has the potential to currently impact on wetlands and river systems both adjoining and downstream of the subject land.

AQUIFER AND ALLOCATION INFORMATION

The subject land is within the Byford 2 sub area.

The DWER was contacted in October 2020 regarding groundwater availability for the subject land. The Yarragadee, was noted as having no allocation. The Perth-Cattamarra Coal Measures had no current allocation limit, the Perth Leederville had approximately 35% allocation available and the Perth-Superficial Swan had some allocation, noting that the yield rate may be low in some locations, especially towards the east. This means there is potential groundwater resources that may be used within the development. Applications will need to be made to the DWER at later stages of planning to ascertain the actual water resources available at that time, and in which aquifer. Should allocations not be readily available, then trading will be undertaken to secure an allocation.

It should also be noted that the thickness of the superficial aquifer is generally thin and may contain clay and colluvial sediments being so close to the scarp. This may impact on the daily yields available due to a reduced hydraulic conductivity.

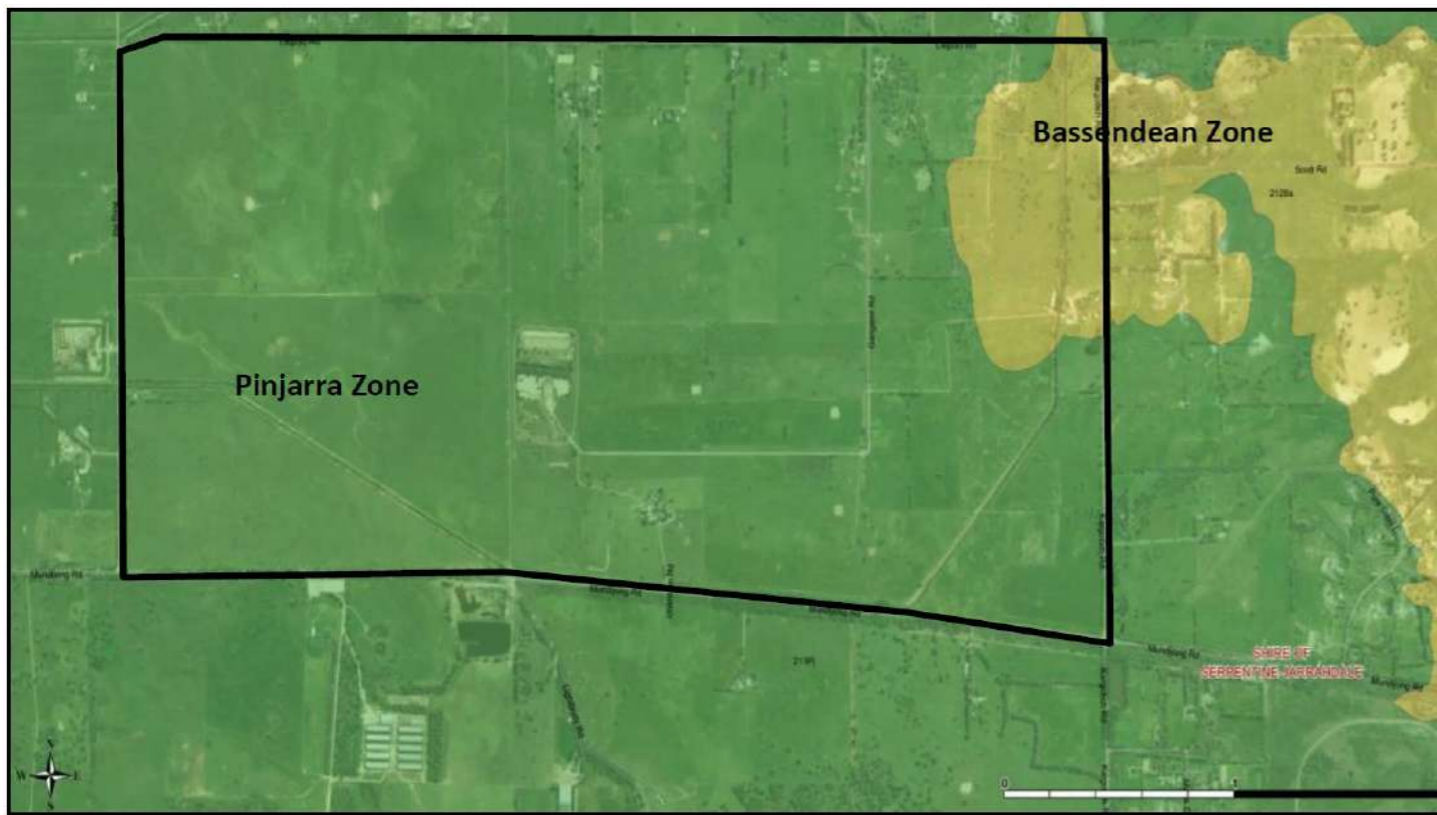


Figure 5 Overall Soil Type

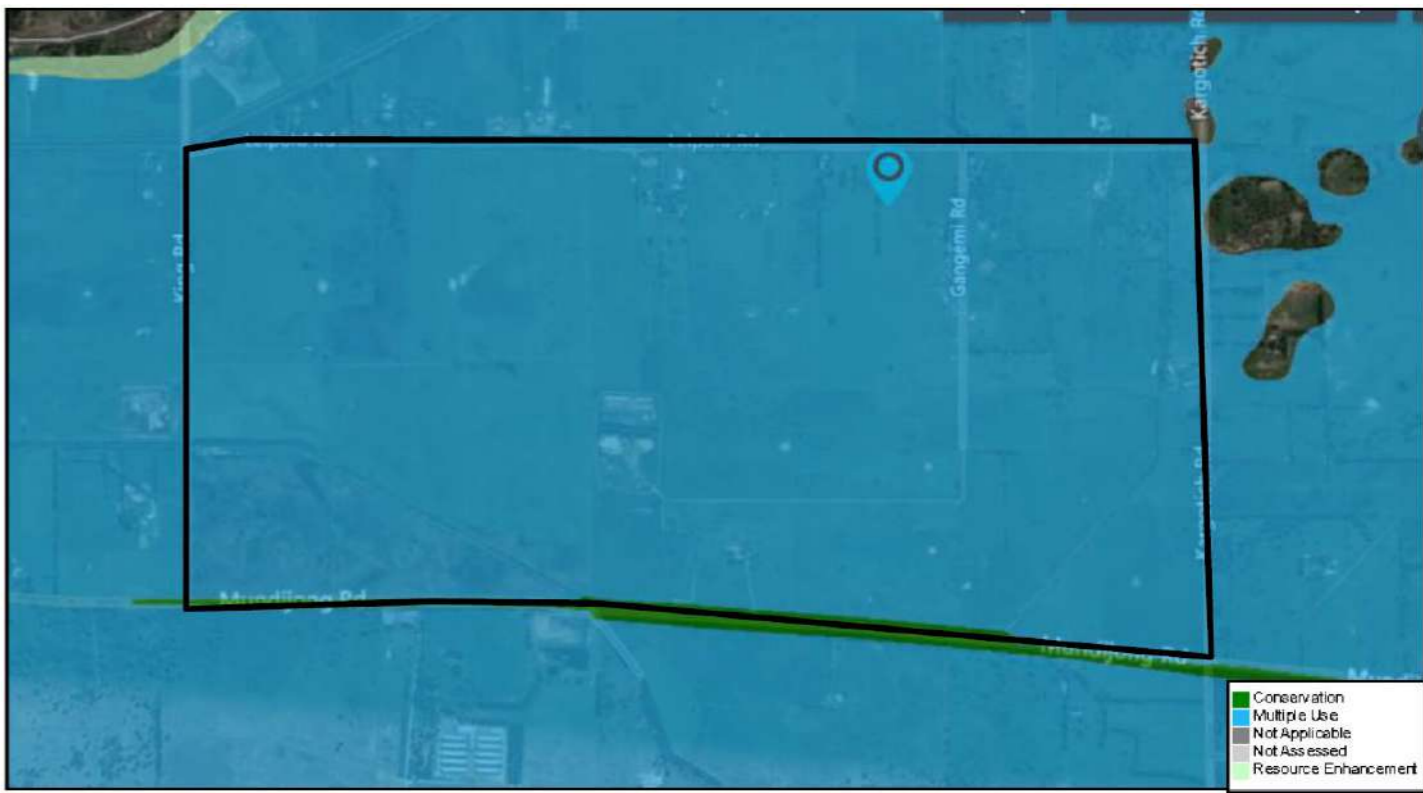


Figure 7 Wetland Mapping

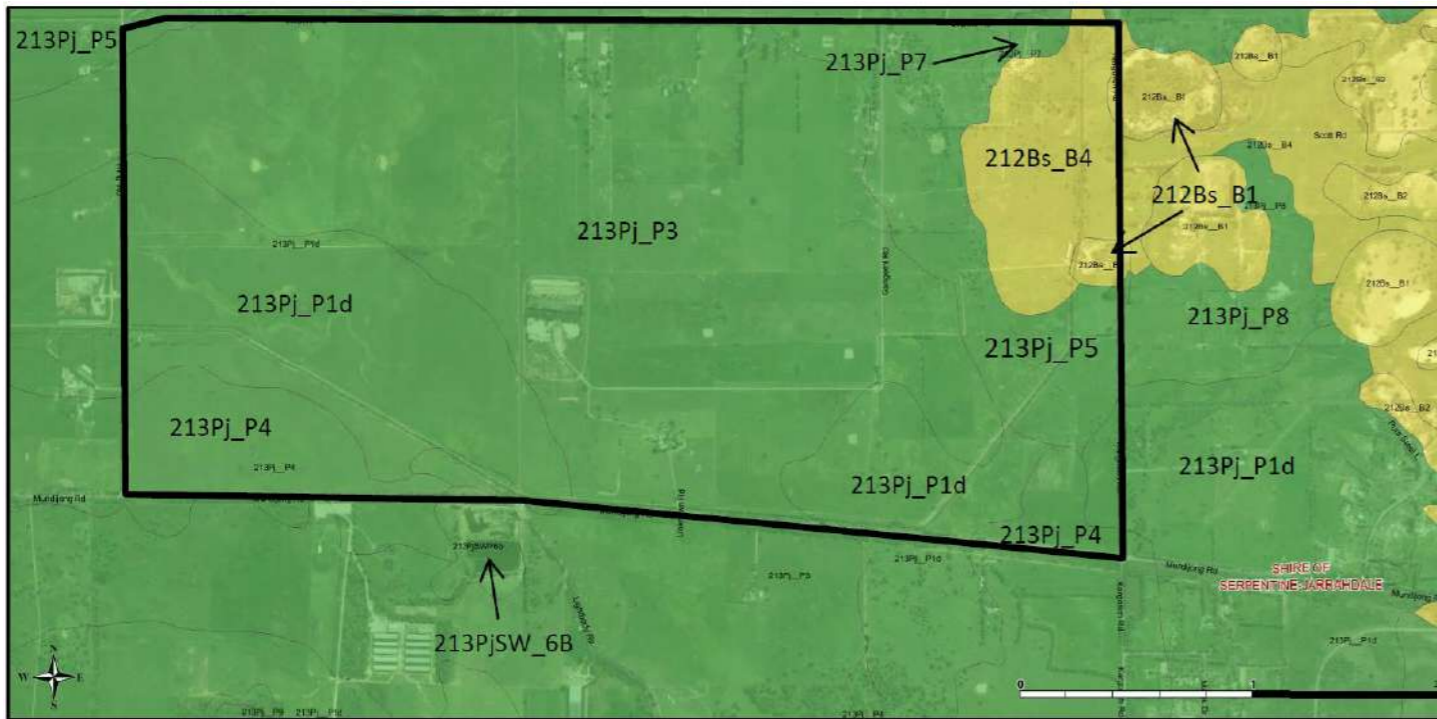


Figure 6 Refined Soil Sub-group

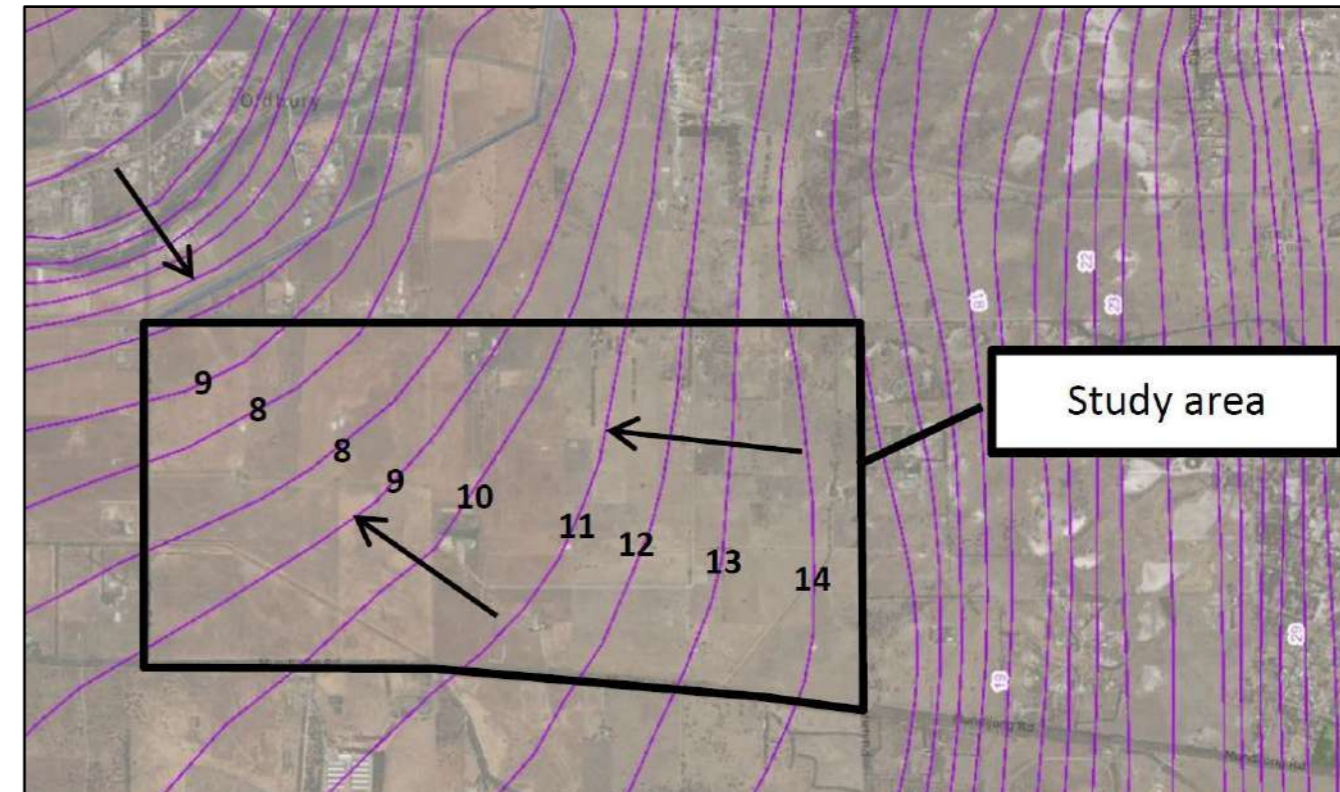


Figure 8 Regional mapped groundwater contours (minimums)

6 PRE-DEVELOPMENT SURFACE WATER HYDROLOGY

SURFACE WATER FEATURES

The subject land is within the Birrega Main Drain and Oakland Main Drain Catchments.

Due to historical drainage works, the majority of the site now drains to west and north via farm drains and small Water Corporation subdrains. The exception to this is the land to the east and south of the Oakland Drain, which feeds the Oakland Drain system.

FLOODING OF THE SITE

Large parts of the existing site are impacted by regional flooding from the Birrega and Oaklands main drains, as shown in Figure 10. This flooding has been determined through detailed flood modelling undertaken by the Department of Water and Environmental Regulation (DWER) and is considered fit for purpose for the current level of planning. Flooding within the site, as determined by this modelling, is generally less than 0.5m deep. There are 2 main exceptions to this, with these being:

- a) to the east of the Oakland drain, near Kargotich Road. This is caused by flood water spilling out of the Oakland Drain,
- b) and in the north west corner of the site, flood waters of the Birrega main drain flood back into the site. The other localised deeper areas are associated farm dams and the former clay quarry, which is currently being backfilled.

Both the Oaklands and Birrega main drains have informal elevated levee bunds along their western (and northern, in the case of Oaklands main drain) sides. These bunds are formed by spoil from the original excavation of the drains and have been increased over time with dredged spoil during maintenance activity.

During major flood events, floodwater from the drains and from adjacent land that cannot be accommodated in the drainage channels tends to build up on the un-leveed side of each drain leaving the western side relatively free of flooding. However, there are a number of locations where the informal levee banks will be breached by predicted flood levels, and other locations where there is potential for levee failure. In these locations, floodwaters may leave the drains and flow west to north west across adjacent land.

In the study area, the western levee bank of the Oaklands Main Drain is predicted to breach causing floodwaters to traverse the north eastern corner of the site. Additionally, the north west corner of the site, and portions of the site to the east and south of the Oaklands main drain are impacted by flooding associated with the main drains. The current DWER flood mapping takes into account the likely breaching of the informal levee banks.

DRAINAGE NETWORK

The predevelopment drainage model has been constructed based on original design drawings of the drains. Typically, the drains are steep sided (1:1.5) and 2m wide at the base with depths varying from 1-2m. A hydraulic roughness of 0.025 has been applied in the predevelopment model consistent with the Water Corporation design calculations although a lower hydraulic roughness of 0.015 has been applied at culverts.

Subcatchment delineation

Modelled subcatchments have been delineated for the site based on analysis of LiDAR elevation data coupled with drainage layouts provided by the Water Corporation.

Broadly, the majority of the site may be considered as a single catchment draining to the north west and feeding into the Birrega main drain via Birrega Sub-drain C1. The remainder of the site, to the east and south of the Oaklands main drain drains into the Oaklands main drain at various locations along its path.

The Birrega main drain catchment has been divided into smaller subcatchments for modelling purposes to align with drainage information provided by the Water Corporation. This has produced eleven culverted connections from the site crossing Leipold Road to feed into Birrega Sub-drain C1. These can be seen in Figure 14.

A review of Streetview mapping along Leipold Road was undertaken to review these locations and all were observable, although the condition of these culverts and degree of blockage could not be established by this method and a survey of these connections is recommended as part of later detailed design.

The model has been constructed to terminate on discharge into the Birrega main drain and includes two external catchments to the north connected to the Birrega Sub-drain C.

Rainfall

Rainfall for design events were developed using ARR2016 and BoM IFD ensemble methodology resulting in an ensemble of 10 rainfall simulation events for each design storm. Ensembles were generated for 1EY, 50%, 20% and 1% AEP events of 30min, 1hr, 3hr, 6hr, 12hr, 24hr and 72hr durations. Ensemble runs were analysed to determine the event resulting in the median peak flow from the site for each duration and the maximum of these was selected for presentation as the critical event for this study.

Runoff parameterisation

Australian Rainfall and Runoff (ARR2019) provides spatially distributed recommendations for initial and continuing loss rates for application in pervious areas of rural catchments. For this site, the recommended rates are:

- Initial loss – 30 mm
- Continuing loss – 2.9 mm/hr

ARR2019 also recommends that impervious areas are allocated initial losses of 1-2mm and zero continuing loss. For the predevelopment model of this site, catchments have been parameterised based on these rates with an estimated 20% impervious area allocation which accounts for roads, roofs, hardstand areas and direct rainfall into drains. A full summary of parameters applied in this study is presented in the West Mundijong Urban Precinct Hydrological Modelling 2020 (Drainage Report) in Appendix A.

Validation with floodplain mapping

Predevelopment modelling results for larger design events (20% AEP and 1%AEP) have been compared to DWER floodplain modelling of the site to review the model's performance in simulating these larger events. A summary of predevelopment simulation results compared to DWER floodplain modelling information is presented in Table 2. The calibration and modelling also includes a backwater effect from the Main Drain with the levels being 11.2mAHD and 11.4mAHD for the 20% AEP and 1% AEP respectively.

The comparison can be seen in Table 2.

Further details related to the modelling can be found in the Drainage Report (Appendix A)

SURFACE WATER QUALITY

There has been no surface water quality testing. It is likely that the water quality would have moderate nutrients due to the majority of the site being active broadscale farmland.



Figure 9 Major and Minor Drainage Lines

West Mundijong Urban Precinct DWMS

Table 2 Predevelopment flows and flood levels

Event/Location	Peak flow		Top water level	
	WC design	Site model	WC design	Site model
50% AEP (3hr#6/7)				
Sub-drain C1 outlet	4.8	3.45	9.7	9.62
Sub-drain C1a outlet	0.3	0.36	11.3	11.19
Sub-drain C1b outlet	1.4	1.32	11.6	11.48
Sub-drain C1c outlet	n/a	1.29	n/a	9.22
20%AEP (1hr#1/2)	DWER Model	Site model	DWER Model	Site Model
Sub-drain C1 outlet	n/a	4.69	10.82	10.65
Sub-drain C1a outlet	n/a	0.50	11.44	11.50
Sub-drain C1b outlet	n/a	1.82	11.82	11.74
Sub-drain C1c outlet	n/a	1.68	10.67	10.63
1% AEP (6hr#1/10)	DWER model	Site model	DWER model	Site model
Sub-drain C1 outlet	n/a	8.83	11.48	11.64
Sub-drain C1a outlet	n/a	1.03	11.72	12.91
Sub-drain C1b outlet	n/a	4.41	11.85	13.10
Sub-drain C1c outlet	n/a	2.19	11.43	11.57



Oakland Main Drain within Subject Land

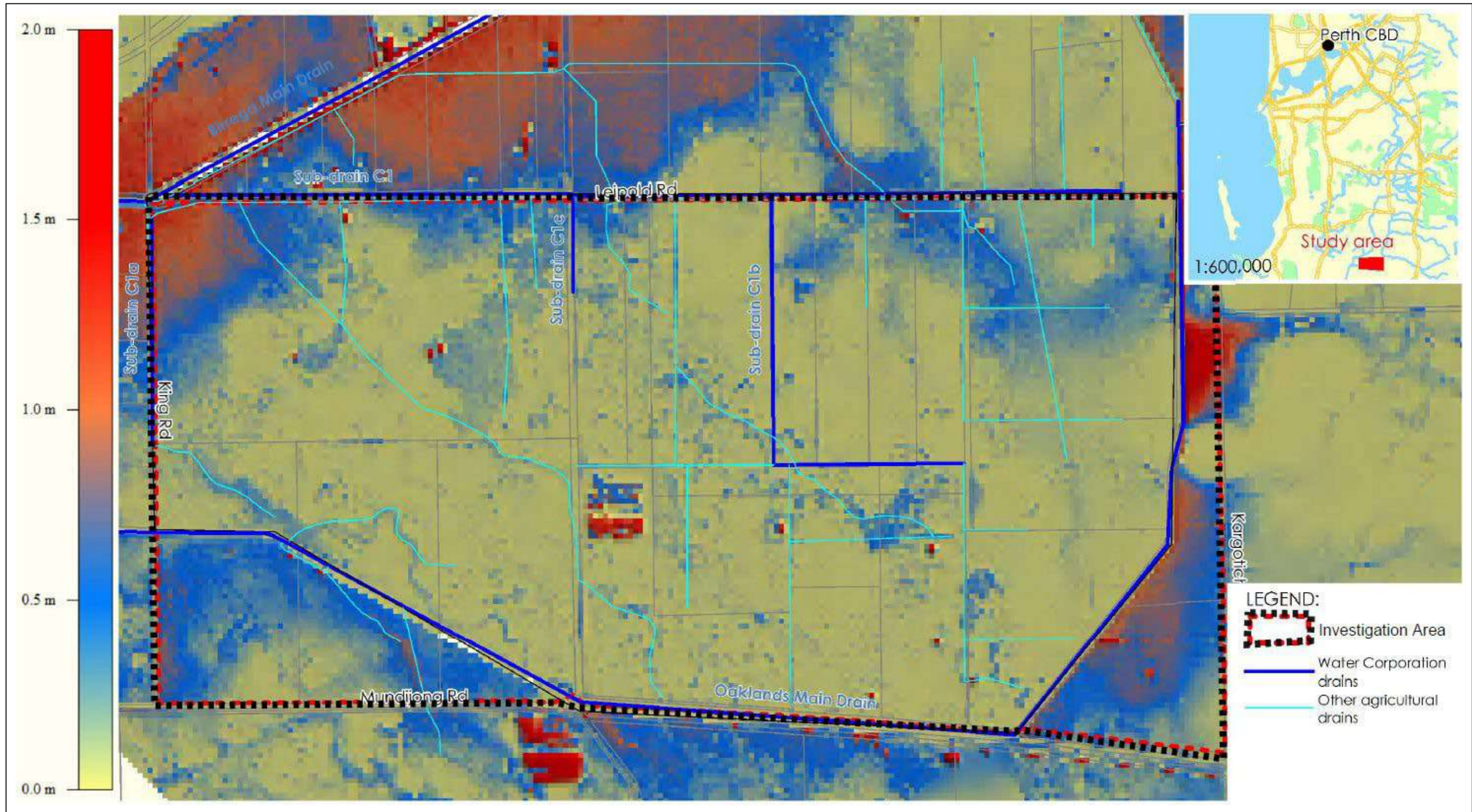


Figure 10 DWER modelled flood depths during 1%AER event

7 SURFACE DRAINAGE MANAGEMENT STRATEGY

The key objectives for surface water management of the site are to:

- Manage the water quality leaving the site to protect downstream natural systems
- Protection of infrastructure, human life and assets from flooding and inundation

To achieve these objectives the surface water generated from future roads and lots is to be managed for both flow rates and water quality. This will include the following design strategies.

Stormwater Flows

- Management of post-development flows to match the pre-development scenario up to and including the critical 1% AEP storm event.
- Flood flows associated with these drains are not to be interrupted, including overland flows.

Stormwater Detention and Conveyance

- A combination of vegetated detention swales and POS basins may be used throughout the subject land, with outflows controlled to peak pre-development flow rates. Indicative locations of the swale network are shown on Figure 11, however these may be modified as part of detailed design.
- Floodplain storage volumes of the Oakland and Birrega Main Drain are to be maintained.
- The MUC and internal road network will be used to convey peak 1% AEP flows through the subject land via overland flow, in conjunction with the pipe and swale network.
- Piped drainage within the road network and the MUC will be used to convey the 20% AEP storm event.

Infrastructure Protection Measures

- All finished flood levels are to be set a minimum of 300mm above the adjoining road level and flood levels generated within the subject land as per current state policy.
- Finished Floor levels of all habitable buildings are to also be a minimum 500mm above the 1% AEP flow level of the relevant Oakland Drain and Birrega Main Drain systems or any other relevant waterway/flood area as per current state policy..
- All buildings are to be set a minimum of 200m from the Oakland drain bank, so as to minimise potential impacts in the event of a levee failure.
- **Oakland Drain**
 - The Oakland Drain may be enhanced by the Water Corporation as part of detailed design. This is to be negotiated with Water Corporation and be in line with their Drainage for Liveability guidelines. Any changes are to be modelled so that the relevant flood effects are taken into account.

POST-DEVELOPMENT STORMWATER MODELLING

Indicative post-development catchment boundaries, discharge points and storage areas are shown in Figure 14. Catchment boundaries were estimated using the layout shown, in conjunction with pre-development catchment boundaries.

Post-development modelling was completed using a 1-dimensional hydrological and hydraulic model (InfoWorks ICM software). The peak 1% AEP allowable discharge rates presented in Table 4 were modelled based on pre-development catchment boundaries and the known flood modelling of the 2 main drains. The modelling is based on drainage infrastructure information provided by the Water Corporation including drain layouts, cross sections, invert levels and design flows.

Drainage network

The post-development drainage model assumes retention of the existing main drainage layout with drains converted from steep sided trapezoidal drains into vegetated swales embedded within multiple use corridors. The vegetated swale have been extended into the development area to provide for connection of all post-development sub catchments.

A hydraulic roughness of 0.035 has been applied to channels in the post-development model consistent with vegetated swales and a lower hydraulic roughness of 0.015 has been applied at culverts.

The water is detained within the MUC via a combination of control orifice outlet pipes (for the 20% AEP) and a combination of the pipe and overflow weir to control the 1% AEP.

Figure 12 presents a representation of the modelled cross-section for a vegetated swale.

Rural main drains such as Birrega and Oaklands were originally designed to achieve the Water Corporation's rural drainage license condition which requires that flooding of surrounding land should recede within 3 days. Typically, this resulted in drains being designed to convey a storm approximately equivalent to a 2-year ARI event (50% AEP used as surrogate). Design drawings supplied by the Water Corporation for the Birrega Sub-C1 drain, which runs along Leipold Rd and is the main receiving drain for runoff from the site, identify that the drain was designed for flows of 5 m³ per 1000 hectares with a Manning's roughness of 0.025. Design flows for the predevelopment and the post development flows to match are shown in Table 4.

Table 3 Storage for each Catchment's MUC systems to achieve required post development flow rates

Location	Maximum detention volumes (m ³)	
	20% AEP	1% AEP
Sub-drain C1a	500	3,200
Sub-drain C1b	35,400	149,500
Sub-drain C1c	38,500	153,000

Storage in the MUC and adjoining road (potentially) for each post-development catchment were sized based on the peak 1% AEP allowable discharge rate. Subsequently the peak 20% AEP outflow rates were calculated as a result of sizing the detention storage available. The storages can be seen in Table 3 with the shape of the storage shown in Figure 12.

To be conservative the other storage (likely to be on lot soakwells, and POS bioretention gardens) was included as an initial loss of 10mm, with a continuing loss of 2.9mm/hr. The actual storage outside of the MUC will be refined as part of future detailed design

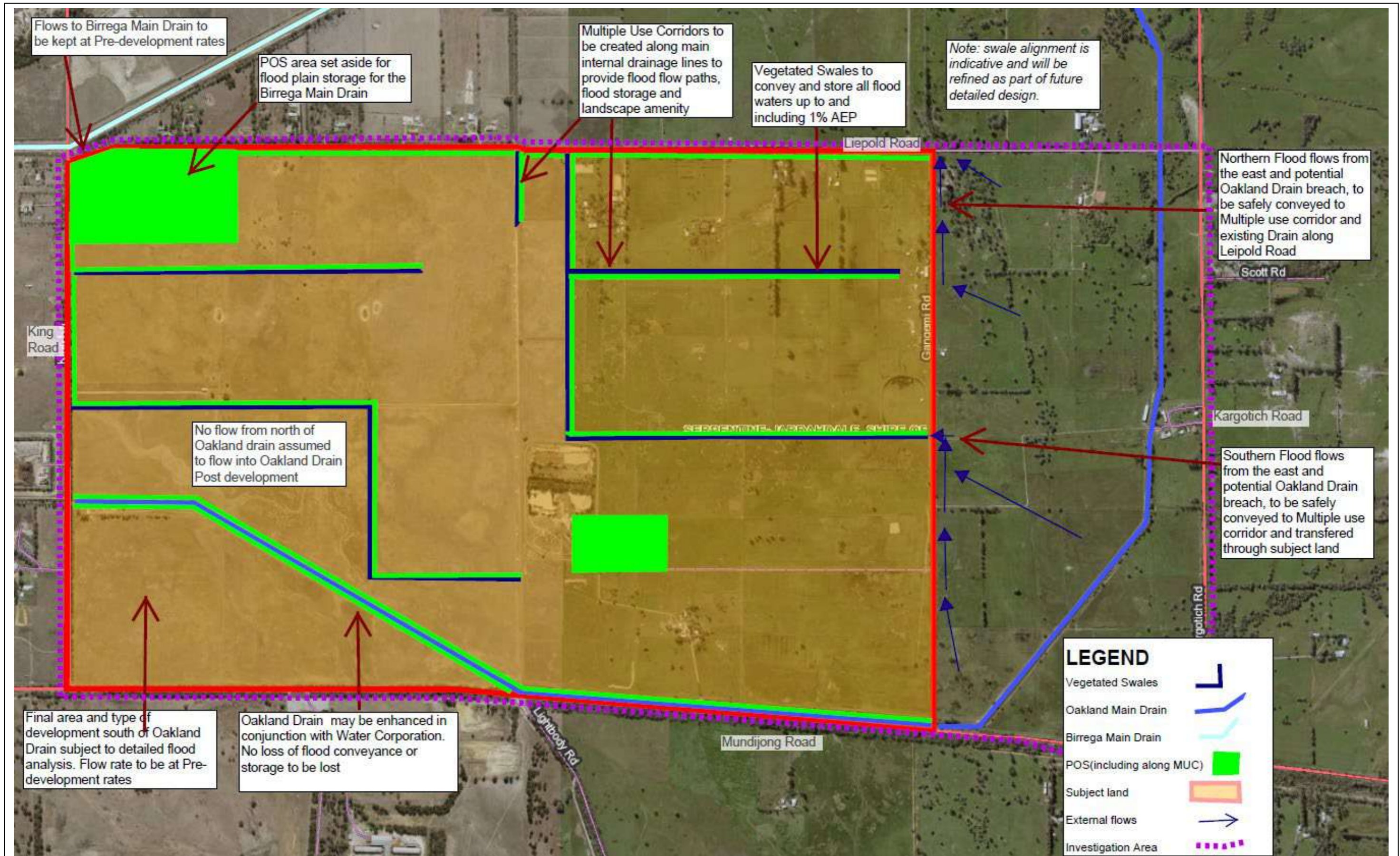


Figure 11 Drainage Management Strategies

Table 4 Comparison of Pre and post development flows and flood heights

Event/Location	Predevelopment		Post-development	
	Peak flow	Top water level	Peak flow	Top water level
1EY (6hr#8)				
Sub-drain C1 outlet	3.12	9.57	2.66	9.42
Sub-drain C1a outlet	0.32	11.12	0.29	11.10
Sub-drain C1b outlet	1.17	11.42	1.04	11.41
Sub-drain C1c outlet	1.16	9.20	1.44	9.28
50% AEP (6hr#8)				
Sub-drain C1 outlet	3.45	9.62	3.07	9.51
Sub-drain C1a outlet	0.36	11.19	0.33	11.18
Sub-drain C1b outlet	1.32	11.48	1.11	11.48
Sub-drain C1c outlet	1.29	9.22	1.55	9.30
20% AEP (3hr#5)				
Sub-drain C1 outlet	4.69	10.65	4.67	10.64
Sub-drain C1a outlet	0.50	11.50	0.62	11.55
Sub-drain C1b outlet	1.82	11.74	1.19	11.77
Sub-drain C1c outlet	1.68	10.63	1.57	10.63
1% AEP (3hr#1/8)				
Sub-drain C1 outlet	8.83	11.64	7.77	11.60
Sub-drain C1a outlet	1.03	12.91	1.00	12.41
Sub-drain C1b outlet	4.41	13.10	4.17	12.56
Sub-drain C1c outlet	2.19	11.57	2.05	11.47

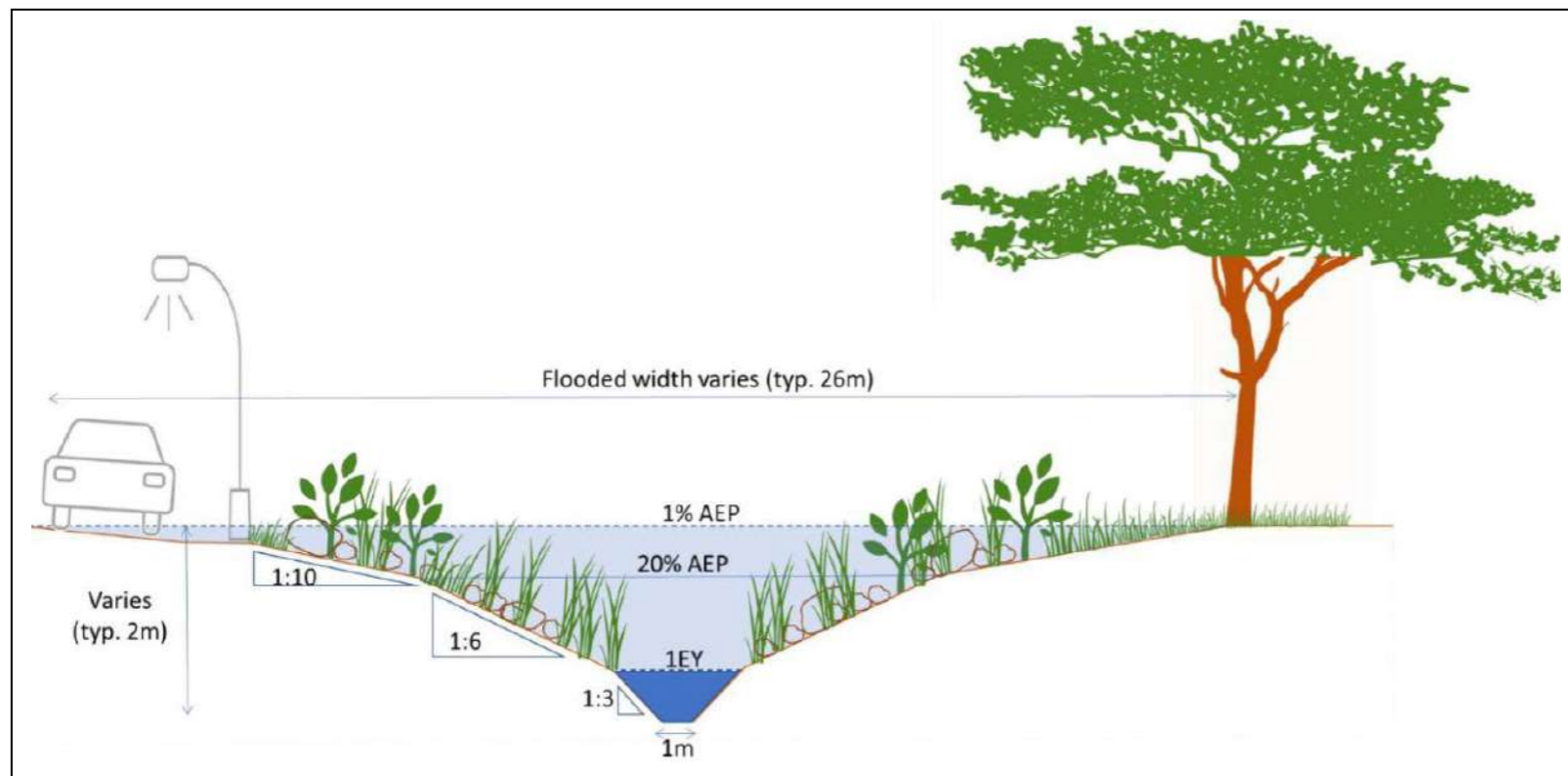


Figure 12 Modelled vegetated swale cross section

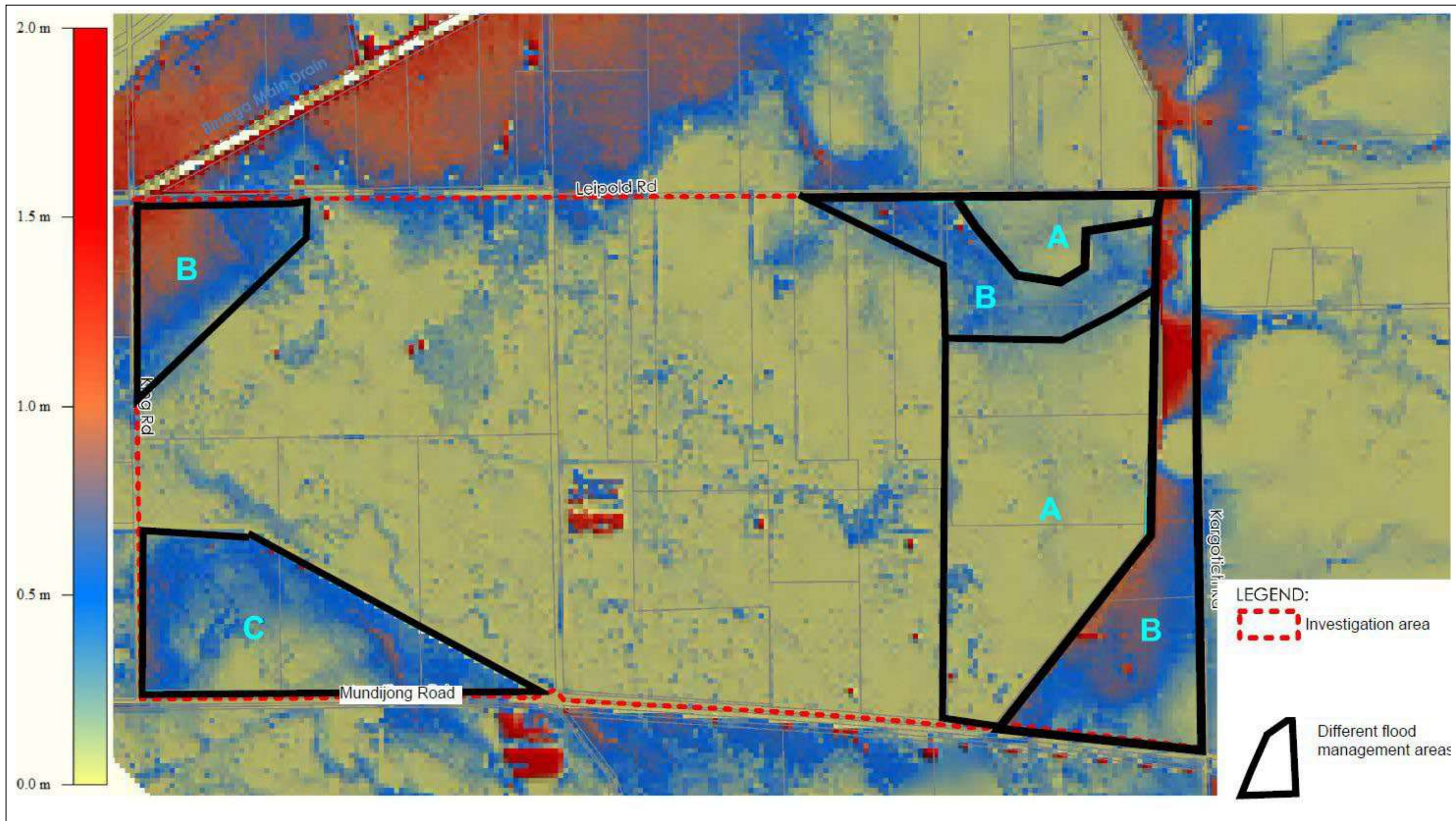


Figure 13 Focal areas for flood management

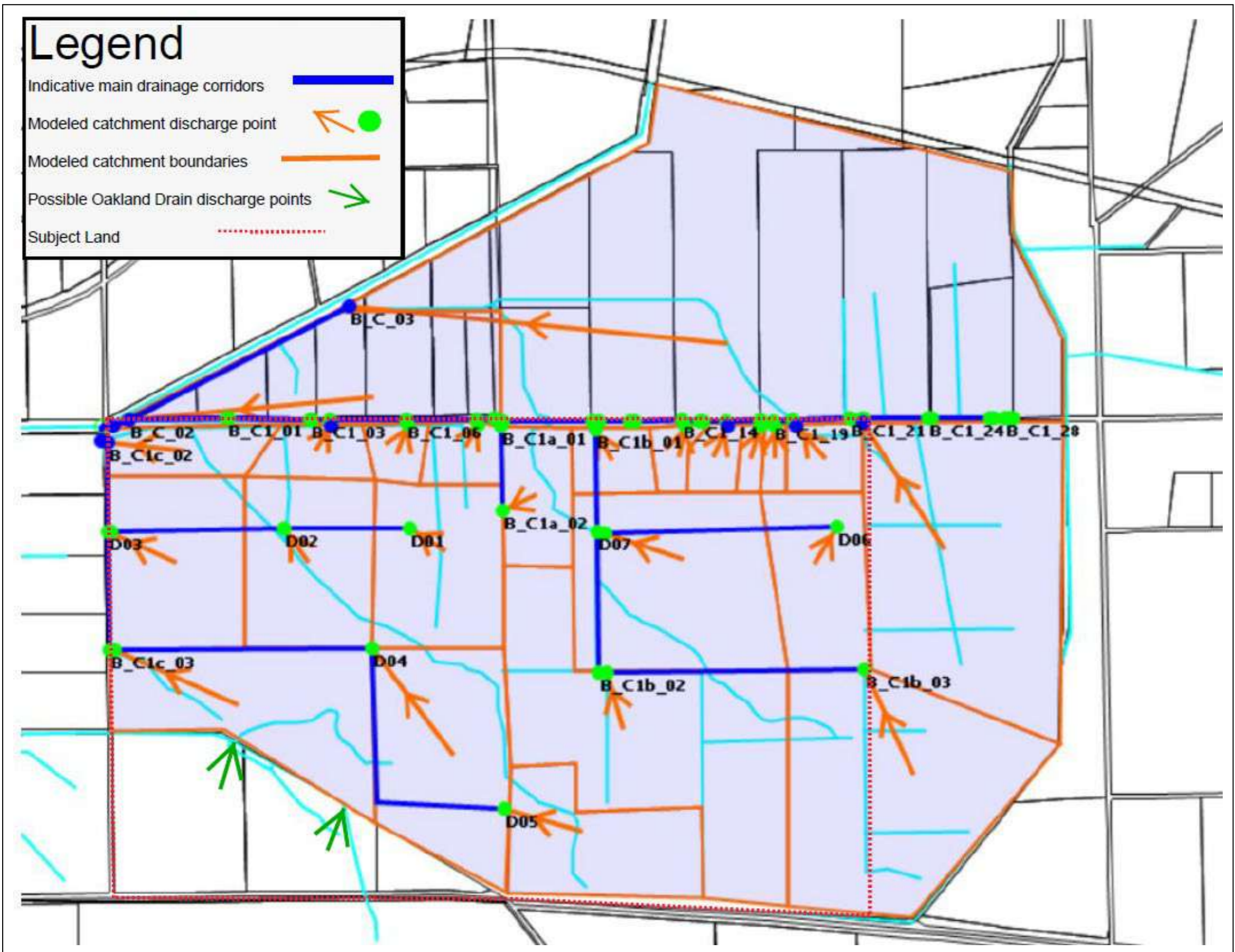


Figure 14 Modelled post development catchments and discharge points

SURFACE WATER QUALITY MANAGEMENT

Detention and treatment for small (approximately the 1 EY events/ first 15mm) will involve a variety of on-lot and road systems. This combined system will focus on both flow control and water quality management.

On Lot Treatment

It is proposed that individual lot owners will provide storage on each lot for lots over 350mm² or as determined in consultation with the Shire at the time of detailed design. This storage will assist with the treatment of stormwater at a lot scale, as well as allowing relatively clean rainwater from rooves to be infiltrated.

Bioretention Systems

In general, flows will initially be directed from the road surface to the kerb line, which would discharge to bioretention basins in the POS or potentially swales (see below). This will depend on the location and design of each catchment. The exact treatment type is to be determined as part of future detailed design.

Bioretention systems are to be designed according to the latest FAWB Adoption Guidelines for Filter Media in Biofiltration Systems and the Stormwater Management Manual for WA design guidelines. The bioretention gardens are to be sized to a minimum 2% of each connected impervious catchment. Plant species are to be as per the Vegetation guidelines for stormwater biofilters in the south-west of Western Australia.

The gardens will be designed to assist in the removal of nutrients, sediments and other potential contaminants from stormwater as the water infiltrates through to groundwater.

Swales

The vegetated swales, within the MUC will also form part of the treatment train. Some of these may function as bioretention swales, especially where flows are small. The swales will slow water down, and in combination with the biological functioning of the plants and associated biofilms, this will allow for sediment and litter settling and nutrient absorption. The swales will mainly be planted with locally native species and suited to riparian habitats. Vegetated swales typically have a capacity for a 25-50% reduction in nutrients. Indicative swale locations can be seen in Figure 11.

FLOODPLAIN STORAGE AND FLOODWAY FLOW PROTECTIONS

In response to current floodplain mapping shown in Figure, 10 the layout for the site has been set out to manage the areas of regional floodplain storage as described below and presented in Figure 13. The recommendations include the investigation area to the east so as to drive a more wholistic approach to water management in the local area. All flood management is to current state policy and available DWER floodplain mapping. Any future changes to this information will be reflected in future detailed design.

These are summarized as follows:

Area A.

On the eastern edge of the site, it is likely that any future large lots will have buildings elevated on pads to prevent inundation of dwellings, rather than wholesale filling. Dwellings and other buildings should be setback a minimum of 200m from elevated portions of the Oaklands drain levee bank to prevent impacts from sudden breaches or levee bank failures.

Area B.

Area B contains areas where there is a need to maintain both floodplain storage and flows. These areas are :

- in the north west corner of the site (associated with the flow of water down the Birrega Main Drain)
- the north east where there is the most likely topping of the Oakland main drain and subsequent flow over the site through areas marked A,
- to the south east of the Oaklands Main Drain, where water backs up from flood flows down Oakland Drain

Provision has been made for POS to be located in the Birrega flooding area (within the subject land) to generally align with existing floodplain mapping. In the north east portion, the flood storage has been stretched into a Multiple Use Corridor along the southern side of Leipold Road.

For the Oakland Drain flooding in the south east, the final land use, including flood storage areas is to be determined as part of the detailed design of this portion of land, noting that the rural use is unlikely to change and this area is outside of the current subject land.

The final configuration of these areas may change, subject to detailed flood modelling as part of detailed design. These areas are to be set aside to allow flows to traverse across them, as well store flood waters.

Area C.

In the south west corner, south of the Oaklands Main Drain, The layout is to be determined subject to detailed flood modelling as part of detailed design. It is noted that there are areas of floodplain storage currently within this location, that are required for the overall functioning of the Oakland Drain system. The exact areas of development and filling will take these flood storage aspects into account.

Remainder of Subject Land

It is proposed that other portions of the site will be fully developed with urban land uses including filling to provide 0.5m separation from regional flood levels, with on-site management of stormwater and provision of appropriate volumes of on-site flood detention storage.

Flooding observed in these portions of the site is principally the result of local rainfall and will be managed in a new drainage system to be constructed as part of the developments on-site stormwater strategy. The Multiple Use Corridors assist with replicating the minor flood storage within this area

8 GROUNDWATER MANAGEMENT

The focus of groundwater management for the development area is to maintain groundwater as close as possible to existing average maximum levels, which has been defined as the Controlled Groundwater Level (CGL) for the site, while maintaining adequate separation from infrastructure. There may be some minor modification of groundwater levels within the site; however, the areas that potentially feed the Conservation Category Wetland south of Mundijong Road will be maintained at levels that support key wetland functions. It is noted that the Oakland Drain's position limits the influence of the subject land on this southern wetland.

Furthermore, groundwater will be managed to achieve a high water quality.

INFRASTRUCTURE SEPARATION

Appropriate separation between lot levels, roads and other critical infrastructure and the CGL will be achieved across the entire subject land. The separation will be achieved through three main methods: use of porous, clean fill along with open swales and where required, sub-soil pipes.

The distance between road sub-soil pipes will be determined by the permeability and depth of the fill within that section of the development.

Swales as shown in Figure 11 and 14 will be alongside the road reserves and within the Multiple Use Corridors. The swales will generally be set at the CGL level and will assist in groundwater control. Subsoil drains would also discharge at just above the CGL level to the swales to ensure the subsoils remain free draining between storm events.

More detailed level monitoring is required as part of the Local Water Management Strategy to determine the current AAMGL. From this an informed CGL can be created for the subject land. Water quality monitoring may also be undertaken as a precautionary measure at least once, given the previous agricultural land use which is likely to have influenced nutrient levels within the groundwater. Should any adverse finding be noted, a more detailed quality monitoring regime can then be determined.

By maintaining the groundwater at a level similar to the current average maximum levels, the development will have minimal impact on the groundwater dependent ecosystems that exist within the Mundijong Road Reserves and further south. Groundwater will still be fed into the wetland systems and the receiving drains, both by the MUC and through direct transmission through the soil profile.

GROUNDWATER QUALITY

Groundwater quality will be maintained and protected using WSUD (as outlined in Section 6) and appropriate landscaping. The former will treat stormwater to remove excessive pollutants prior to discharge to the soil profile and ultimately the groundwater. The landscaping will also employ strategies that limit the nutrients applied so that excessive nutrients are not leached through to the groundwater. This will include the timing of nutrient applications and the irrigation regime that accompany them, allowing for the nutrients to then be taken up by the vegetation, rather than moving through to the groundwater.

Advice will also be provided to lot purchasers on Nutrient wise gardening to assist with minimising nutrient leakage from private lot areas.

USE OF GROUNDWATER

Groundwater is the most likely source of irrigation of the POS areas. There is currently allocation available below the subject land, in the Leederville and Superficial Aquifers. An allocation will need to be obtained via DWER licencing for any groundwater usage. Should there be no free allocation at the time of development, groundwater trading may be undertaken to secure a groundwater source. The groundwater quality should also be checked to make sure it is both suitable for the plants being grown and that there are no potential contaminants that are not suitable for public areas

9 SUSTAINABLE WATER SERVICES STRATEGY

SEWER

There is no existing wastewater infrastructure in the surrounding area. The Water Corporation's current wastewater planning extends from the scarp and stops at the future Tonkin Highway reserve. As expected, there is no wastewater planning over this site due to its current planning status.

Water Corporation have confirmed that the nearest wastewater pumping station will be located on Scott Street, approximately 1.8 km to the north east. This pumping station (type 90) services land to the East of the Tonkin Highway extension. This pumping station is on the Water Corporation Capital Investment Programmed with funding scheduled for the fifth year. The Water Corporation confirmed its long term ultimate planning for the region details a large Type 1000 relay pumping station on Scott Street. This will convey effluent west to either Rockingham or Kwinana treatment plants. The timing of this is unknown. The pumping station will service a significant area, likely to include suburbs from Byford to Serpentine. Its catchment is expected to cover this site due to its very close proximity. The Water Corporation has secured a parcel of land to the west of the Tonkin Highway extension. A service corridor will be required along Mundijong Road for its pressure main. A standard wastewater gravity network will be established within this site as typical for an urban development.

As planning for the site progresses, a more detailed assessment of the sewer can be undertaken. An indicative sewer layout and pressure main is shown in Figure 15 including the location of the pump station.

More detailed information can be found in the Infrastructure and Engineering Constraints Assessment

POTABLE WATER

The Water Corporation's Serpentine Trunk Main (Ø1370 and Ø1220) runs north-south through the centre of the site and conveys water into the metropolitan area. These are primary Water Corporation assets and are located within a dedicated service corridor. The Water Corporation also has a Ø1065 steel water main that extends west from the Serpentine Trunk Main along Mundijong Road. It is expected these mains will remain.

As the site falls outside of the current planning area, the Water Corporation does not have any detailed water supply concepts. Discussions with the Water Corporation confirmed there are two potential options to provide a water supply for the site. Those being a connection to the existing large water mains or establishing a tank on the scarp to supply the greater area. The Corporation acknowledged the tank option is more likely. As part of the tank option, it is expected a distribution main will extend to the site with reticulation connections servicing the development. It is also likely this distribution main will connect into the existing Mundijong network to reinforce its water supply plus service the proposed Industrial land development cell.

A normal water main network will be established within this site as typical for an urban development. A preliminary water servicing concept has been developed and is shown in Figure 16.

NON POTABLE WATER SUPPLY

Non-potable water may be utilised within the subject land, predominately for POS irrigation. The water source is likely to be groundwater. If there is no allocation of groundwater freely available at the time of application (noting that there is currently allocation in the Leederville and superficial aquifer), a licence will be sought via trading. This is to be undertaken as part of detailed design, with the exact volume determined as part of what water can be accessed through trading and a landscaping concept plan. The initial assessment will be undertaken as part of the LWMS.

West Mundijong Urban Precinct DWMS

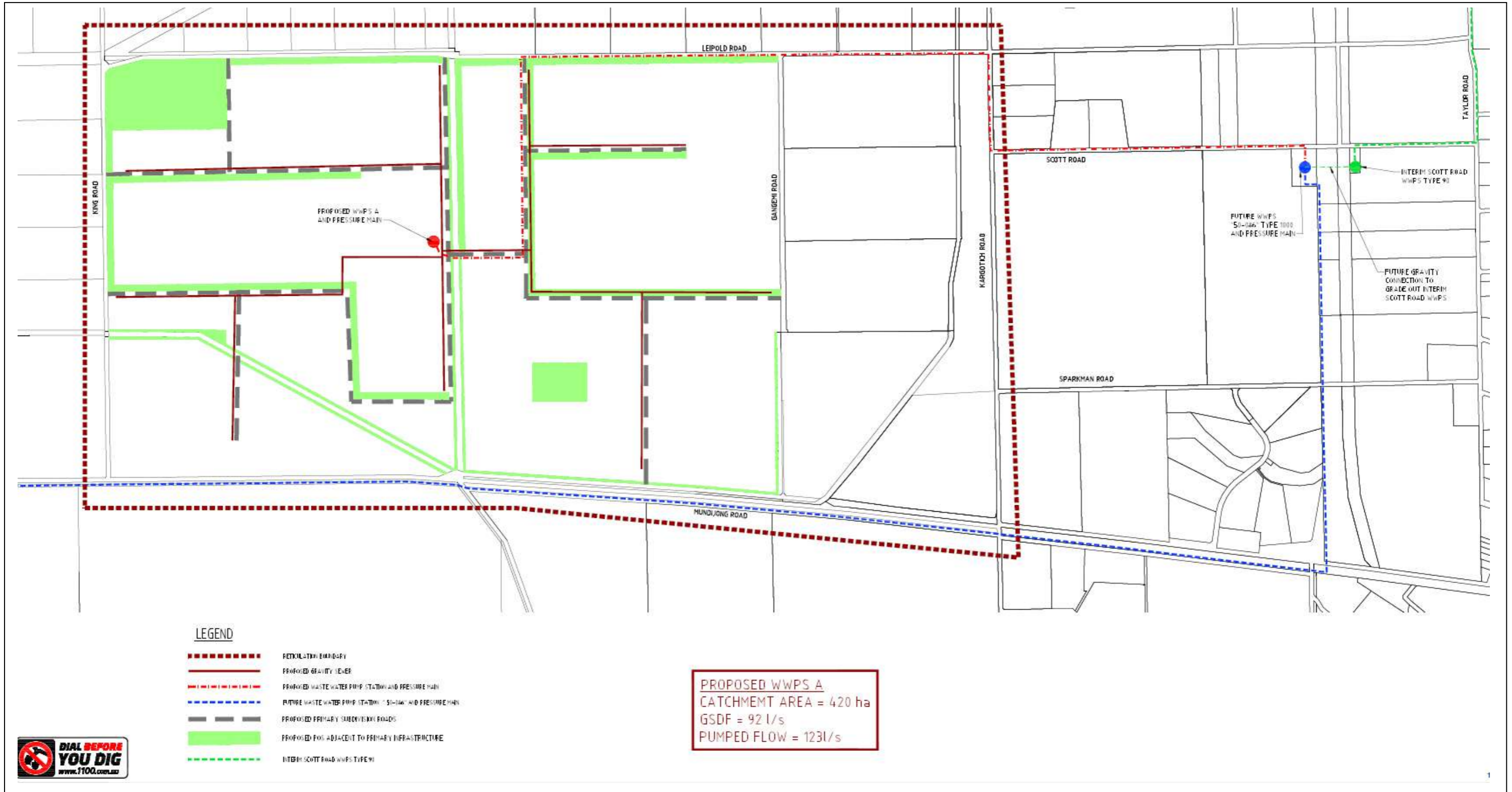


Figure 15 Sewer Concept Plan



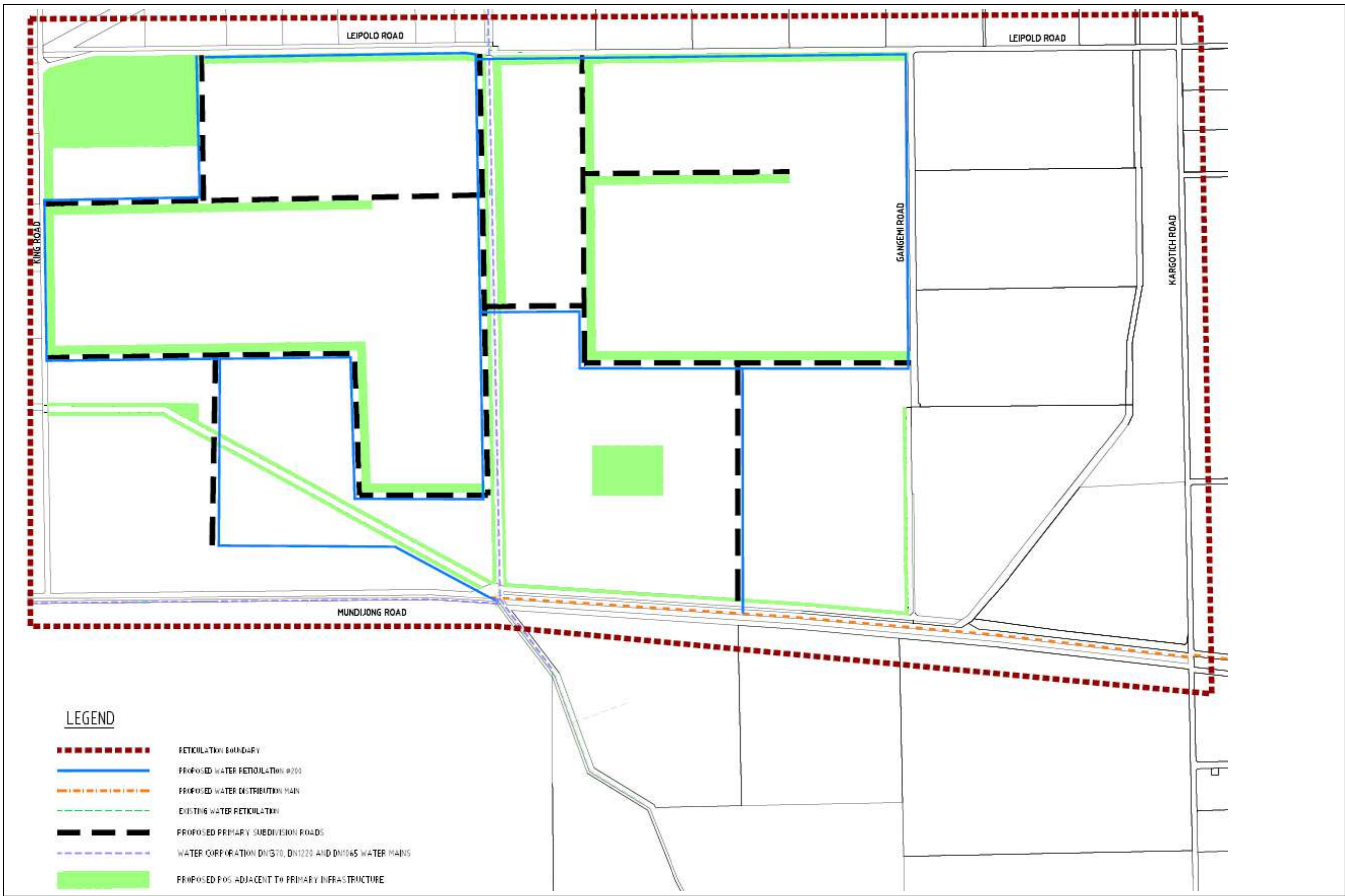


Figure 16 Potable Water Concept Plan

10 WATER DEPENDENT ECOSYSTEMS MANAGEMENT

There are two main focuses for the management of water dependent ecosystem (WDE) as part of the subject land's future development: firstly assessment and management of the adjoining Conservation Category Wetland (UFI 14817) on Mundijong Road and secondly to treat water prior to discharge into this system and other downstream systems.

Secondly, there will also be the creation of new WDE habitat across the site. This includes the bioretention gardens, and vegetated swales within the Multiple Use Corridors. There is a potential for enhancement of the Oakland Main Drain, subject to Water Corporation approval and detail design. Any enhancement works would need to prove that flow and flood management aspects can be maintained.

ON SITE WATER DEPENDENT ECOSYSTEM CREATION

Swale network

Swales are to be designed to act as ephemeral streams and provide habitat values for generalist fauna, especially avifauna and herpetofauna. This can be achieved through the use of native species for the plantings and the creation of a variety of habitat types for a range of riparian fauna.

Infiltration Systems

POS based bioretention gardens constructed as part of this development will provide some ephemeral wetland type habitat to generalist wetland and riparian species. The construction and planting of these structures can maximise this effect through shaping to create various zones and the use of locally native plants. This can be complemented by utilising native plantings in surrounding streetscape areas.

As such these areas can act as areas for future colonisation by a variety of small fauna and assist with fauna movement between larger natural systems that are being retained on the site and in the surrounding wetland areas. The bioretention garden areas are to include both an understorey of sedges and rushes as well as an overstorey of wetland shrubs. In larger systems, trees may also be incorporated. Species should be chosen from the Vegetation guidelines for stormwater biofilters in the south west of Western Australia, or similar publications.

Oakland Drain

The Oakland Drain could potentially be enhanced to suite the future urban form using the principles set out in the Water Corporation's Drainage for Liveability guideline. The focus would be on those areas within the denser urban form. The works may include a path network, suitable understorey and larger trees, as well as appropriate sediment control structures, which also increase habitat diversity. Any works need to take into account the requirement for the levee bank to be retained and potentially strengthened to reduce potential flood risks.

In the eastern portion, that is within the low density transitional zone, the focus would be on revegetation with appropriate species and protection of the bund wall.

Negotiations are to be undertaken with Water Corporation on appropriate works as part of future detailed design. Any potential works will need to be modelled to so that the flood impacts are taken into account with any future development.

Conservation Category Wetland Buffer.

The Conservation Category Wetland (UF14817) on the southern boundary has been provided with a buffer as part of the Oakland Drain POS strip. The wetland quality is currently being investigated to determine its true classification north of Mundijong Road, noting its currently degraded state. The final agreed buffer would be designed to allow for the functioning of the wetland system by managing the flow of water from the development into it. It is noted that the general slope of the land is away from this wetland and there is currently a levee bund stopping water entering the drain and adjoining wetland from the subject land. Flows from the proposed residential area, will also generally slope away from the Oakland Drain, meaning there will continue to be little flow of water toward the wetland area. Future detailed planning is to outline appropriate access management, weeds and litter control between the residential area and the wetland. This would be based on the qualities within the wetland currently as well as the fact that there is a drain located between the wetland and the development area. This would likely be achieved through appropriate fencing, access track and revegetation. Given the location of the Oakland Drain, the buffer may be incorporated into a potential Drainage for Liveability system.

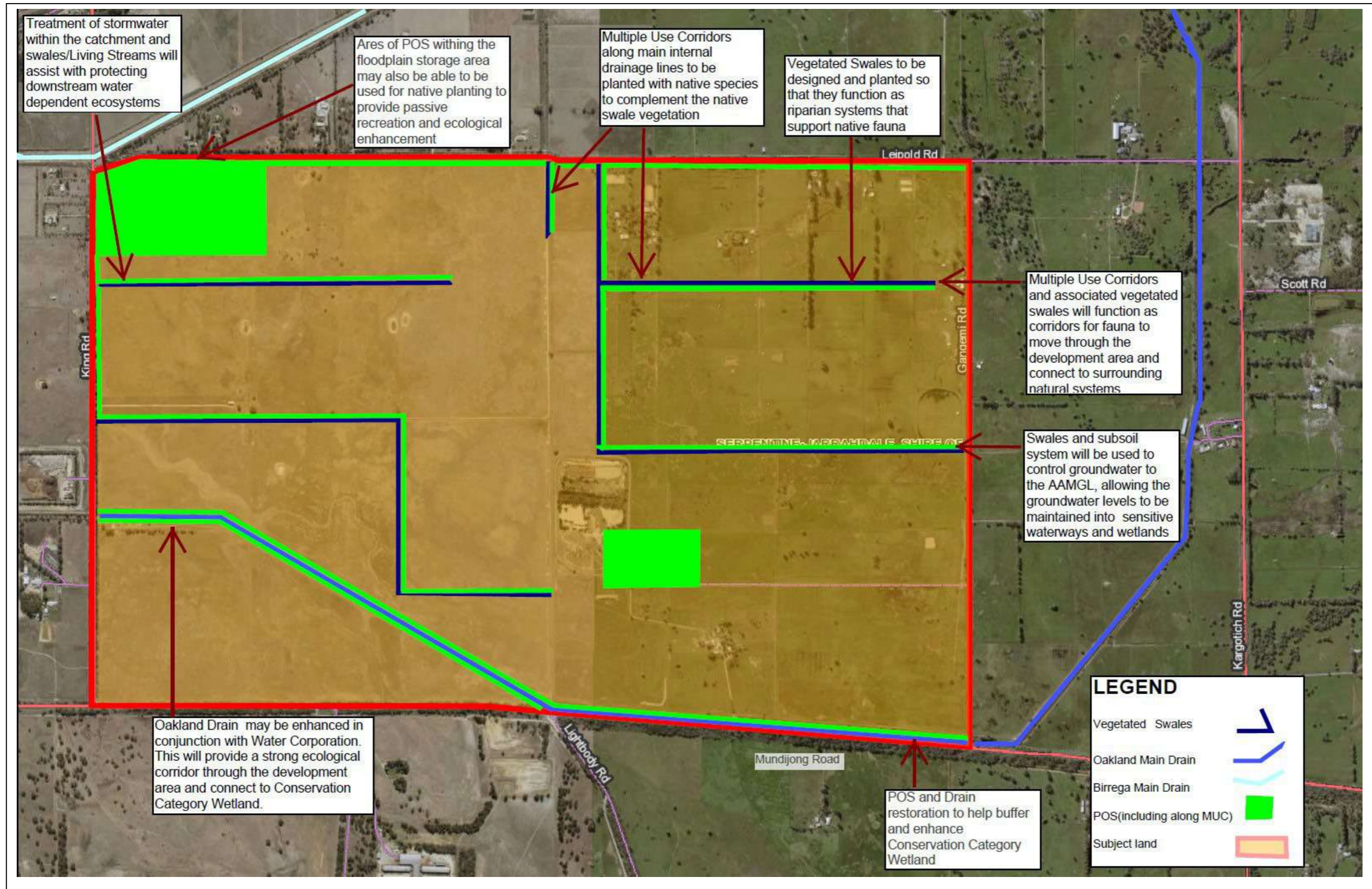
MOSQUITO MANAGEMENT

To ensure that the proposed drainage system does not hold standing water unnecessarily over the spring and summer months, all bioretention gardens are to be designed to ensure that drainage flows will be infiltrated in accordance with the design objectives for WSUD. This will minimise the likelihood of still ponding water being present during mosquito breeding times.

No permanent still water bodies are proposed for the project, which will reduce the chance of mosquitos breeding in the subject area. Some swales may contain a base flow through spring, however the flowing nature of this water will assist within minimising opportunity for mosquito breeding.

A Mosquito Management Plan is to be undertaken as part of future detailed design to outline appropriate management actions to minimise the risk of mosquitos.

Figure 17 Water Dependent Ecosystem Management Plan



11 MONITORING & MAINTENANCE

PREDEVELOPMENT GROUNDWATER

Pre-development superficial groundwater monitoring for the subject land is to be undertaken as part of the LWMS. This would be by the construction of a bore field across the site. These should be monitored monthly between April and October and 3 monthly between November and March for 2 years (2 seasonal peaks) to determine level changes as well as maximum water levels. This will be analysed in comparison to long term nearby DWER groundwater bores to determine a suitable Annual Average Maximum Groundwater Level. An initial quality monitoring round may be undertaken within the first winter. Based on the initial results found, a more detailed monitoring program for water quality can be produced if there are any significant water quality concerns.

PREDEVELOPMENT SURFACE WATER

Surface water monitoring for water quality is not considered necessary, given there are no natural flowing water systems or spring groundwater found within the site. The rural landuses are typical of the area and are likely to have moderate nutrient runoff and limited other contaminants, as is common from rural areas.

CONSTRUCTION PHASE

Installation of drainage control structures ahead of the construction phase of the development will be utilised. This will include the use of water sensitive urban design techniques such as sediment curtains, hydro mulching and temporary detention basins to maintain the quality of the water leaving the development area during construction. The bioretention gardens, swale network and basins will be monitored for any damage, including compaction, sediment build up, oils, and litter during and at the completion of construction to ensure the structure's effectiveness is not diminished. Sediment and litter on roads will be monitored, with removal completed as necessary with street sweeping. To minimise issues with degradation of vegetated treatment systems, it is recommended that planting should be delayed until the risk of high sediment loads has passed. Construction monitoring and maintenance regimes are to be developed as part of the LWMS and finalised within the UWMP.

POST DEVELOPMENT

The post development monitoring and maintenance regimes will depend on the treatment trains incorporated into the development and likely risks to on site infrastructure and nearby ecosystems. The following provides guidance on the targets and likely process to be undertaken. Full details are to be included in the UWMP. Any monitoring program should seek guidance from the Local Government, Water Corporation and Department of Water and Environmental Regulation, so that it considers all relevant aspects and requirements at the time of development.

WSUD Structural Performance Monitoring

Performance monitoring of WSUD elements will be completed to ensure the system is working effectively. Indicators will be used as a cost effective method to evaluate the adequacies of WSUD performance. It can be assumed that if the WSUD elements operate in accordance to design then the desired management objectives are being met.

The key WSUD elements to be monitored will include:

- Ensuring the inlet and outlet structures are free of debris
- Vegetative cover of the systems is maintained;

- Sediment build up is not impeding the functionality
- Erosion is not present;
- Soils are not compacted;
- Litter is removed;
- Excessive hydrocarbons are not present in the system;
- Weeds controlled;
- Infiltration of stormwater is maintained to reduce standing water (in non-wetland systems);
- Flows are not excessively detained;
- Stormwater pipes are flowing freely;
- Gross Pollutant Traps, where used are functioning and are not blocked; and
- Subsoil pipes are flowing freely.

Compared to traditional engineered structures for stormwater runoff management, the WSUD elements require different routine maintenance and these are generally of a landscape maintenance nature. The most common maintenance is the removal of weeds, debris and siltation. The most time intensive period of maintenance for a vegetated WSUD system is during plant establishment (which typically includes two growing seasons), when supplementary watering, plant replacement and weeding may be required. The WSUD elements will be constructed and utilised in different stages so that the functions of the WSUD elements are protected from elevated pollutant loads generated from a developing catchment.

It is recommended that vegetated WSUD elements are monitored by personnel with floristic knowledge and/or qualifications and be capable of identifying invasive species within the natively vegetated WSUD systems. Furthermore, personnel in charge of monitoring should have a good understanding of principles and the functional design of the WSUD elements and the treatment system.

The drainage piped network will also require maintenance to make sure they continue to function as designed. This will include rodding, removal of sediments and other debris, as well as the replacement of broken components due to general long-term corrosion and wear.

Maintenance inspections should be conducted after significant storm events (mobilised sediments and coarse material). Inspections should focus on ponding time for the different systems, unequal surface flow distribution and scouring.

A key focus should also be on the control of litter and sediment that is often generated during the house/building construction phase. This is the most common time when systems are degraded or fail, due to large volumes of pollutants such as non-biodegradable litter, cement fines, direct vehicle compaction, sand movement and other sedimentation issues. Compliance aspects will need to be discussed with the Local Authority, so that rectification of the source problem can be achieved.

REPORTING

All information collected from the monitoring programs should be recorded and provided in a report, prepared by the developer, to the Department of Water and Environmental Regulation and Local Government. The report will compare monitoring results with target design and performance criteria to ascertain what, if any, actions may be required, and will provide ongoing assessment of the suitability of monitoring and reporting strategies. If a trigger value for a contingency action is reached, a more detailed report on the occurrence, its impact and proposed action to prevent recurrence is to be compiled by the developer and submitted to the Local Authority and Department of Water and Environmental Regulation. After 2 years of monitoring for the relevant Stage by the developer, the local authority will become responsible for any further monitoring they wish to undertake

West Mundijong Urban Precinct DWMS

Table 5 Monitoring requirements

Function	Item to Monitor	Purpose of Monitoring	Trigger for Immediate Action	Maintenance Action Required	Monitoring Frequency	Responsible Authority (Timeframe)
PRE - DEVELOPMENT						
Water monitoring	Groundwater	Determine AAMGL of superficial groundwater	NA	NA	Approx monthly winter/spring, quarterly through summer /autumn For 2 years	Developer
CONSTRUCTION PHASE & POST-DEVELOPMENT						
Drainage Management Systems (includes traditional and WSUD systems)	Structural Design	Systems are constructed to engineer detailed design specifications.	System constructed differs to design specifications.	Remedial work to rectify system to meet design specifications.	During and after construction	Developer
	Structural Effectiveness (inlets, traps and outlets)	Inspection for debris, litter and sediments surrounding structural components.	Debris, litter or sediments causing blockages or impairing functions.	Remove any debris or blockages. Inspect system for any erosion related issues.	Every 3 months	Developer (2 years) until handover to Local Government
	Erosion	Inspection for erosion.	Presence of severe erosion or erosion impairing functions.	Investigate, identify and rectify the cause of the erosion. Replace filter media as required.	Event based (mobilisation of sediments) and a minimum of every 3 months	Developer (2 years) until handover to Local Government
	Sediment Build Up	Inspection for sediment accumulation within pits, on the surface of bioretention systems and within basins.	Accumulation of large volumes of sediments and/or silts in pits or on the surface (according to Shire standards).	Investigate, identify and stabilise cause of sediment source. Remove accumulated sediments and replace filter media or plants removed.	Event based (mobilisation of sediments) and a minimum of every 3 months	Developer (2 years) until handover to Local Government
	Compaction	Inspection of filter media for compaction.	Water remains ponding longer than designed in bioretention system after a storm event.	Investigate cause of compaction. If localised, remove top 500mm of filter media, break up the filter and then return to system without any compaction. If extensive seek expert advice.	Every 3 months	Developer (2 years) until handover to Local Government
	Weeds	Inspection for the presence of weeds.	Weeds are noxious or highly invasive or if weeds cover more than 25% of area.	Manual removal or targeting herbicide application, with waterway approved products.	Every 3 months	Developer (2 years) until handover to Local Government
	Plant Condition	Inspection of vegetation health and cover, and presence of dead plants.	Plants dying or a pattern of plant deaths.	Investigate cause of plant deaths and rectify. Infill plantings may be required.	Every 3 months	Developer (2 years) until handover to Local Government
	Organic Litter	Inspection for the presence of organic litter (e.g. leaves) on surface.	Litter coverage is thick or extensive, or detracting from the visual appearance of the system.	Investigate source of litter and undertake appropriate response, e.g. alter landscaping maintenance practices, community education). Remove litter.	Every 3 months	Developer (2 years) until handover to Local Government
	Rubbish/Litter	Inspection for the presence of litter.	Litter is blocking structures or detracting from the visual appearance of the system.	Identify source of litter and undertake appropriate responses. Remove litter.	Every 3 months	Developer (2 years) until handover to Local Government
	Oil/Hydrocarbons	Inspection for the occurrence of oil on surface.	Oil coverage persists for more than 3 weeks, and is thick.	Notify the EPA of the spill and cleanup requirements.	Every 3 months	Developer (2 years) until handover to Local Government
Filter Media	Check that media is draining as designed	Infiltration rate is outside of the design specifications	Replacement of top layer or all of the filter media (depending on issue)	Every 3 months	Developer (2 years) until handover to Local Government	

12 IMPLEMENTATION AND GOVERNANCE PLAN

The implementation of the water management strategies outlined in this report will rely on a range of detailed reports being undertaken, governance frameworks being established and implemented and commitments to on ground works, coupled with long-term maintenance/operations. The following is a summary of the process to achieve implementation.

INDIVIDUAL DEVELOPER REQUIREMENTS

- As part of the local structure plans, complete LWMS's for the relevant subject land areas
- As part of the subdivision process complete UWMP's for each subdivisional area
- Modelling of all stormwater management systems
- Geotechnical assessments and Acid Sulphate Soil investigations.
- Produce and implement Construction and Sediment Control reports.
- Implement all servicing and drainage infrastructure in accordance with the overarching strategy for the entire subject land.
- Apply appropriate fill and groundwater control structures on site where required.
- The planting of vegetation within the bioretention gardens and swale areas with appropriate locally native plants and maintenance of the plants until handover to the Local Authority.
- Water sensitive landscaping of the streetscape as approved by the Local Authority.
- Undertake post development monitoring as required
- Undertake monitoring of WSUD infrastructure to assess their performance and respond accordingly for the required monitoring period.

DEPARTMENT OF WATER AND ENVIRONMENTAL REGULATION REQUIREMENTS

- Review and approval of LWMS
- Provide guidance on the UWMP as requested by the Local Authority.
- Assist with direction for the provision of non potable water services

SHIRE OF SERPENTINE JARRAHDALE REQUIREMENTS

- Review and approval of the LWMS
- Approval of UWMP's
- Responsibility for the maintenance of the internal stormwater system, after handover.
- Maintenance of the MUC so that the water management functions are maintained.
- Ongoing encouragement of Waterwise and nutrient wise practices for lot owners.

SERVICE PROVIDER REQUIREMENTS (WATER CORPORATION)

- Implement and run the required potable water and sewer services as required by legislation
- Manage the regional drainage network for flood and conveyance functions

13 REFERENCES

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Porter Consulting Engineers, 2020, Infrastructure and Engineering Constraint Assessment Proposed Mundijong West Development. Perth

Urbaqua, 2020, West Mundijong Urban Precinct Hydrological modelling

Appendix A WEST MUNDIJONG URBAN PRECINCT HYDROLOGICAL MODELLING

West Mundijong Urban Precinct

Hydrological modelling

Prepared for Oversby Consulting

By Urbaqua

November 2020

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SUMMARY

This report has been prepared to provide technical hydrological information to facilitate the development of a District Water Management Strategy for the proposed West Mundijong Urban precinct.

The site area considered in this report includes all of the land that is relevant to flood management, including some areas that are not included in the proposed West Mundijong Urban precinct.

The floodplain development strategy presented in this report sets out the areas that are proposed to be filled and areas that will be left unfilled to appropriately manage flooding of the site.

A proposed drainage system has been modelled for the site incorporating retention of the existing main drainage layout with drains converted from steep sided trapezoidal drains into vegetated swales embedded within multiple use corridors. Vegetated swales have been extended into the development area to provide for connection of all post-development subcatchments.

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1 INTRODUCTION AND BACKGROUND

This report has been prepared to present the findings of hydrological modelling and floodplain assessments undertaken in support of the proposed West Mundijong Urban precinct.

1.1 Study area

The site, as shown in Figure 1, is located approximately 3km west of the Mundijong town site. It is bordered by Leipold Road to the north, Kargotich Road to the east, Mundijong Road to the south and King Road to the west. There are two Water Corporation main drains and several sub-drains within and adjacent to the site.

1.2 Preliminary stakeholder consultation

Preliminary consultation was undertaken with DWER and the Water Corporation to obtain data and information relevant to the site and to discuss objectives for the modelling. Relevant correspondence is provided in Appendix A.

1.3 Study objectives

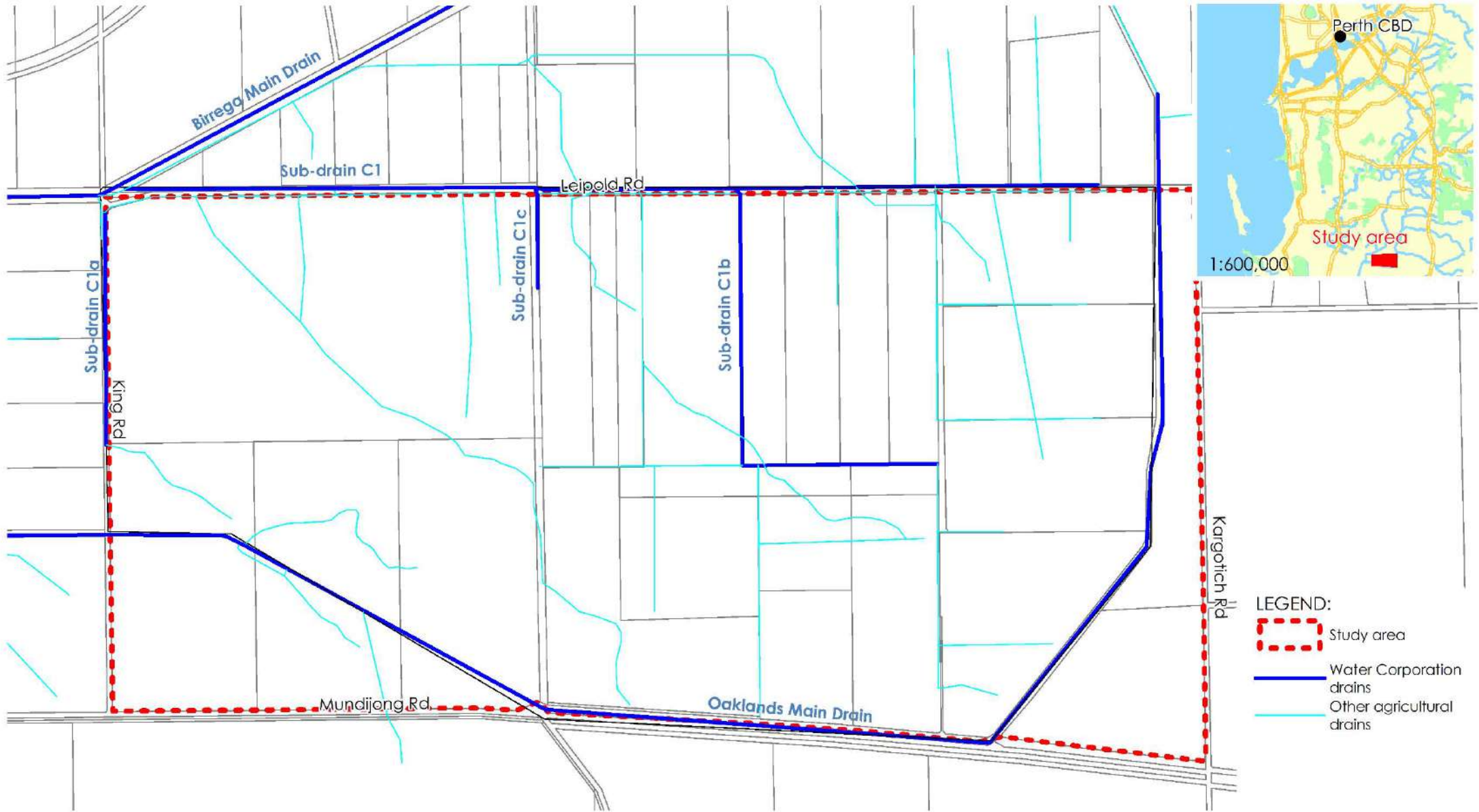
The objectives of this study are to provide floodplain advice and stormwater modelling information to facilitate the development of a District Water Management Strategy for the proposed West Mundijong Urban precinct.

1.4 Data sources

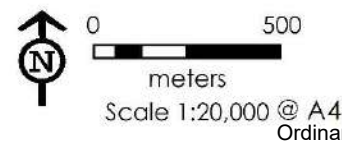
Data for this study has been obtained from DWER and the Water Corporation as listed below:

- LiDAR ground elevation data – DWER
- Current floodplain mapping – DWER
- Dimensions and elevations of existing drainage infrastructure – Water Corporation
- Design flow information for existing drains – Water Corporation

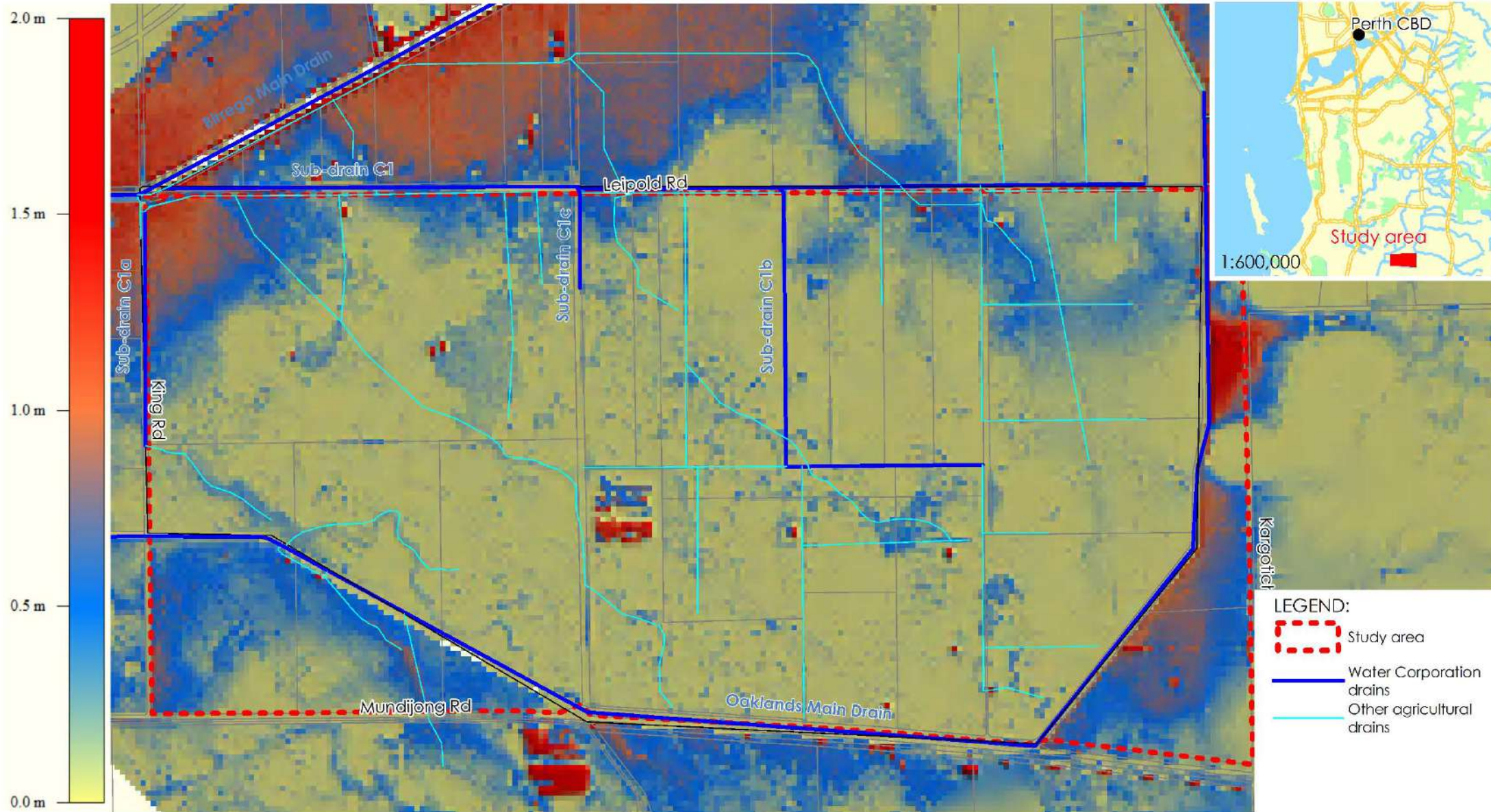
Oversby Consulting - Stormwater Modelling for West Mundijong Urban Precinct
 District Water Management Strategy
 Figure 1 - Site location



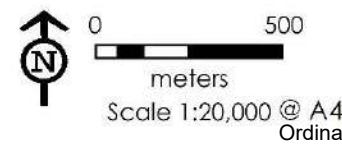
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 Data source: DWER, Created by: YY Projection: MGA2020, zone 50.



Oversby Consulting - Stormwater Modelling for West Mundijong Urban Precinct
 District Water Management Strategy
 Figure 3 - Current flood depth (source: DWER, 2020)



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 Data source: DWER, Created by: YY Projection: MGA2020, zone 50.



2.1 Floodplain development strategy

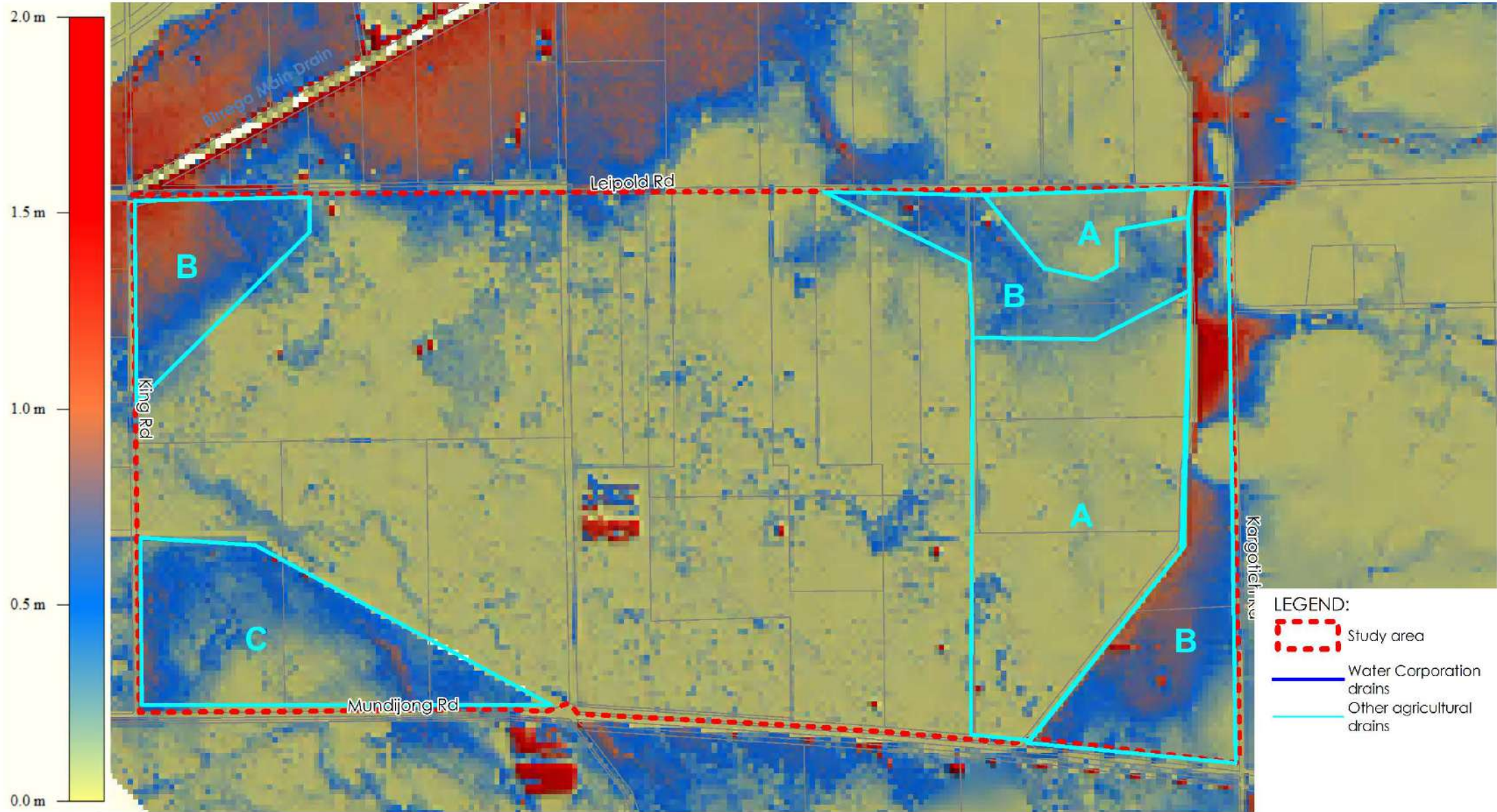
In response to current floodplain mapping shown in Figure 2 and Figure 3, development proposals for the site have been adapted to retain key areas of regional floodplain storage as described below and presented in Figure 4.

A. On the eastern edge of the site, large lots are proposed with buildings elevated on pads to prevent inundation of dwellings. Dwellings will be setback a minimum of 200m from elevated portions of the Oaklands drain levee bank to prevent impacts from sudden breaches or levee bank failures.

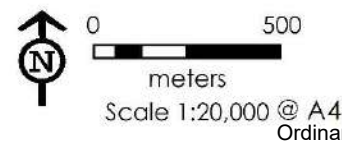
B. In the north west corner of the site, the north east passing through areas marked A, and to the south east of the Oaklands Main Drain, no filling is proposed. Provision has been made for POS to be located in these areas aligned with existing floodplain mapping. The final configuration of these areas may change, subject to detailed flood modelling as part of detailed design.

C. In the south west corner, south of the Oaklands Main Drain, limited filling is proposed to facilitate some development without loss of floodplain storage. The layout to be determined subject to detailed flood modelling as part of detailed design.

It is proposed that other portions of the site will be fully developed with urban land uses including filling to provide 0,5m separation from regional flood levels with on-site management of stormwater and provision of appropriate volumes of on-site flood detention storage. Flooding observed in these portions of the site is principally the result of local rainfall and will be managed in a new drainage system to be constructed as part of the developments on-site stormwater strategy. The on-site stormwater strategy is discussed in more detail in section 3 of this report.



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 Data source: DWER, Created by: YY Projection: MGA2020, zone 50.



3 STORMWATER MODELLING

3.1 Model build and calibration

A 1-dimensional hydrological and hydraulic model of the site areas draining to the Birrega Main Drain has been constructed to facilitate the conceptual design of an on-site stormwater management strategy including sizing of flood storage and major conveyance systems. The layout of the predevelopment model is presented in Figure 5.

Areas of land draining to the Oaklands Main Drain have not been modelled at this time. The intended floodplain development strategy for these areas, as discussed in section 2.1, is for limited filling to facilitate some development without loss of floodplain storage. The layout in these areas to be determined subject to detailed flood modelling as part of detailed design. Subcatchment delineation and flow paths for all areas draining to Oaklands Main Drain will remain unchanged.

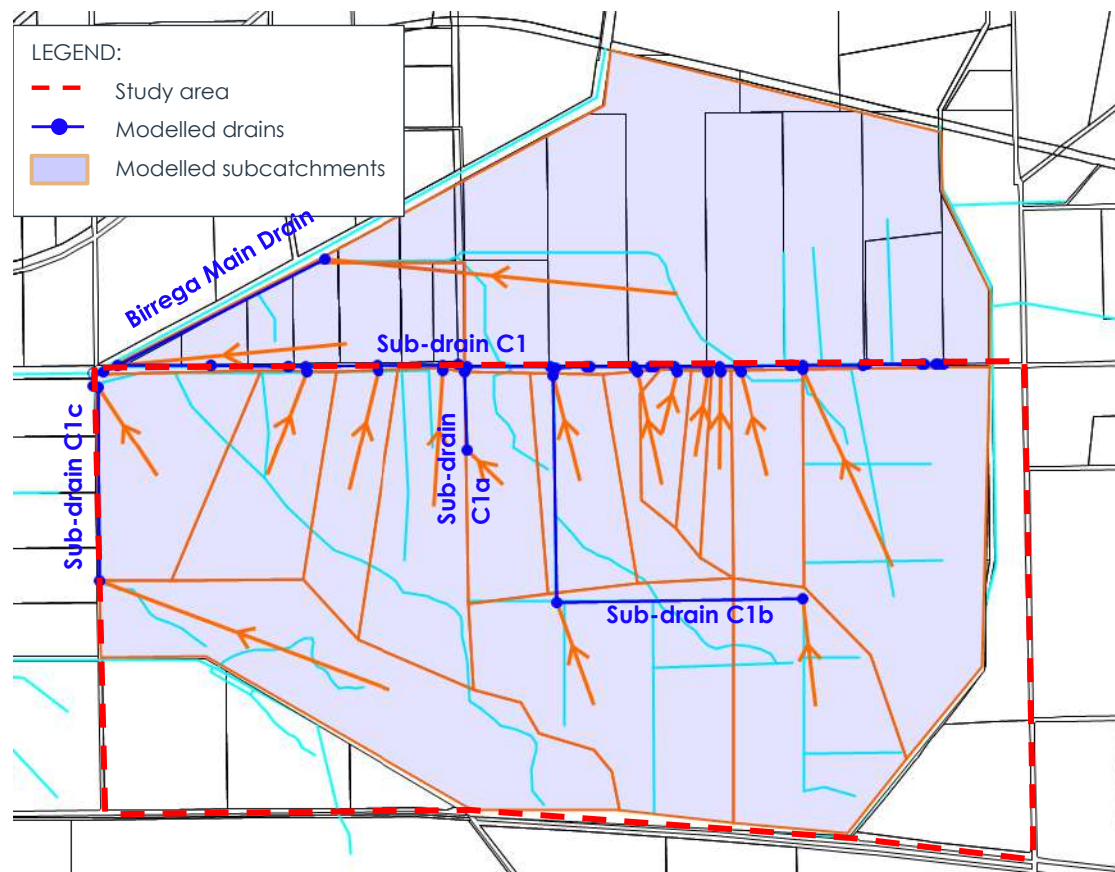


Figure 5: Predevelopment model layout

3.1.1 Predevelopment model

A predevelopment drainage model has been constructed using InfoWorks ICM based on drainage infrastructure information provided by the Water Corporation including drain layouts, cross sections, invert levels and design flows.

Rural main drains such as Birrega and Oaklands were originally designed to achieve the Water Corporation's rural drainage license condition which requires that flooding of surrounding land should recede within 3 days. Typically, this resulted in drains being designed to convey a storm approximately equivalent to a 2-year ARI event. Design drawings supplied by the Water Corporation for the Birrega Sub-C1 drain which runs along Leipold Rd and is the main receiving drain for runoff from the site identify that the drain was designed for flows of 5 m³ per 1000 hectares with a Manning's roughness of 0.025.

Drainage network

The predevelopment drainage model has been constructed based on original design drawings of the drains. Typically, the drains are steep sided (1:1.5) and 2m wide at the base with depths varying from 1-2m. A hydraulic roughness of 0.025 has been applied in the predevelopment model consistent with the Water Corporation design calculations although a lower hydraulic roughness of 0.015 has been applied at culverts.

Subcatchment delineation

Modelled subcatchments have been delineated for the site based on analysis of LiDAR elevation data coupled with drainage layouts provided by the Water Corporation.

Broadly, the majority of the site may be considered as a single catchment draining to the north west and feeding into the Birrega main drain via Birrega Sub-drain C1. The remainder of the site, to the east and south of the Oaklands main drain drains into the Oaklands main drain at various locations along its path.

The Birrega main drain catchment has been divided into smaller subcatchments for modelling purposes aligned with drainage information provided by the Water Corporation which indicates that there are eleven culverted connections from the site crossing Leipold Road to feed into Birrega Sub-drain C1. A review of streetview mapping along Leipold Road was undertaken to review these locations and all were observable, although the condition of these culverts and degree of blockage could not be established by this method and a survey of these connections is recommended.

The model has been constructed to terminate on discharge into the Birrega main drain and includes two external catchments to the north connected to the Birrega Sub-drain C.

Rainfall

Rainfall for design events were developed using ARR2016 and BoM IFD ensemble methodology resulting in an ensemble of 10 rainfall simulation events for each design storm. Ensembles were generated for 1EY, 50%, 20% and 1% AEP events of 30min, 1hr, 3hr, 6hr, 12hr, 24hr and 72hr durations. Ensemble runs were analysed to determine the event resulting in the median peak flow from the site for each duration and the maximum of these was selected for presentation as the critical event for this study.

Runoff parameterisation

Australian Rainfall and Runoff (ARR2019) provides spatially distributed recommendations for initial and continuing loss rates for application in pervious areas of rural catchments. For this site, the recommended rates are:

- Initial loss – 30 mm
- Continuing loss – 2.9 mm/hr

ARR2019 also recommends that impervious areas are allocated initial losses of 1-2mm and zero continuing loss. For the predevelopment model of this site, catchments have been parameterised based on these rates with an estimated 20% impervious area allocation which accounts for roads, roofs, hardstand areas, areas of standing surface water and direct rainfall into drains. A full summary of parameters applied in this study is presented in Table 1.

Table 1: Summary of model parameters

Parameter	Unit	Predevelopment	Post-development
Catchment roughness (Manning's N)			
Pervious area	-	0.025	0.025
Impervious area	-	0.015	0.015
Hydraulic roughness (Manning's N)			
Rural open drains	-	0.025	0.035
Culverts	-	0.015	0.015
Vegetated swales	-	0.035	0.035
Initial Loss			
Pervious area	mm	30	10
Impervious area	mm/hr	1.5	15*
Continuing loss			
Pervious area	mm	2.9	2.9
Impervious area	mm/hr	0	0
% Impervious area			
Undeveloped rural land	%	20	20
Rural enterprise development	%	-	40
Urban development	%	-	75
POS	%	-	20 [^]

Notes:

*15mm initial loss applied to reflect on-site management of runoff from the first 15mm of rainfall.

[^]20% impervious area allocated to POS includes allowance for buildings, carparks, footpaths and inundated drainage areas.

Application of tailwater

No tailwater level was applied in preliminary calibration simulations as it is assumed that at design flow rates (approx. 50%AEP) there would be a relatively free discharge. However, for all design simulations of larger rainfall events tailwater levels of 11.4mAHD (1%AEP) and 11.2mAHD (20%AEP) have been applied at outlets to the Birrega Main drain, taken from DWER floodplain modelling results.

Calibration to design

The predevelopment drainage model has been constructed based on the original design of the drains and has been tested using a range of 50%AEP IFD ensemble events (BoM, 2016). It is

noted that the 50% AEP is in fact a more frequent event than the 2-year ARI event and is therefore likely to generate lower runoff volumes than the original design considered. However, the comparison of these flows to the design flows provided on design drawings provides a good way to determine if the model is performing similarly to the original design intent. A summary of predevelopment simulation results compared to Water Corporation design information is presented in Table 2.

Validation with floodplain mapping

Predevelopment modelling results for larger design events (20% AEP and 1%AEP) have also been compared to DWER floodplain modelling of the site to review the model's performance in simulating these larger events. A summary of predevelopment simulation results compared to DWER floodplain modelling information is presented in Table 2.

Table 2: Summary of predevelopment model simulations

Event/Location	Peak flow		Top water level	
	WC design	Urbaqua model	WC design	Urbaqua model
50% AEP (3hr#6/7)				
Sub-drain C1 outlet	4.8	3.45	9.7	9.62
Sub-drain C1a outlet	0.3	0.36	11.3	11.19
Sub-drain C1b outlet	1.4	1.32	11.6	11.48
Sub-drain C1c outlet	n/a	1.29	n/a	9.22
20% AEP (1hr#1/2)	DWER model	Urbaqua model	DWER model	Urbaqua model
Sub-drain C1 outlet	n/a	4.69	10.82	10.65
Sub-drain C1a outlet	n/a	0.50	11.44	11.50
Sub-drain C1b outlet	n/a	1.82	11.82	11.74
Sub-drain C1c outlet	n/a	1.68	10.67	10.63
1% AEP (6hr#1/10)	DWER model	Urbaqua model	DWER model	Urbaqua model
Sub-drain C1 outlet	n/a	8.83	11.48	11.64
Sub-drain C1a outlet	n/a	1.03	11.72	12.91
Sub-drain C1b outlet	n/a	4.41	11.85	13.10
Sub-drain C1c outlet	n/a	2.19	11.43	11.57

It is noted that some of the top water levels identified in Table 2 are significantly elevated above DWER reported flood levels at coinciding locations. This is a characteristic of the limited ability to accurately represent overland flooding in flat landscapes using a 1-dimensional model. In major events, when the capacity of drains modelled as 1-dimensional features are exceeded, top water levels are often higher than those predicted using 2-dimensional models, particularly higher up in the catchment. The addition of overland flowpaths to represent flooding moving overland has improved this representation but in areas of very flat land where there are multiple potential overland flowpaths present it is not possible to accurately reflect this flood behaviour. However, for the purposes of this assessment, to provide a worst-case preliminary assessment of flood levels and comparative pre- and post-development scenarios it is considered reasonable to accept this limitation on model performance.

3.1.2 Post-development model

A post-development drainage model has also been constructed using InfoWorks ICM based on preliminary land use planning advice. The layout of the predevelopment model is presented in Figure 6.

Drainage network

The post-development drainage model assumes retention of the existing main drainage layout with drains converted from steep sided trapezoidal drains into vegetated swales embedded within multiple use corridors. Vegetated swales have been extended into the development area to provide for connection of all post-development subcatchments.

A hydraulic roughness of 0.035 has been applied to channels in the post-development model consistent with vegetated swales and a lower hydraulic roughness of 0.015 has been applied at culverts.

Figure 7 presents a representation of the modelled cross-section for vegetated swales.

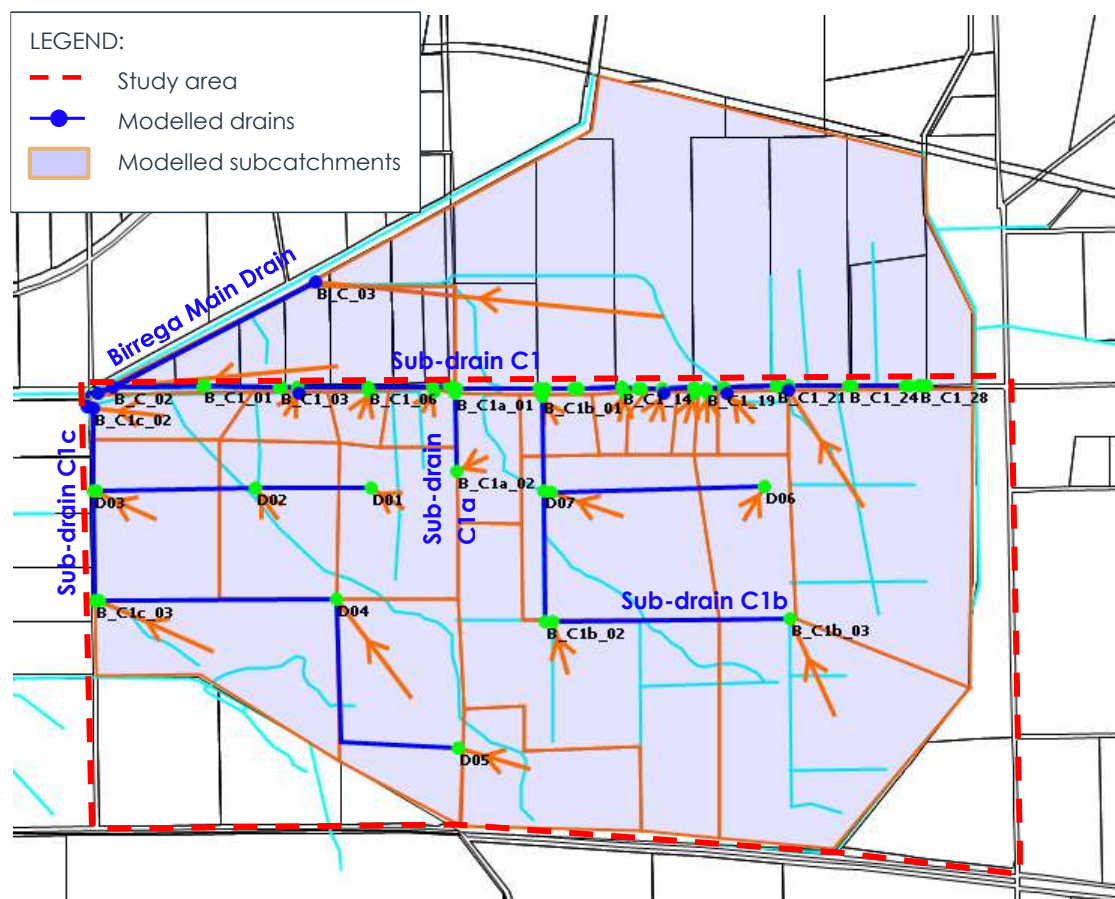


Figure 6: Post-development model layout

Subcatchment delineation

Post-development modelled subcatchments have been amended to align with lot boundaries and proposed street alignments.

Rainfall

Design events developed for the predevelopment model have also been applied for post-development modelling.

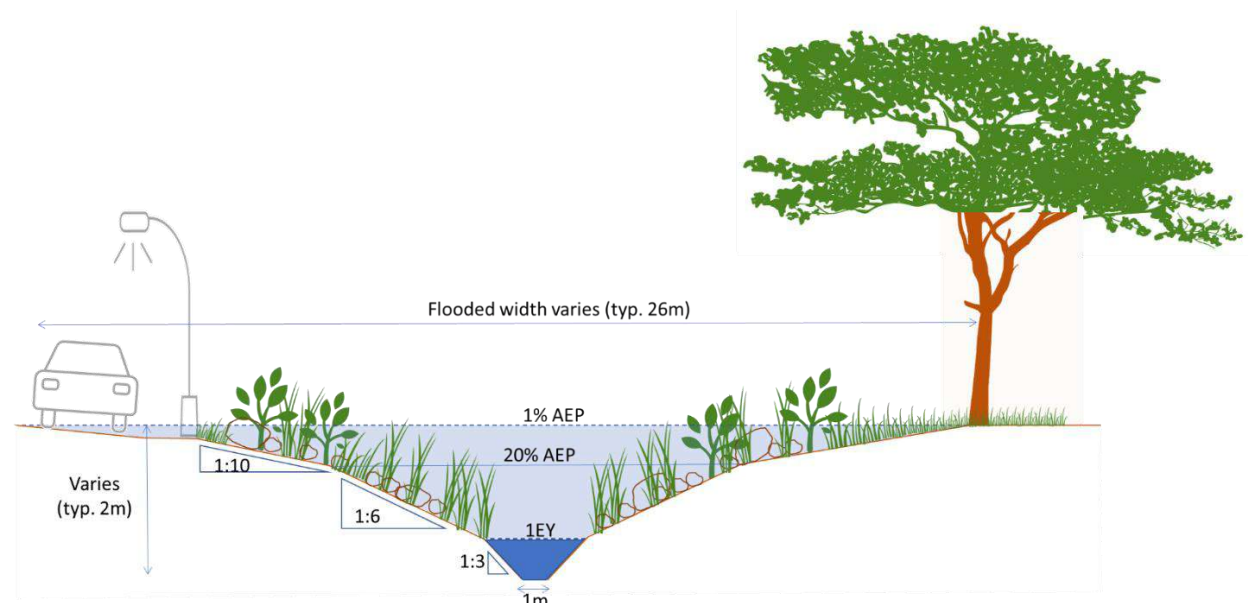


Figure 7: Modelled vegetated swale cross-section

Runoff parameterisation

Australian Rainfall and Runoff (ARR2019) recommends that initial and continuing loss rates in urban areas are developed based on the individual site characteristics but that pervious areas are expected to have initial losses at 20-40% of rural rates and similar continuing losses. For this site, the following rates have been applied:

- Initial loss – 10 mm
- Continuing loss – 2.9 mm/hr

Post-development impervious areas are parameterised consistent with the predevelopment model. Undeveloped land has been assigned 20% impervious area consistent with the predevelopment model. Developing portions of the site have been assigned up to 60% impervious area varying by development type. A full summary of parameters applied in this study is presented in Table 1.

Comparison to predevelopment peak flows and levels

Table 3 presents a summary of pre- and post-development peak flows and levels at key locations. In most cases, the post-development peak flows and levels are lower than in predevelopment modelling. Where post-development peak flows or levels were initially found to exceed the predevelopment case, detention storage has been applied.

Longitudinal sections for the Birrega Sub-drain C1 are provided in Appendix B for the critical duration (median ensemble) 1EY, 20% AEP and 1% AEP events.

Table 3: Summary of pre- and post-development model simulations

Event/Location	Predevelopment		Post-development	
	Peak flow	Top water level	Peak flow	Top water level
1EY (6hr#8)				
Sub-drain C1 outlet	3.12	9.57	2.66	9.42
Sub-drain C1a outlet	0.32	11.12	0.29	11.10
Sub-drain C1b outlet	1.17	11.42	1.04	11.41
Sub-drain C1c outlet	1.16	9.20	1.44	9.28
50% AEP (6hr#8)				
Sub-drain C1 outlet	3.45	9.62	3.07	9.51
Sub-drain C1a outlet	0.36	11.19	0.33	11.18
Sub-drain C1b outlet	1.32	11.48	1.11	11.48
Sub-drain C1c outlet	1.29	9.22	1.55	9.30
20% AEP (3hr#5)				
Sub-drain C1 outlet	4.69	10.65	4.67	10.64
Sub-drain C1a outlet	0.50	11.50	0.62	11.55
Sub-drain C1b outlet	1.82	11.74	1.19	11.77
Sub-drain C1c outlet	1.68	10.63	1.57	10.63
1% AEP (6hr#9/10)				
Sub-drain C1 outlet	8.83	11.64	7.77	11.60
Sub-drain C1a outlet	1.03	12.91	1.00	12.41
Sub-drain C1b outlet	4.41	13.10	4.17	12.56
Sub-drain C1c outlet	2.19	11.57	2.05	11.47

Storage provision

Detention storage is provided within the site using culverts sized to convey allowable peak flow rates coupled with overflow pathways for larger events. Using this approach, the online storage available in vegetated swales and multiple use corridors is maximised.

Table 4 provides a summary of the online storage volumes provided within the site on each of the main drainage corridors.

Table 4: Summary of online detention storage

Location	Maximum detention volumes (m ³)	
	20% AEP	1% AEP
Sub-drain C1a	500	3,200
Sub-drain C1b	35,400	149,500
Sub-drain C1c	35,800	153,000

APPENDIX A – STAKEHOLDER CORRESPONDENCE

From: [Urban Water Enquiries](#)
To: [Helen Brookes](#)
Cc: [Melinda MacKay](#); [Simon Rodgers](#)
Subject: FW: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)
Date: Thursday, 1 October 2020 9:10:22 PM
Attachments: [image001.png](#)
[image002.png](#)

Hi Helen,

We have looked at your enquiry and sought advice from Simon Rodgers. Please see comment below and response to your questions in red.

The flood depths and potential access / evacuation difficulties should be assessed for the safety of future residents. Raising the houses on pads (islands) protects against flood damage to the property but not address the people safety aspect. If flood depths in the area are small, this may not be an issue, but it at least needs to be discussed.

1. Would this type of development be acceptable in this location without modifications to the drain banks? – **yes pending potential isolation risk can be managed**
2. I presume we would need to maintain a separation between the drain and any dwelling to allow for the potential overtopping/spoil bank failure... would 200m be sufficient for this purpose? – **Yes, a 200metre set-back for the levee would be suitable to protect against the erosion in the vicinity of a potential breach in the spoil bank**
3. Would a simple model assessment of lost floodplain storage & resulting afflux be sufficient to determine if the extent of proposed filled pads is acceptable. – **yes, pending ability to consider flood depths and potential isolation.**

Answers to the other questions are not as simple.

1. Is filling of the entire site to its boundary with the Birrega Drain likely to be acceptable?
2. Assuming the answer to 1 is no, would a 100m buffer left unfilled be considered a reasonable approach?
3. Again, would a simple model assessment of lost floodplain storage & resulting afflux be sufficient to determine if the extent of proposed fill is acceptable?

Local rainfall/stormwater between the drains and floodwaters from Birrega (or Oaklands) drain upstream of the land pond against the Birrega bank and any water that cannot drain into Birrega drain would flow in a general southerly direction along Birrega towards it's junction with Oakland drain. Filling the entire area would likely impact this general flow path and without assessing how drainage between the drains is impacted we are unable to comment on the whether a 100 metre buffer is enough to alleviate any local drainage impacts. This will require something a bit more complex than a simple lost storage assessment (please let us know if you are looking at a more in depth assessment).

If you would like to discuss further, please contact myself or Simon Rodgers.

Many thanks,
Melinda

[Melinda MacKay](#)

Supervising Engineer, Drainage and Liveability | Science and Planning

Department of Water and Environmental Regulation
 Prime House, 8 Davidson Terrace, JOONDALUP WA 6027
 Locked Bag 10, Joondalup DC, WA 6919
 T: (08) 6364 6647
 E: melinda.mackay@dwer.wa.gov.au | www.dwer.wa.gov.au
 Twitter: @DWER_WA

From: Helen Brookes <helen@urbaqua.org.au>
Sent: Friday, 18 September 2020 11:06 AM
To: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Cc: Simon Rodgers <simon.rodgers@dwer.wa.gov.au>; Melinda MacKay <melinda.mackay@dwer.wa.gov.au>
Subject: RE: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)

Thanks Mel, much appreciated.

Kind regards,

Helen Brookes
 Director, **Urbaqua**
 M: 0439 096 472

From: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Sent: Friday, 18 September 2020 10:50 AM
To: Helen Brookes <helen@urbaqua.org.au>
Cc: Simon Rodgers <simon.rodgers@dwer.wa.gov.au>; Melinda MacKay <melinda.mackay@dwer.wa.gov.au>
Subject: RE: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)

Hi Helen,

This one is with me, I appreciate that you're getting pressure from your client. I'll give you a call a bit later to discuss.

Thanks,
Melinda

[Melinda MacKay](#)

Supervising Engineer, Drainage and Liveability | Science and Planning

Department of Water and Environmental Regulation
 Prime House, 8 Davidson Terrace, JOONDALUP WA 6027
 Locked Bag 10, Joondalup DC, WA 6919
 T: (08) 6364 6647
 E: melinda.mackay@dwer.wa.gov.au | www.dwer.wa.gov.au
 Twitter: @DWER_WA

From: Helen Brookes <helen@urbaqua.org.au>
Sent: Friday, 18 September 2020 10:05 AM
To: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Cc: Simon Rodgers <simon.rodgers@dwer.wa.gov.au>
Subject: RE: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)

Hi again Rachel,

Just following up on this one again, Client is putting a bit of pressure on me to get fully underway & I want to make sure I am heading in the right direction.

Kind regards,

Helen Brookes
 Director, [Urbaqua](#)
 M: 0439 096 472

From: Helen Brookes
Sent: Thursday, 10 September 2020 2:58 PM
To: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Cc: simon.rodgers@water.wa.gov.au
Subject: RE: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)

Hi Rachel,
 Trying not to be a nuisance but wondering if I might get a response to this soon(ish) I'm happy to wait for the data, just want to make sure I am on the right track.

Kind regards,

Helen Brookes
 Director, [Urbaqua](#)
 M: 0439 096 472

From: Helen Brookes
Sent: Wednesday, 2 September 2020 7:29 PM
To: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Subject: RE: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)

Thanks for this Rachel,
 I have a couple of questions to run by you...

The current proposal for the site suggests low density (R10-R15) along the eastern boundary (adjacent to the Oaklands Drain up to the lot boundary west of node OAK20 in your long section). Therefore we anticipate that this area would not require broadscale filling but would be dwellings on raised pads most likely. My questions about this bit are:

1. Would this type of development be acceptable in this location without modifications to the drain banks?
2. I presume we would need to maintain a separation between the drain and any dwelling to allow for the potential overtopping/spoilbank failure... would 200m be sufficient for this purpose?
3. Would a simple model assessment of lost floodplain storage & resulting afflux be sufficient to determine if the extent of proposed filled pads is acceptable.

For the remainder of the site, the proposal would require filling of the land to 0.5m above the flood height which would take the land up above spoil bank height and prevent any overtopping into the development. I'm pretty comfortable that all the flooding out of the Oaklands drain is minor enough beyond OAK20 for the filling to be considered acceptable but I'm a bit more cautious about the flooding from the Birrega Drain in the north-western corner of our site although it doesn't appear to be flowing through. For this bit again I have some questions:

1. Is filling of the entire site to its boundary with the Birrega Drain likely to be acceptable?
2. Assuming the answer to 1 is no, would a 100m buffer left unfilled be considered a reasonable approach?
3. Again, would a simple model assessment of lost floodplain storage & resulting afflux be sufficient to determine if the extent of proposed fill is acceptable?

Finally, is it possible for you to provide us with hydrographs for the Birrega and Oaklands drains upstream of our site so that we can use them for floodplain model assessments please?

I would think that the two railway bridges would be reasonable locations for these to be extracted?

Kind regards,

Helen Brookes
 Director, [Urbaqua](#)
 M: 0439 096 472

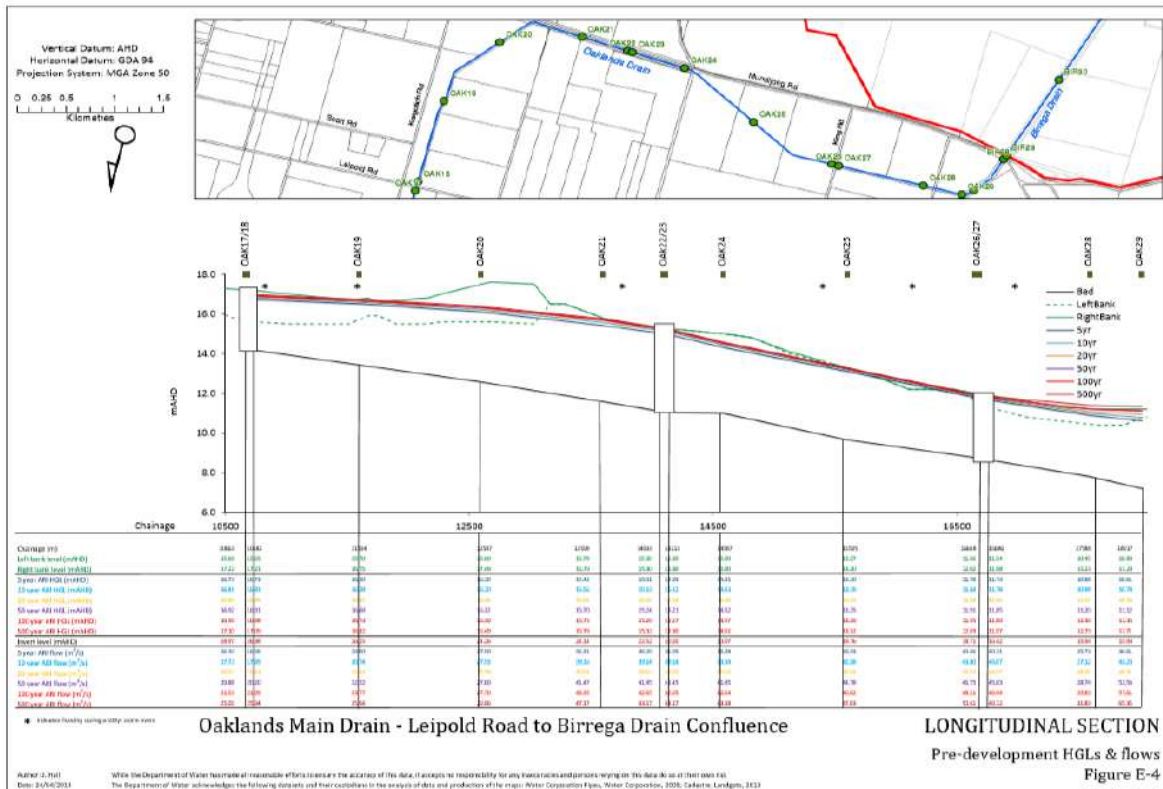
From: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Sent: Tuesday, 25 August 2020 1:10 PM
To: Ross Perrigo <ross@urbaqua.org.au>
Cc: Helen Brookes <helen@urbaqua.org.au>
Subject: RE: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)

Hi Ross,

Please find attached 4 asci files for the 1 in 100yr AEP and 1 in 5 yr AEP flood depth and elevation for the area around Land between Birrega and Oaklands bounded by Leopold and Mundijong Roads. The asci files have been clipped. Also included is the standard 100yr floodplain map.

Please note:

1. DISCLAIMER: This work has been undertaken by the Department of Water and Environmental Regulation for the Birrega and Oaklands Flood and Drainage Study. Planning decisions should not be made based on this work and are for information purposes only. DWER needs to be contacted for any development or filling proposals within 200m of the 1% AEP flood extent. DWER will also need to be contacted for flood data and water management advice. This information should only be used for the purposes of this work and no other.
2. The results attached are from the regional scale Birrega and Oaklands flood model, the information provided can be used as a guide, but local modelling is recommended for the scale of your area.
3. The below plan from the Birrega Oaklands Flood modelling and drainage study shows that the spoil bank overtops in a number of locations through this area and is likely to erode and increase flows through this general area which is not considered within our mapping. Anecdotal information that the spoil bank on the Oakland Main Drain adjacent to Scott Rd failed during the 1987 event confirms this potential. Consequently, local modelling for the area that includes spoil bank failure/s is recommended when considering proposed development.



Should you require further information/clarification then please let me know.

Thanks,

Rachel

Rachel Forrest
Environmental Officer
Urban Water

Department of Water and Environmental Regulation
Prime House, 8 Davidson Terrace, JOONDALUP WA 6027
Locked Bag 10, Joondalup DC, WA 6919
T: (08) 6364 7822
E: rachel.forrest@dwer.wa.gov.au | www.dwer.wa.gov.au
Twitter: @DWER_WA

From: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Sent: Tuesday, 18 August 2020 10:41 AM
To: Ross Perrigo <ross@urbaqua.org.au>; Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>
Cc: Helen Brookes <helen@urbaqua.org.au>
Subject: RE: Oaklands Flood Modelling & Drainage Study - Data Request (UW#125)

Hi Ross,

Thanks for the request below. I have forwarded your request on to our modelling group to extract the appropriate data. I will be in touch with you once I receive the data from them (most likely next week).

For your reference, this enquiry number is UW#125.

Thanks,

Rachel

Rachel Forrest
Environmental Officer
Urban Water

Department of Water and Environmental Regulation
Prime House, 8 Davidson Terrace, JOONDALUP WA 6027
Locked Bag 10, Joondalup DC, WA 6919
T: (08) 6364 7822
E: rachel.forrest@dwer.wa.gov.au | www.dwer.wa.gov.au
Twitter: @DWER_WA

From: Ross Perrigo <ross@urbaqua.org.au>
Sent: Thursday, 6 August 2020 4:57 PM
To: Urban Water Enquiries <urbanwater.enquiry@dwer.wa.gov.au>

Cc: Helen Brookes <helen@urbaqua.org.au>

Subject: Oaklands Flood Modelling & Drainage Study - Data Request

Hello,

Urbaqua are currently undertaking stormwater modelling in support of the West Mundijong Urban Precinct DWMS. As part of preparing our modelling we require outputs from the *Birrega and Oaklands Flood modelling and Drainage Study* (DoW, 2015). We are not looking to challenge any of the modelling results, but would like to ensure that our modelling/management incorporates the presented levels.

Are we able to have a copy of the flood level and flood depth data (5 year ARI and 100 year ARI) for the area shown below in red (imposed on Figure 1-1 of the report). Is this data able to be provided in a gridded/raster format?



I can provide shapefiles and further information if required. If you are able to advise on the likely turnaround time too that would be appreciated.

Don't hesitate to give me a call should you have any questions.

Regards,

Ross Perrigo
Senior Engineer
m: 0403 315 926 |p: 9328 4663

Urbaqua

land & water solutions

4/226 Carr Place Leederville 6007

www.urbaqua.org.au

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Helen Brookes

From: Martin Daniels <Martin.Daniels@watercorporation.com.au>
Sent: Friday, 14 August 2020 2:38 PM
To: Helen Brookes
Cc: James Wegner; Christina Young
Subject: RE: Birrega-Oaklands drain info request
Attachments: Birrega-Oaklands Overall Plan.pdf; 46150-23-8.pdf;
 PR_Drainage_-_Mundijong_Drainage_-_Historical_Plans_-_Legend.pdf;
 PR_Drainage_-_Mundijong_Drainage_-_Historical_Plans_-_Map_4.pdf;
 PR_Drainage_-_Mundijong_Drainage_-_Historical_Plans_-_Map_6.pdf; Birrega-Oaklands drain info.zip

Hi Helen,

Further to your request below I was asked to provide the information on behalf of Christina.

I have highlighted green on the 1st plan attached the various drains that I have provided available detail drawings (contained within the attached zip-file).

In addition I have provided additional separate PDF's which provide limited information on the various bridges, culverts and crossings within the area of interest.

Please note that in terms of GIS data and floodplain information you should contact DWER relating to the Birrega Oaklands Flood Study recently completed by them.

I have also attached a link to their floodplain mapping tool for your information:-

<http://www.water.wa.gov.au/maps-and-data/maps/flood-maps>

I hope this helps but please contact me if you have any further queries.

Regards

Martin Daniels

Plnr – Drainage & Liveable Communities
 Asset Investment Planning Metro

E Martin.Daniels@watercorporation.com.au

T (08) 9420 3924



watercorporation.com.au



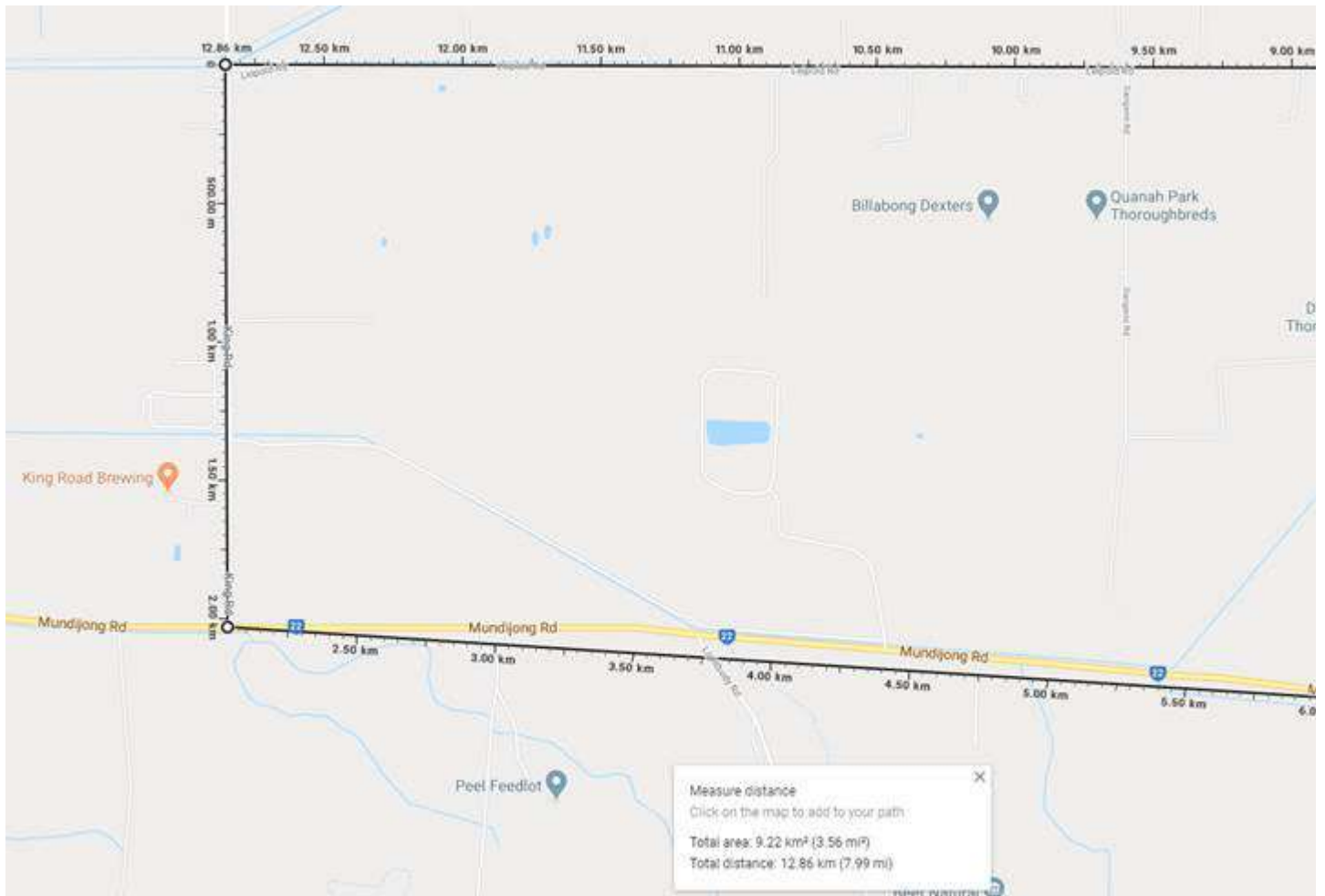
From: Helen Brookes [mailto:helen@urbaqua.org.au]
Sent: Friday, 7 August 2020 9:12 AM

To: Christina Young
Subject: Birrega-Oaklands drain info request

Hi Christina,
 I hope you are well?

I am just commencing some work just west of Mundijong in the Shire of Serpentine-Jarrahdale & the site is traversed twice and bounded to the south by the Oaklands drain as well as just clipping the Birrega drain at the north-western corner.

I'm wondering if you would be able to share whatever GIS elevation data, drain cross sections, culvert dimensions and invert levels that are available for the drains and floodplain in the vicinity please?



Kind regards,

Helen Brookes
 Director



Suite 4/226 Carr Place, Leederville WA 6007
 M: 0439 096 472
www.urbagua.org.au

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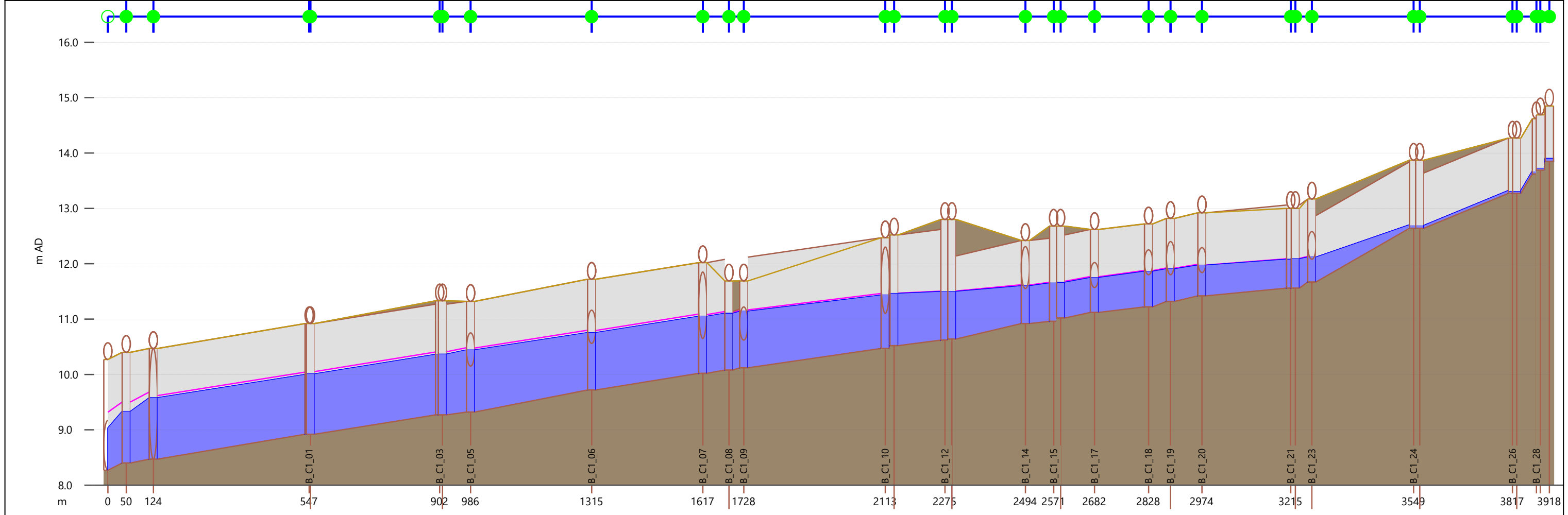
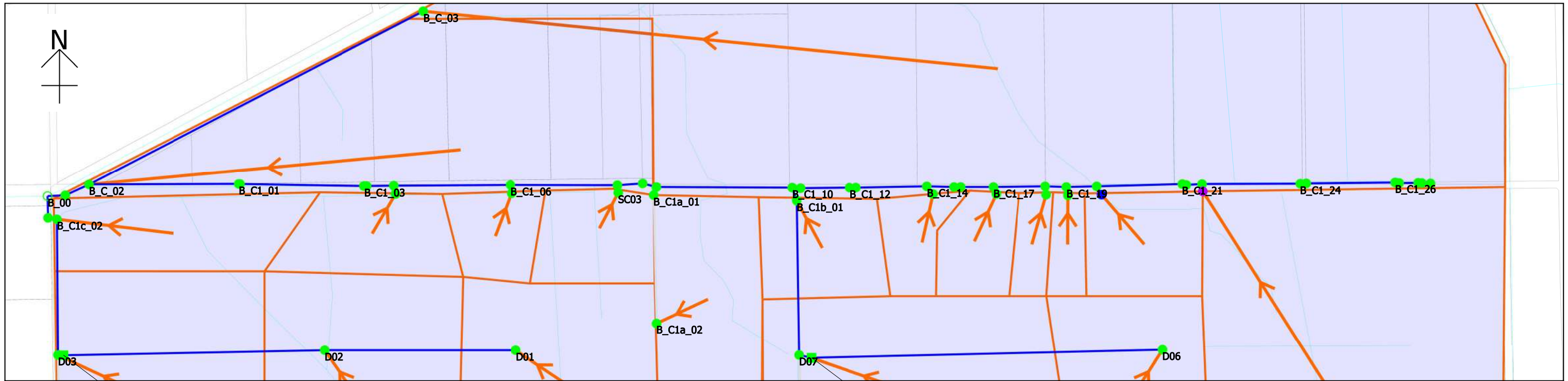
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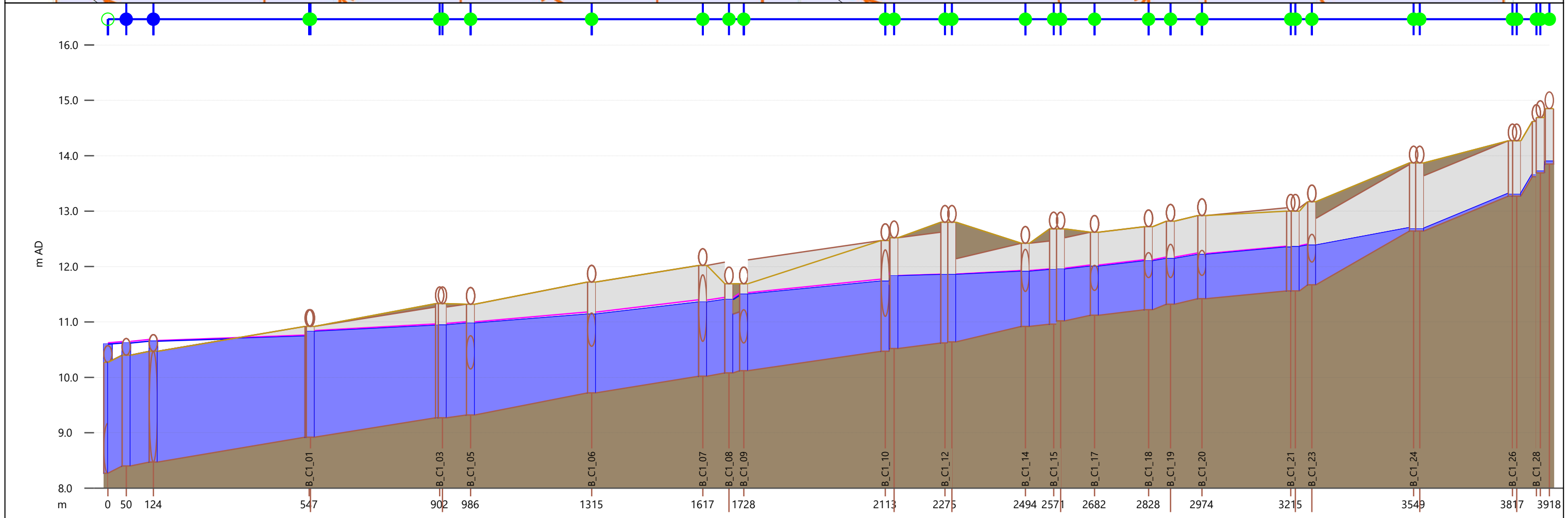
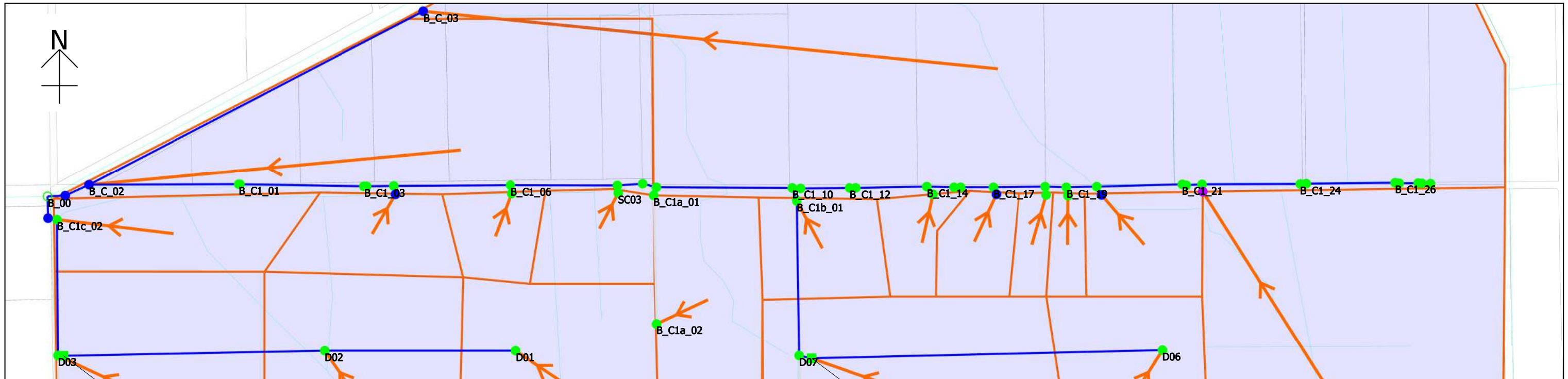
APPENDIX B – LONGITUDINAL SECTIONS



Link	-	-	B_C1_01.1	B_C1_03.1	-	B_C1_06.1	B_C1_07.1	-	-	B_C1_10.1	-	-	B_C1_14.1	-	-	B_C1_18.1	-	-	B_C1_21.1	-	B_C1_24.1	B_C1_26.1	-	-
DS flow (m3/s)	-	-	3.15424	3.16608	-	3.00049	2.85477	-	-	2.28924	1.16574	1.23212	-	-	1.03848	-	-	0.64629	-	0.07115	0.00000	-	-	-
Node	-	B_C_02	B_C1_01	B_C1_02	B_C1_03	B_C1_05	B_C1_06	B_C1_07	B_C1_09	B_C1_10	-	-	-	-	-	-	-	B_C1_20	-	B_C1_23	B_C1_24	-	-	-
level (m AD)	-	9.576	9.996	10.007	10.360	10.440	10.752	11.048	11.139	11.430	-	-	11.597	-	11.745	-	-	11.971	12.079	12.117	12.677	12.677	13.300	-

West Mundijong Urban Precinct - Predevelopment
 Birrega sub-drain C1 - 1 EY (3hr#7)

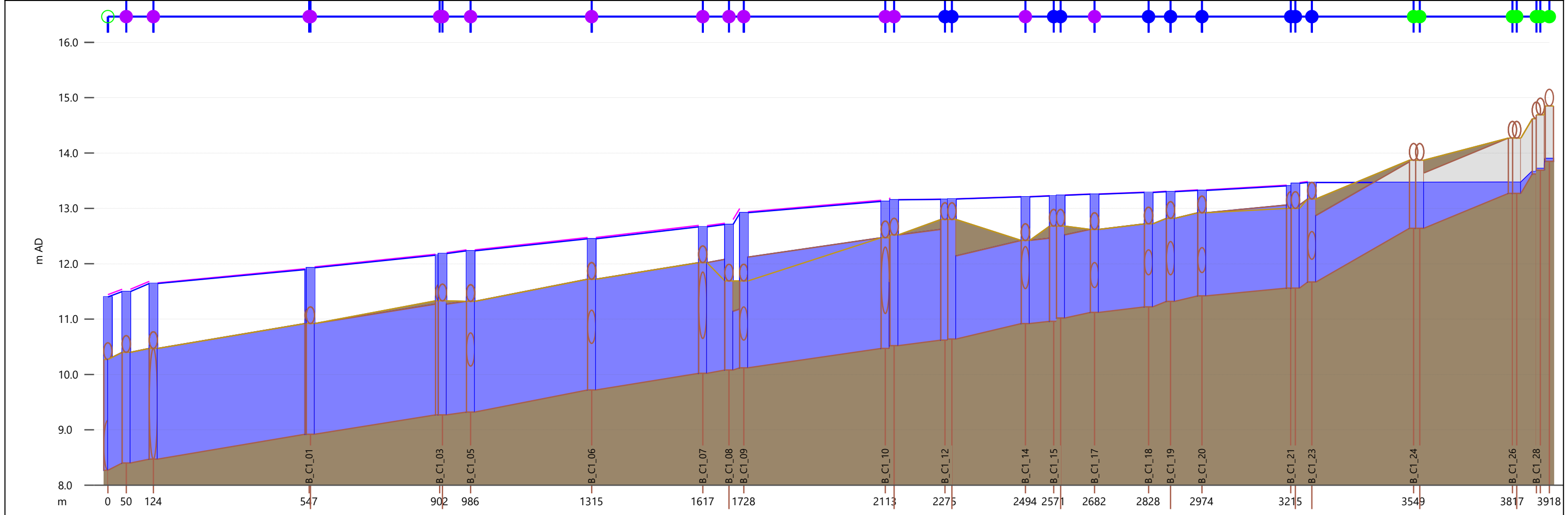
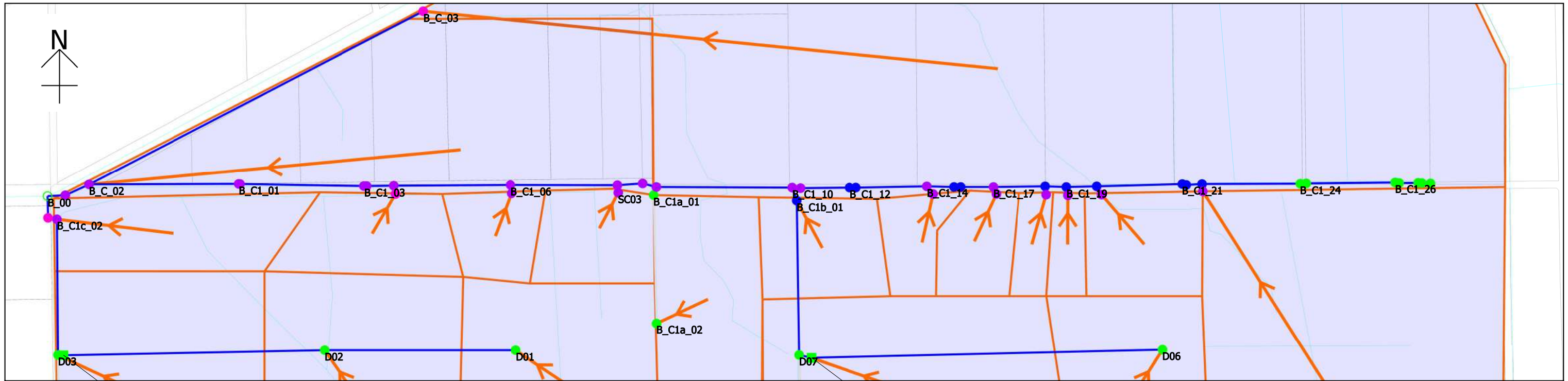




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DS flow (m3/s)	-	-	4.69655	4.65685	-	4.35551	4.20855	-	-	3.60138	1.76112	1.81147	-	-	1.79536	-	-	1.38795	-	-	-0.12287	0.00000	-	-
Node	-	B_C_02	B_C1_01	B_C1_02	B_C1_03	B_C1_05	B_C1_06	B_C1_07	-	B_C1_09	B_C1_10	-	-	-	-	-	-	B_C1_20	-	B_C1_23	B_C1_24	-	-	-
level (m AD)	-	10.653	10.740	10.826	10.935	10.975	11.139	11.355	-	11.499	11.735	-	-	-	11.910	-	12.002	-	12.215	12.349	12.384	12.677	12.677	13.300

West Mundijong Urban Precinct - Predevelopment
 Birrega sub-drain C1 - 20% AEP (1hr#1)

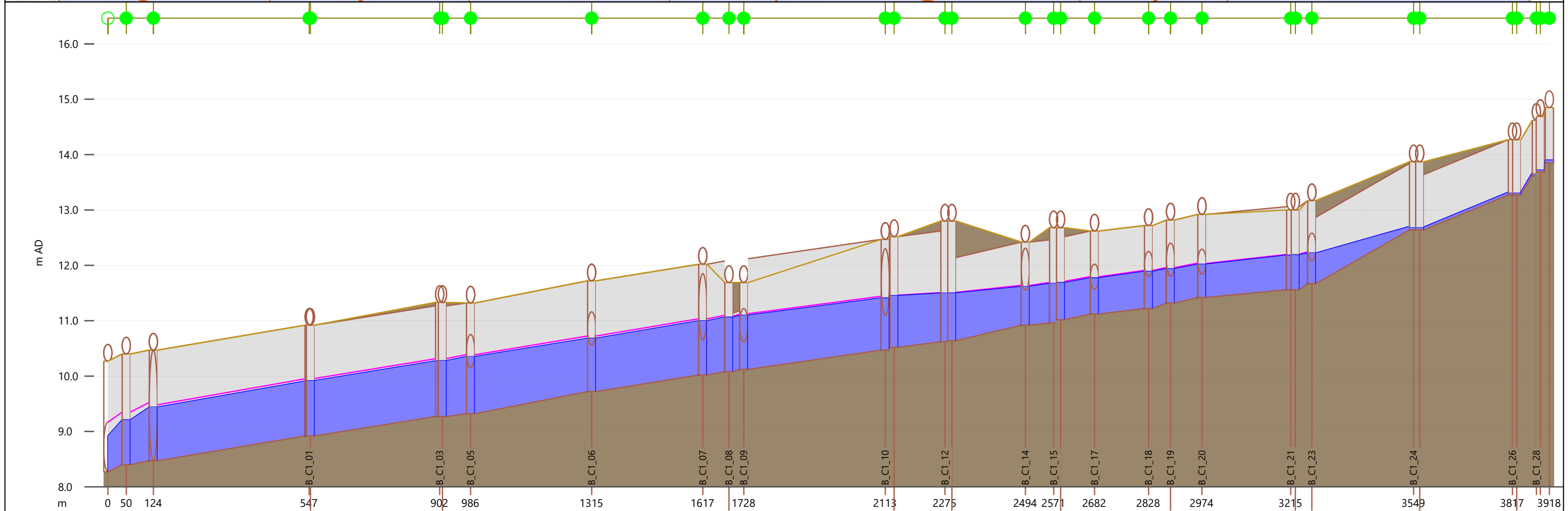
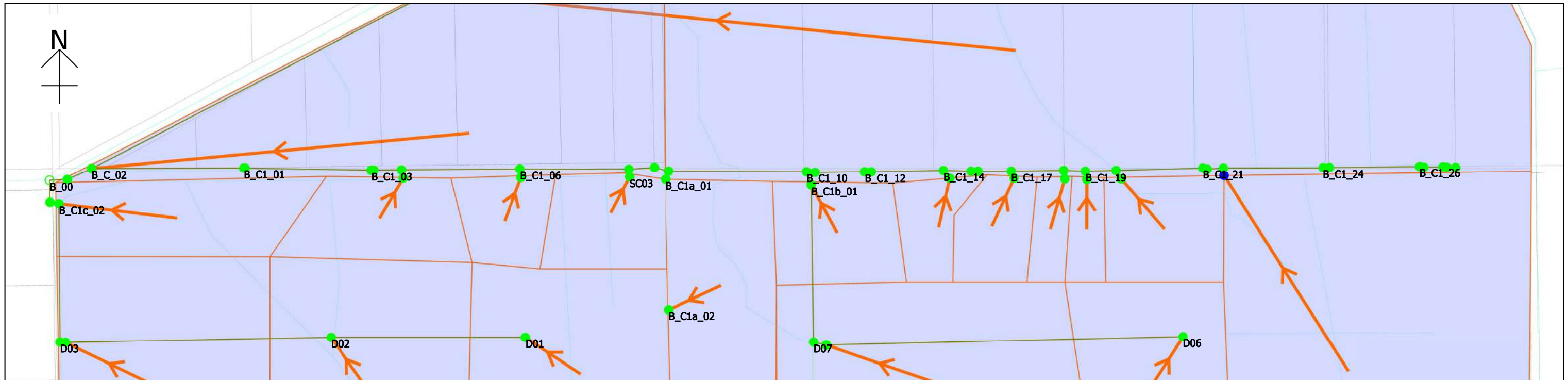




Link	-	-	B_C1_01.1	B_C1_03.1	-	B_C1_06.1	B_C1_07.1	-	-	B_C1_10.1	-	B_C1_14.1	-	-	B_C1_18.1	-	-	B_C1_21.1	-	B_C1_24.1	B_C1_26.1	-	-
DS flow (m3/s)	-	-	8.84903	8.44442	-	8.89112	9.23232	-	-	7.62855	4.65388	4.12743	-	-	3.92816	-	-	4.04391	-	-0.45565	-0.11184	-	-
Node	-	B_C_02	B_C1_01	B_C1_02	B_C1_03	B_C1_05	B_C1_06	B_C1_07	B_C1_09	B_C1_10	-	-	-	-	-	-	-	B_C1_20	-	B_C1_23	B_C1_24	-	-
level (m AD)	-	11.643	11.894	11.928	12.154	12.232	12.451	12.665	12.922	13.127	-	-	-	-	-	-	-	13.324	13.406	13.468	13.468	13.468	13.470

West Mundijong Urban Precinct - Predevelopment
 Birrega sub-drain C1 - 1% AEP (6hr#1)

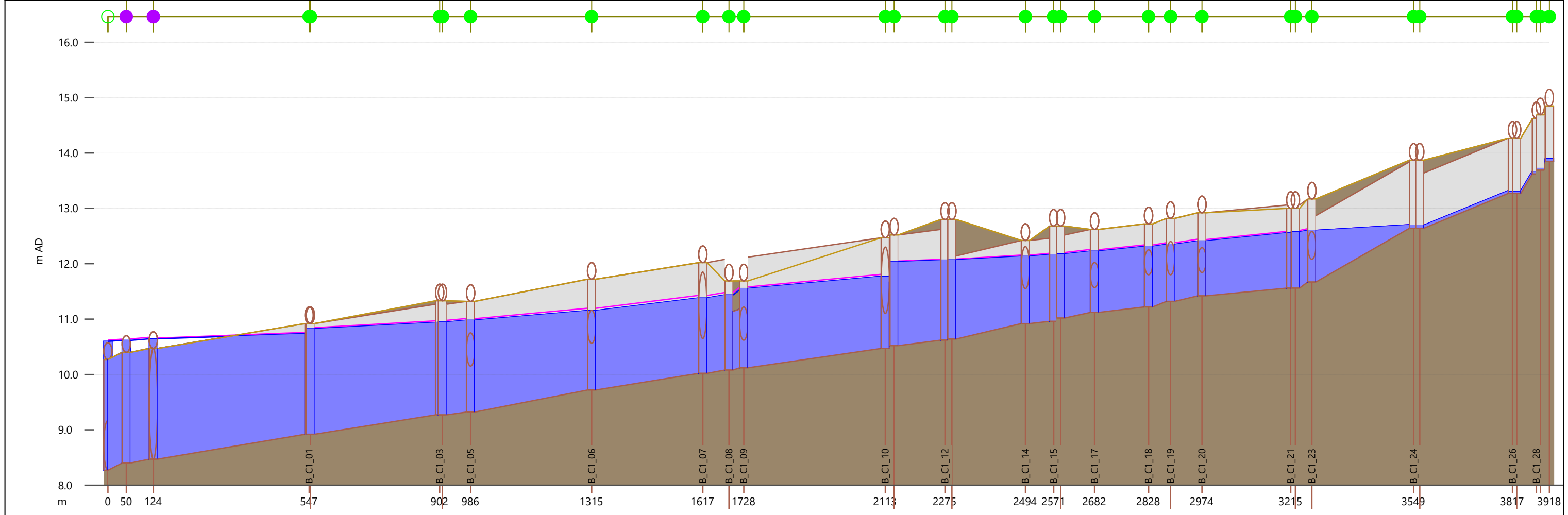
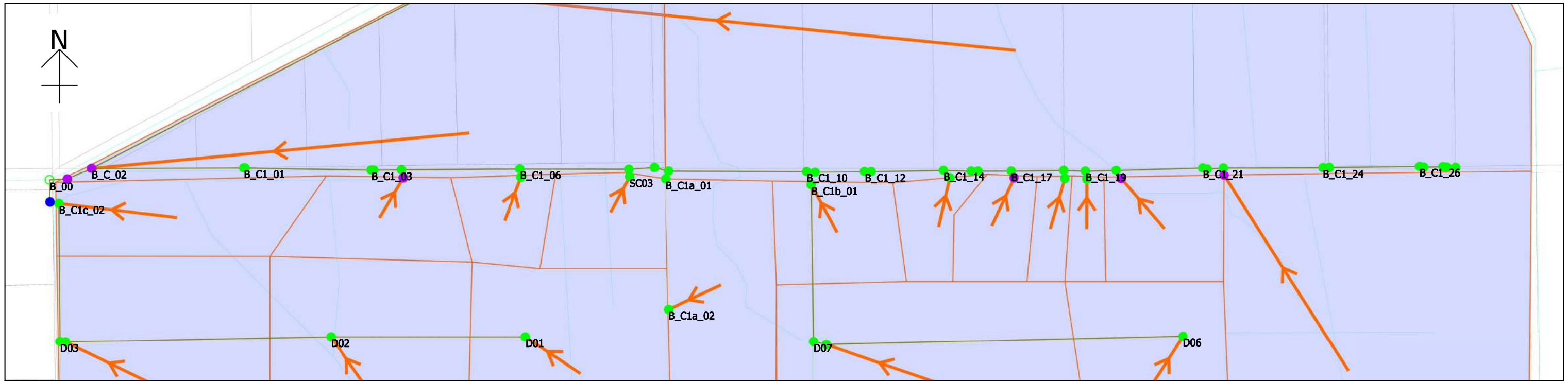




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DS flow (m3/s)	-	-	2.73388	2.72822	-	2.64038	2.58886	-	-	2.22047	-	1.26904	1.28175	-	-	1.15162	-	-	0.91342	-	0.02711	0.00000	-	-	
Node	-	B_C_02	B_C1_01	B_C1_02	B_C1_03	B_C1_05	B_C1_06	B_C1_07	-	B_C1_09	B_C1_10	-	-	-	-	-	-	-	B_C1_20	-	B_C1_23	B_C1_24	-	-	
level (m AD)	-	9.438	9.906	9.914	10.272	10.349	10.680	10.995	-	11.097	11.409	-	-	-	-	-	-	-	12.018	-	12.181	12.221	12.677	12.677	13.300

West Mundijong Urban Precinct - Post-development
 Birrega sub-drain C1 - 1EY (6hr#8)

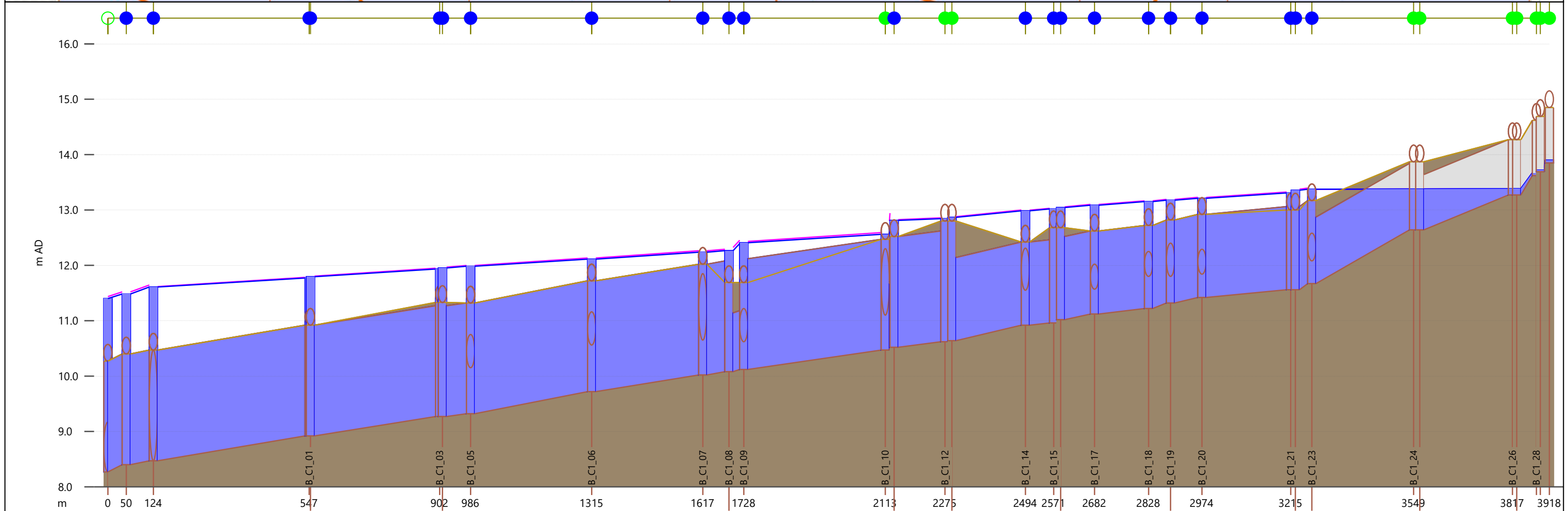
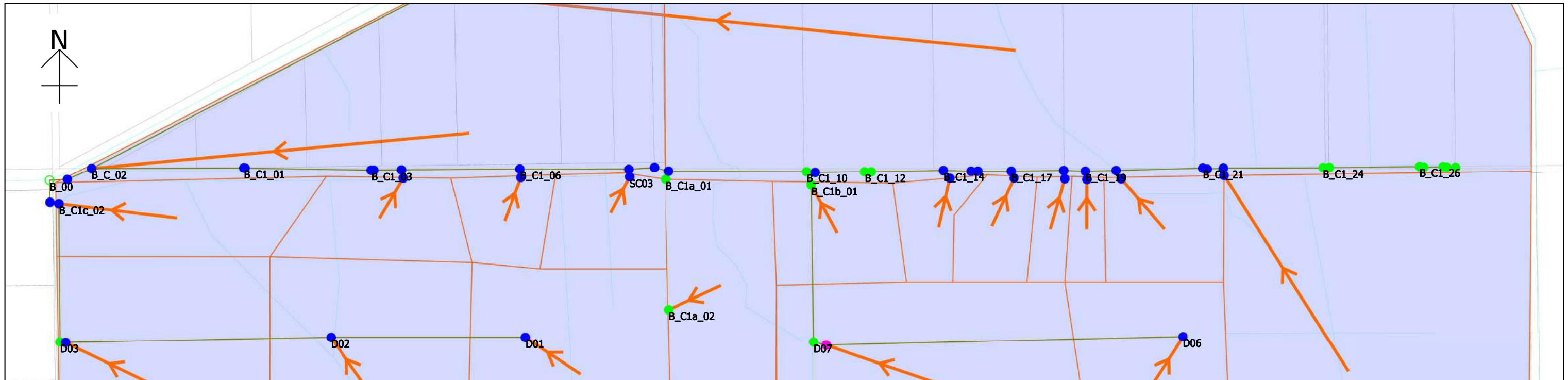




Link	-	-	B_C1_01.1	B_C1_03.1	-	B_C1_06.1	B_C1_07.1	-	-	B_C1_10.1	-	-	B_C1_14.1	-	-	B_C1_18.1	-	-	B_C1_21.1	-	B_C1_24.1	B_C1_26.1	-	-
DS flow (m3/s)	-	-	4.77175	4.74382	-	4.53188	4.42366	-	-	3.70084	2.67591	2.72237	-	-	2.53803	-	-	2.12620	-	-0.15488	-0.00037	-	-	-
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level (m AD)	-	10.645	10.736	10.825	10.938	10.979	11.153	11.382	11.553	11.771	-	-	12.133	-	12.227	-	-	12.411	12.558	12.602	12.696	12.696	13.300	-

West Mundijong Urban Precinct - Post-development
 Birrega sub-drain C1 - 20% AEP (3hr#5)





Link	-	-	B_C1_01.1	B_C1_03.1	-	B_C1_06.1	B_C1_07.1	-	-	B_C1_10.1	-	-	B_C1_14.1	-	-	B_C1_18.1	-	-	B_C1_21.1	-	B_C1_24.1	B_C1_26.1	-	-
DS flow (m3/s)	-	-	6.78602	6.57655	-	6.71103	7.07149	-	-	6.79531	5.09185	4.58606	-	-	4.02450	-	-	3.95971	-	-0.39052	-0.09093	-	-	-
Node	-	B_C_02	B_C1_01	B_C1_02	B_C1_03	B_C1_05	B_C1_06	B_C1_07	-	B_C1_09	B_C1_10	-	-	-	-	-	-	B_C1_20	-	B_C1_23	B_C1_24	-	-	-
level (m AD)	-	11.609	11.771	11.795	11.934	11.984	12.112	12.237	-	12.409	12.560	-	-	12.985	-	13.086	-	13.211	13.307	13.375	13.377	13.377	13.384	-

West Mundijong Urban Precinct - Post-development
 Birrega sub-drain C1 - 1% AEP (6hr#9)





Client: Oversby Consulting

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft report	V1	HBr	SSh	Electronic	13 Oct 2020
Final report	V2	HBr	SSh	Electronic	14 Oct 2020
Revised final report	V3	HBr	SSh	Electronic	22 Oct 2020
Revised final report	V4	HBr	SSh	Electronic	13 Nov 2020
Revised final report	V5	HBr	SSh	Electronic	24 Feb 2021

Urbaqua

land & water solutions

Suite 4/226 Carr Place

p: 08 9328 4663 | f: 08 6316 1431

e: info@urbaqua.org.au

www.urbaqua.org.au

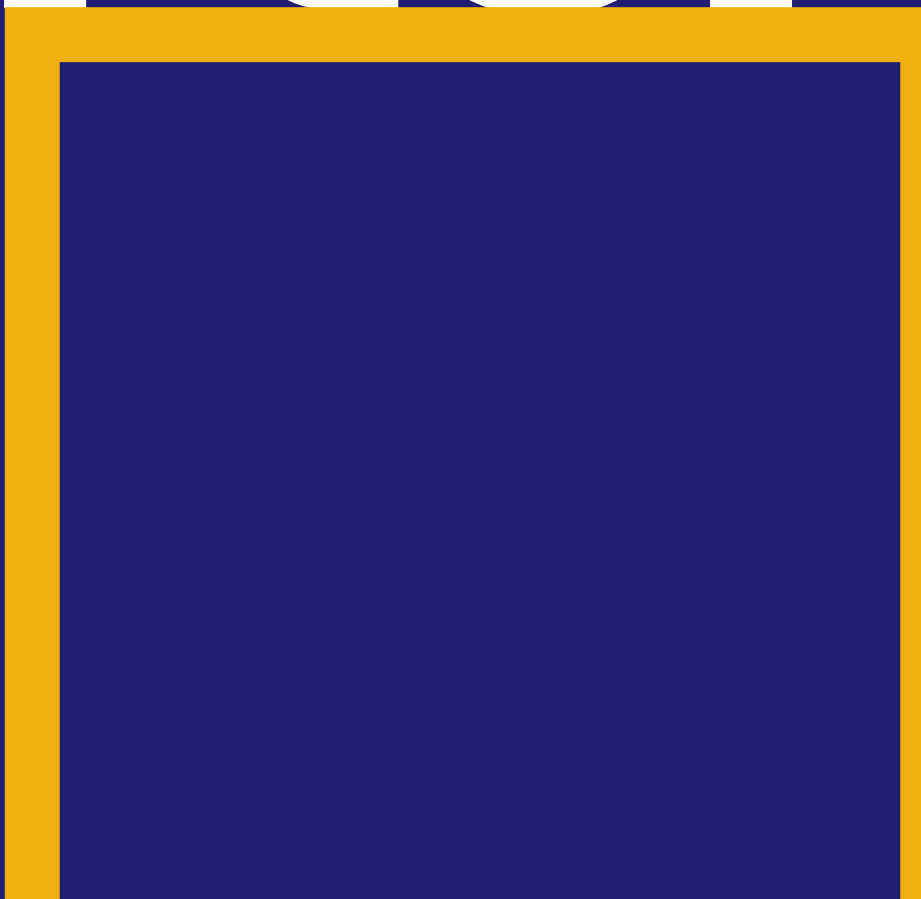
Appendix B INFRASTRUCTURE AND SERVICING ASSESSMENT PROPOSED MUNDIJONG WEST DEVELOPMENT



**INFRASTRUCTURE AND
SERVICING ASSESSMENT**

**Proposed Mundijong West
Development**

Porter



REPORT PREPARED FOR
WPG LANDHOLDINGS PTY LTD

Prepared by	Porter Consulting Engineers
Postal address	PO Box 1036 Canning Bridge WA 6153
Phone	(08) 9315 9955
Email	office@portereng.com.au

Date	28 April 2022
Our reference	R75D.20
Job Number	19-1-10
Checked	<i>SCH</i>

HISTORY AND STATUS OF THE DOCUMENT

Revision	Date issued	Author	Issued to	Revision type
Rev A	09/11/2019	S Highman	WPG Landholdings Pty Ltd	First Draft
Rev B	25/02/2021	S Highman	WPG Landholdings Pty Ltd	For WAPC Submission
Rev C	24/03/2022	S. Highman	WPG Landholdings Pty Ltd	For WAPC Submission
Rev D	28/04/2022	S. Highman	WPG Landholdings Pty Ltd	For WAPC Submission

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3.0	ENVIRONMENTAL	2
4.0	URBAN DEVELOPMENT	3
5.0	SITWORKS AND EARTHWORKS	3
6.0	WASTEWATER	3
	6.1 <i>External to the Site</i>	3
	6.2 <i>Wastewater Servicing</i>	4
7.0	WATER RETICULATION	4
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APPENDIX 1 – Concept Wastewater Servicing Plan

APPENDIX 2 – Concept Water Servicing Plan

1.0 INTRODUCTION

Porter Consulting Engineers was commissioned by WPG Landholdings Pty Ltd to complete an infrastructure and servicing assessment on a parcel of land that falls outside of the proposed Mundijong District Structure Plan. The intent being to ultimately rezone the land to facilitate urban development.

The following are the outcomes of our investigation.

2.0 SITE DETAILS

2.1 Landform

The site is located approximately 3km west of the Mundijong town site. It is bordered by Leipold Road to the north, Kargotich Road to the east, Mundijong Road to the south and King Road to the west. Refer the below for the site location.

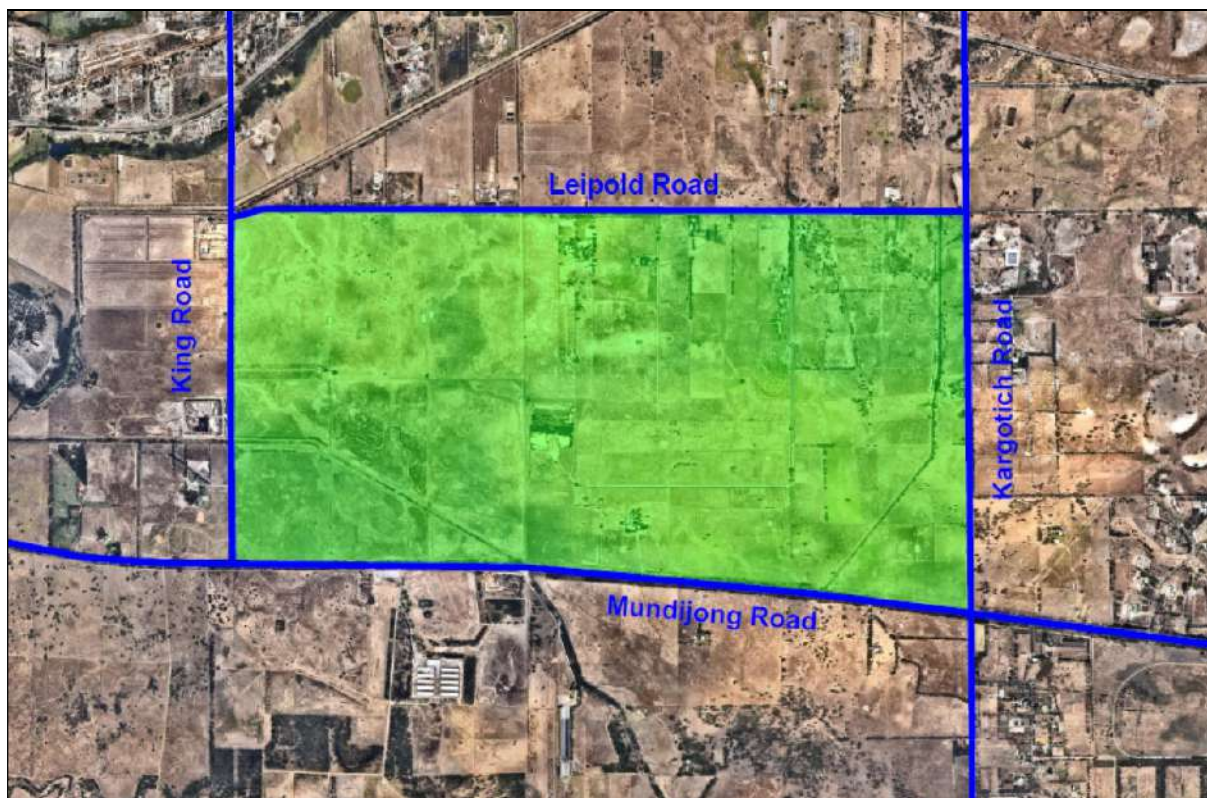


Figure 1 – Site Layout

While our investigation relates to the overall Site Area depicted in **Figure 1**, it is noted that it is only proposed to rezone land west of Gangemi Road to Urban under the Metropolitan Region Scheme.

The site is approximately 860 hectares in size and has a gradual fall from the south east down to the north west. The site is predominantly vacant farmland with houses and sheds scattered throughout. There is sparse vegetation.

For its size, the site has a very small number of individual properties.

There is a formal Water Corporation open drain (Oakland Drain) that flows south along Kargotich Road before turning west and running parallel to Mundijong Road. It crosses King Road approximately 700m north of Mundijong Road. There are other shallow farm drains throughout that connect into the Oakland drain. There are also various drainage structures at the road crossings.

The Tonkin Highway extension will pass the site approximately 1.8km to the east. It is understood that the Shire of Serpentine Jarrahdale are progressing the planning of the West Mundijong Industrial Development in between the highway and Kargotich Road.

2.2 Ground Conditions

Mapping suggest the ground consists of sandy clay to depth and is commonly defined as Guildford Formation. It is expected a layer of topsoil will be present. The western portion of the Water Corporation open drain falls within a clay sandy silt zone defined as alluvial origin. These ground conditions are relatively common in regions along the bottom of the Darling Scarp.

Detailed geotechnical investigations will be required throughout the detailed planning and design phases to verify the ground profile.

Detailed groundwater investigations will be completed during the local structure planning phase to establish the profile. This profile will be used to establish drainage arrangements and ultimately finished lot levels. Due to the Guildford Formation, it is expected groundwater will be shallow.

Acid Sulphate Soil (ASS) mapping indicates that the site falls within a moderate to low risk of ASS occurring within 3m of natural source surface but high to moderate risk of ASS beyond 3m. It is expected that any dewatering will require a preliminary ASS investigation and where required, an ASS Management Plan. It is expected standard construction methods will be utilised to manage the ASS.

It appears the existing ground conditions do not prohibit urban development.

3.0 ENVIRONMENTAL

Aurora Environmental have been engaged to complete a Desktop Environmental Assessment of the site. An environmental review and assessment was not completed as part of this investigation, please refer to Aurora's report for further details.

4.0 URBAN DEVELOPMENT

There are multiple landowners within the western portion of the site (west of Gangemi Road) and it is understood all are in support of its urban development. This support will assist in the planning of the infrastructure and ensure efficiencies in delivering the project.

5.0 SITEWORKS AND EARTHWORKS

The site is generally feature free apart from the various open drains and a borrow pit that appears to have been formed in the 1970's. It is expected the borrow pit will be backfilled and compacted as part of the development works.

Pending the outcomes of the geotechnical investigations, it is expected topsoil will be stripped prior to the placement of structural fill to establish the finished surface level. The filling specifics will be considered during the design process. Techniques such as topsoil screening and blending would need to be investigated as it presents an opportunity to reduce the quantity of imported fill. It is expected excess topsoil will be reused across the development where appropriate.

Some clay layer shaping may be required pending the outcomes of the drainage studies and the detailed engineering designs.

The above works are typical for a development of this nature and we do not foresee any issues that would prohibit urban development.

6.0 WASTEWATER

6.1 External to the Site

There is no existing wastewater infrastructure in the surrounding area. The Water Corporation's current wastewater planning extends from the scarp and stops at the future Tonkin Highway reserve. As expected, there is no wastewater planning over this site due to its current planning status.

Water Corporation have confirmed that the nearest wastewater pumping station will be located on Scott Street, approximately 1.8 km to the north east. This pumping station (type 90) services land to the East of the Tonkin Highway extension. This pumping station is on the Water Corporation Capital Investment Programmed with funding scheduled for the fifth year. Refer the green linework in Appendix 1 for details.

The Water Corporation confirmed its long term ultimate planning for the region details a large Type 1000 relay pumping station on Scott Street. This will convey effluent west to either Rockingham or Kwinana treatment plants. The timing of this is unknown. The pumping station will service a significant area, likely to include suburbs from Byford to Serpentine. Its catchment is expected to cover this site due to its very close proximity. The Water Corporation has secured a parcel of land to the west of the Tonkin Highway extension

for this Type 1000 pumping station. A service corridor will be required along Mundijong Road for its pressure main. Refer to the blue linework in Appendix 1 for the Type 1000 details.

6.2 Wastewater Servicing

As the planning phases progress for this site, the Water Corporation will prepare wastewater servicing concepts. It is expected the site will have one wastewater pumping station which will receive gravity inflow from the site and will pump the effluent east towards Scott Street. Due to the limited number of individual properties, it is expected the placement of the pumping station, pressure main and the associated incoming infrastructure will be easy to plan resulting in an efficient design. A suggested pumping station location and pressure main layout is shown in red in Appendix 1.

The pressure main servicing this pumping station will take a direct route to a Scott Street site via the existing road reserves. The future Water Corporation planning will nominate this pressure mains discharge location. We have notionally shown this into the future Type 1000 (blue in Appendix 1).

A standard wastewater gravity network will be established within this site as typical for an urban development. A concept wastewater servicing layout is shown in maroon as presented in **Appendix 1**.

7.0 WATER RETICULATION

7.1 Primary Mains

The Water Corporation's Serpentine Trunk Main (Ø1370 and Ø1220) runs north-south through the centre of the site and conveys water into the metropolitan area. These are primary Water Corporation assets and are located within a dedicated service corridor. The Water Corporation also has an Ø1065 steel water main that extends west from the Serpentine Trunk Main along Mundijong Road. It is expected these mains will remain. Refer the below extract from Water Corporations database for details.



Figure 2 – Primary Water Infrastructure

7.2 Water Servicing

There are no water distribution or reticulation mains of suitable size in the surrounding area that can be connected to provide a supply point for this site. This is expected for an existing rural zone.

As the site falls outside of the current planning area, the Water Corporation does not have any formal water supply concepts. As the planning phases progress for this site (LSP process), the Water Corporation will consider concepts to facilitate development.

Discussions with the Water Corporation confirmed there are two potential options to provide a water supply for the site. Those being a connection to the existing large water mains or establishing a tank on the scarp to supply the greater area. The Corporation acknowledged the tank option is more likely. As part of the tank option, it is expected a distribution main will extend to the site with reticulation connections servicing the development. It is also likely this distribution main will connect into the existing Mundijong network to reinforce its water supply plus service the proposed Industrial land development cell.

A normal water main network will be established within this site as typical for an urban development. A concept water servicing plan is presented in **Appendix 2**.

It is expected the Corporations water supply planning can be extended over this site as part of the amendment to the Metropolitan Region Scheme.

8.0 DRAINAGE

Oversby Consulting have been appointed to prepare the District Water Management Strategy (DWMS) for this site. Refer to the DWMS for a description of the site, the operation of the existing drainage network, ground water advice, modelling outcomes and post development arrangements.

In summary, the outcomes of the DWMS are as follows:

- the Oakland Water Corporation open drain will retain current flow capacity and storage;
- the existing on site flood storage volumes will be maintained;
- corridors to manage flood water to pass through will be established;
- fill will be placed to manage ground water and flood separation;
- living streams will be established to attenuate post development runoff and allow for conveyance of stormwater generated onsite;
- vegetated swales will assist with controlling groundwater rise; and
- standard street and lot drainage will be installed.

In conjunction with the earthwork requirements as noted in Section 5 of this report, the above are typical for a development of this nature and we do not foresee any issues that would prohibit urban development

9.0 ROADS

The four roads that border the site are controlled by the Shire of Serpentine Jarrahdale. Mundijong Road provides primary access to the Kwinana Freeway and South Western Highway, with King Road and Kargotich Road extending north to Thomas Road. Leopold Road is along the northern boundary of the site linking King and Kargotich Roads

KCTT have been appointed to undertake the Transport Impact Assessment (TIA) for this site. Please refer to the TIA for further details. In summary, it considered the following to enable comment on road safety, the internal road network and intersection controls as well as provide road sections based on liveable neighbourhoods

- land use,
- road network information,
- traffic volumes,
- crash information,
- public transport,
- pedestrian/cyclist infrastructure,
- RAV routes,
- trip generation, and
- analysis of networks

The existing intersections on the four corners of the site are either stop or give way controlled. It appears all intersections have sufficient lines of sight. The TIA notes it is likely intersection upgrades will be required pending traffic volumes and distribution. Based on our assessment, we do not foresee any constraints that would prohibit the upgrade of these intersections.

Each of the perimeter roads will have intersections to allow access into the site. It is not expected the geometry or profile of these existing roads will impact on the locations of these future intersections. It is expected any intersections off Mundijong Road will require a bridge or culvert arrangement to allow the road to pass over the existing Oakland Drain.

The site will have an internal road network with varying road hierarchies as typical with a development of this nature.

The Main Roads WA Restricted Access Vehicle (RAV) mapping confirms King Road and the Western portion of Mundijong Road are RAV 4 compliant with Kargotich Road being RAV 3 compliant. It is noted RAV access is typically not required for a residential development. Although possible, it is expected that internal RAV access will not be required for this development.

Main Roads WA plan to extend Tonkin Highway past Mundijong Road to the South West Highway. The Main Roads WA website confirms development works are continuing throughout 2022. A Construction program is not available however informal advice suggests construction may commence in 2024. It is expected the extension will cross Mundijong Road approximately 1.8km east of the site. It is understood the road reserve for the future Tonkin Highway exists and federal funding has been committed. The Tonkin Highway extension will not impact on the development of this site.

The TIA (Section 2.19) notes Nicholson Road is to be extended to Mundijong Road and classified as Integrator Arterial. The TIA's "Proposed Changes in the Surround Road and Rail Network Plan" shows Nicholson diverting down to Boomerang and onto King. We are of the opinion this arrangement is likely as it minimises the number of rail and drain crossings plus reduces the number of intersections on Mundijong Road.

There is a rail corridor running parallel to Leipold Road. The King and Kargotich Road crossings are at grade and fully controlled (boom and light). The rail crosses King Road about 700m north of Leipold Road and crosses Kargotich Road about 1,000m north of Leipold Road. Refer the below for further details.

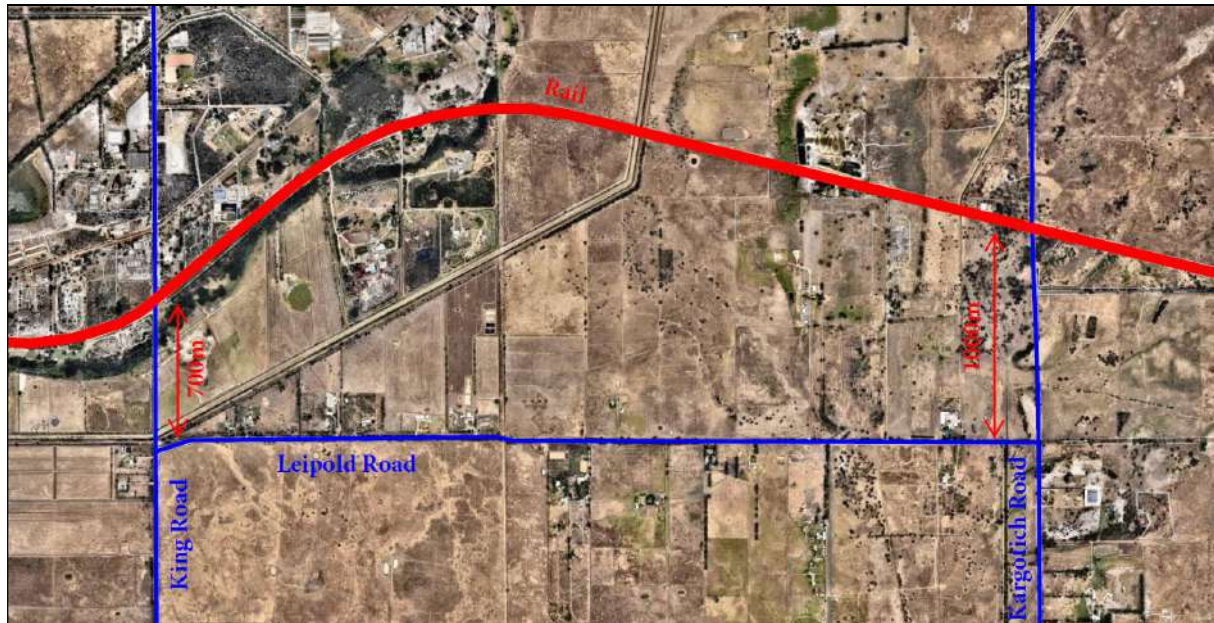


Figure 3 – Proximity of Rail Infrastructure

Due to Mundijong Road's connectivity, primary vehicle access to the site will be from the south. Due to the separation, the rail's impact on this development is expected to be negligible.

Based on the outcomes of our investigations, we do not foresee any issues that would prohibit urban development.

10.0 POWER

A review of the Western Power database shows two high voltage transmission lines running north-south through the site. One appears to be contained within Serpentine Trunk Main corridor and the other is approximately 500m west of Kargotich Road (contained in its own service corridor). It is expected these transmissions lines will remain. There are existing high voltage distribution lines along portions of the existing road reserves as typically expected.

A review of the Western Power mapping (2026) confirms the south western corner of the site has approximately 15 to 20 MVA spare capacity whereas the balance of the site has less than 5 MVA spare capacity. Previous Western Power advice indicated reinforcing works are required on their Byford Station to increase the supply in the broader area. These reinforcing works will increase available power to not only this site but also the greater Serpentine Jarrahdale district. It is likely a high voltage feeder extension is needed to provide a point of supply to the site as expected with all large scale developments.

Early engagement with Western Power is recommended to progress the power supply discussions. This will outline the scope of any feeder works as well as emphasize to Western Power the importance of upgrading supply to their Byford Station. It is expected this process will take time to complete however this can be undertaken concurrently with the planning phase. It is expected a resolution on the power supply arrangements for the site will be achieved.

Once a point of supply has been established, it is expected the site will have a traditional high and low voltage network, as is typical with a development of this nature.

11.0 COMMUNICATIONS

There are existing communication networks in the surrounding road reserves. Due to the size and scale of development, it is expected NBN be the default communications provider. There are other providers who can offer a point of difference to NBN. Due to the size of this site, it is expected all would be interested in this project. Early engagement with the communications provider is recommended to ensure connections are available when required.

We do not foresee any communications issues that would prohibit urban development.

12.0 GAS SUPPLY

ATCO Gas' distribution mapping confirms they have a high pressure feeder that runs south along Soldiers Road terminating at Mundijong. There is a feeder that heads west along Bishop Road that terminates approximately 4 km from the north eastern corner of the site. If a gas supply is required for this development, it is likely an extension from Bishop Road is needed. A standard gas reticulation network would be established from this extension to service each of the lots.

It is recommended early engagement with ATCO is arranged to manage this gas service if required.

The Australia Gas Infrastructure Group have advised the Dampier Bunbury Natural Gas Pipeline corridor is positioned well clear of the site, some 7km to the south west.

We do not foresee any gas supply issues that would prohibit urban development.

13.0 SUMMARY

The size of the site and limited number of individual lots simplifies the rezoning and development process resulting in shorter timeframes and efficient designs (road, POS and infrastructure).

The expected ground conditions for this site are not dissimilar to other residential areas within close proximity to the bottom of the Darling Scarp. The findings of the DWMS, as summarised in Section 8 of this report, are typical for a development of this nature.

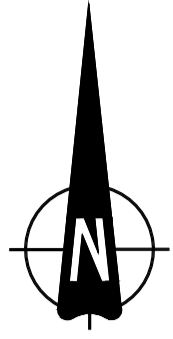
There is minimal services planning for the site due to its current zoning. When the rezoning application is initiated, each of the service authorities will consider how they can establish a point of supply. Our investigations confirm this site is no different to others that are on the fringe of development and points of supply for each can be provided by the various service authorities.

It is recommended continual discussions are held with the service authorities to ensure their planning and the provision of their infrastructure aligns with the development of this site.

Primary access to the site is via Mundijong Road. This intersects with both Kwinana Freeway and South Western Highway as well as the future Tonkin Highway interchange. Access into the site can be off Mundijong Road or any of the other three bounding roads.

No engineering or servicing constraints have been identified that would prohibit urban development of this site.

APPENDIX 1 – Concept Wastewater Servicing Plan



LEGEND

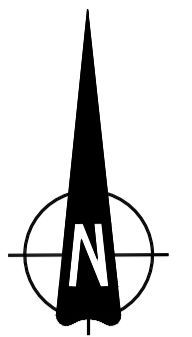
- - - - - RETICULATION BOUNDARY
- — — — — PROPOSED GRAVITY SEWER
- · - · - PROPOSED WASTE WATER PUMP STATION AND PRESSURE MAIN
- - - - - FUTURE WASTE WATER PUMP STATION "50-086" AND PRESSURE MAIN
- - - - - PROPOSED PRIMARY SUBDIVISION ROADS
- █ PROPOSED POS ADJACENT TO PRIMARY INFRASTRUCTURE
- - - - - INTERIM SCOTT ROAD WFPS TYPE 90

PROPOSED WFPS A
 CATCHMENT AREA = 420 ha
 GSDP = 92 l/s
 PUMPED FLOW = 123l/s



MUNDIJONG WEST MUNDIJONG		EXTERNAL WATER CORPORATION INFRASTRUCTURE ADDED LAYOUT ALTERED ISSUED FOR APPROVAL		COPYRIGHT COPYRIGHT IN THIS DRAWING IS THE PROPERTY OF THE CONSULTANT. THE CLIENT HAS LICENSE TO USE THIS DRAWING FOR THE PROJECT ONLY. THE USER SHALL BE RESPONSIBLE FOR "SITE CHECKING" ALL DIMENSIONS BEFORE COMMENCEMENT OF WORK. CAD DRAWING OR NOT MANUALLY ALTER. ONLY PLANS WITH NUMERICAL REVISION (REV '1' OR HIGHER) AND SIGNED AS APPROVED SHALL BE USED FOR CONSTRUCTION.				Level 2 Kishorn Court 58 Kishorn Road Mt Pleasant 6153 WA PO Box 1836 Canning Bridge 6153 WA Tel (08) 9315 9955 Email office@portereng.com.au www.portereng.com.au		CLIENT: WPG LANDHOLDINGS PTY LTD		DRAWING: CONCEPT SEWER SERVICING PLAN		SCALE: 1:10000 DATE: JULY 2020 DESIGN: SCH DRAWN: MEG CHECK: APPD		DRAWING No: 19-1-10/200		REV No: C A1		ORIGINAL DRAWING SITE	
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APPENDIX 2 - Concept Water Servicing Plan



- LEGEND**
- RETICULATION BOUNDARY
 - PROPOSED WATER RETICULATION #200
 - PROPOSED WATER DISTRIBUTION MAIN
 - EXISTING WATER RETICULATION
 - PROPOSED PRIMARY SUBDIVISION ROADS
 - WATER CORPORATION DN1370, DN1220 AND DN1065 WATER MAINS
 - PROPOSED POS ADJACENT TO PRIMARY INFRASTRUCTURE



PROJECT: **MUNDIJONG ROAD MUNDIJONG**

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Porter
 Consulting Engineers
 Level 2 Kishorn Court
 58 Kishorn Road
 Mt Pleasant 4553 WA
 PO Box 1836
 Canning Bridge 4553 WA
 Tel (08) 9315 9955
 Email office@portereng.com.au
 www.portereng.com.au
T1090 Pty Ltd ACN 078 971 748 is a trustee for the Consulting Engineers Unit Trust trading as Porter Consulting Engineers ACN 78 628 296 391.

CLIENT: **WPG LANDHOLDINGS PTY LTD**

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Level 2 Kishorn Court
58 Kishorn Road
Mount Pleasant 6153
Western Australia

PO Box 1036
Canning Bridge 6153
Western Australia

Tel: (08) 9315 9955
Email: office@portereng.com.au

www.portereng.com.au

CONTACT US

Oversby Consulting

Water and Environmental Management

Brendan Oversby
Director

☎ 0447 614 411
✉ brendan@oversbyconsulting.com.au
🌐 www.oversbyconsulting.com.au
📍 PO Box 369 DARDANUP WA 6236



**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 2.6
Environmental Assessment Report





2 Bulwer Street
PERTH WA 6000
T: (+61) 8 9227 2600
F (+61) 8 9227 2699
www.auroraenvironmental.com.au

ENVIRONMENTAL ASSESSMENT

Various Lots bound by Mundijong Road, Gangemi Road, Leipold Road and King Road, Oldbury



Prepared For: Watson Project Management Group
6/110 Erindale Road
BALCATTWA WA 6021

Report Number: AP2020/169

Report Version: 4

Report Date: 23 May 2022

EXECUTIVE SUMMARY

Aurora Environmental was commissioned by Watson Project Management Group to complete an environmental assessment of a 647 hectare (ha) parcel of land in Oldbury bound by Mundijong, Gangemi, Leipold and King Roads ('the Site').

The Site is currently zoned 'Rural' under the Metropolitan Region Scheme (MRS) and 'Rural' under the Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 (and draft Local Planning Scheme No. 3). The aim of this assessment is to support an MRS Amendment to rezone the Site to 'Urban' and identify potential development constraints.

The environmental assessment found the Site contains few environmental constraints that would prevent future development. From an ecological perspective, the degraded nature of the Site due to previous clearing and many years of low intensity agricultural use mean that sensitive environments are unlikely to be adversely impacted.

Aurora Environmental recommends the following matters should be considered in future planning and development stages:

- Soil permeability is anticipated to be low and potentially not suitable for infiltration of stormwater. Testing should be conducted to inform stormwater management options.
- Implement a pre-development groundwater and surface water monitoring program to capture pre-development water quality data and groundwater levels. It is expected that standard engineering solutions such as filling and sub-soil drainage will be required to achieve adequate separation from shallow groundwater levels and 100-year flood levels. These solutions will be further explored and refined through subsequent planning stages, consistent with the approach to urban development elsewhere in the Shire and the south metropolitan sub-region more broadly.
- Provide a buffer of 50m to the mapped conservation category wetland (CCW) along Mundijong Road, which is also a Bush Forever Site, and prepare a management plan for the treatment of the buffer/interface with the proposed development at the Site. The buffer should be reflected in the structure plans and the management plan could be prepared at local structure plan stage or as a condition of subdivision. An investigation to reclassify this portion of the CCW is currently being considered as the area is degraded and not commensurate with CCW values.
- Prepare more detailed bushfire management plans during future stages of the planning process, consistent with State Planning Policy requirements and building on the strategic hazard assessment prepared by Lush Fire and Planning.
- Conduct a targeted ASS investigation if there is potential to disturb ASS and if required prepare and implement an ASS and Dewatering Management Plan. The requirement for an ASS investigation should be reviewed once disturbance details (such as dewatering and excavation) is known. This is best undertaken at the subdivision stage when more detailed engineering design has been completed.
- During future stages of the planning process, site-specific odour, noise and/or dust studies will be required to establish appropriate buffers to the Peel Feedlot (sheep) and Serpentine Jarrahdale

Environmental Assessment

Various Lots Bound by Mundijong, Gangemi, Leipold and King Roads, Oldbury

Holding Yards (cattle) located south of the Site, if the proponent is seeking to reduce the EPA (2015) recommended separation distance of 1,000m. These studies will also need to consider any recommended separation distances or buffers associated with other external land uses that could impact the Site in the future.

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Aurora Environmental has implemented a comprehensive range of quality control measures on all aspects of the company’s operation.

An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed and signed off by senior members of the consultancy team prior to issue to the client.

Document No: WPL2020-003_ENVA_001_at_V4

Report No: AP2020/169

Author: Darko Mikic
 Environmental Scientist

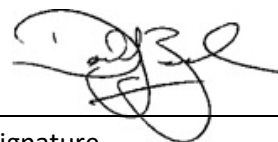


23 May 2022

Signature

Date

Reviewed by: Paul Zuvela
 Manager – Environmental
 Impact Assessment



23 May 2022

Signature

Date

Environmental Assessment

Various Lots Bound by Mundijong, Gangemi, Leipold and King Roads, Oldbury

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1	WPL2020-003_ENVA_001_at_V4	V4	23 May 2022	Watson Property Group	DM

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1 INTRODUCTION

1.1 BACKGROUND

Aurora Environmental has been commissioned by Watson Project Management Group to conduct an environmental assessment of a 647-hectare (ha) parcel of land ('the Site') in Oldbury (Figure 1). The Site is bound by Mundijong, Gangemi, Leipold and King Roads. It is located on the eastern side of the Swan Coastal Plain, approximately 50km south-south-east of the Perth Central Business District and approximately 3km west of the Mundijong township.

The Site is currently zoned 'Rural' under the Shire of Serpentine-Jarrahdale's ('the Shire') Town Planning Scheme No. 2 and the Shire's Draft Local Planning Scheme No.3, and 'Rural' under the Metropolitan Region Scheme.

Historical aerial photography from Landgate (2020) shows that in November 1953 the entire Site had been cleared with a few trees scattered throughout paddocks. No houses or other built structures are evident. A few houses can be seen by September 1974 and the first evidence of clay extraction on Lot 275 was noted. The most recent aerial photography (February 2020) and site inspection (February 2019) confirmed the majority of the Site is cleared of native vegetation with scattered trees, mainly in the north-east corner. The Site is used primarily for low intensity agriculture and horse keeping.

1.2 PURPOSE

The aim of this assessment is to determine the suitability of the western portion of the Site (west of Gangemi Road) for rezoning to enable future urban development. Also provided are:

- Recommendations for future environmental investigations;
- Advice in relation to the mitigation and management of potential environmental impacts associated with the future development of the Site; and
- Guidance about the environmental approvals that may be required in order to facilitate development of the land.

1.3 SCOPE

The scope of this environmental assessment included a review of the following:

- Geology, soils and acid sulfate soils (ASS) risk;
- Desktop information about conservation significant flora, vegetation and fauna using the Department of Biodiversity, Conservation and Attractions' (DBCA) NatureMap database (DBCA, 2020a) and the Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (DAWE, 2020);
- Desktop information about wetlands and other surface water features;
- Available groundwater information;
- The Department of Water and Environmental Regulation's (DWER) Contaminated Sites online database;

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- Historical aerial photographs (Landgate, 2020a) to see if there were any historical activities at the Site that may have the potential to cause contamination;
- Surrounding land uses and the potential for land use conflicts between the proposed use for the Site and adjacent land uses;
- Aboriginal heritage issues based on desktop information available from the Department of Planning, Lands and Heritage's (DPLH) Aboriginal Heritage Inquiry System;
- Minutes of the Shire of Serpentine-Jarrahdale's Special Council Meeting 22 June 2020; and
- Previous advice from the Environmental Protection Authority (EPA) relating to the Site or nearby sites.

A brief site inspection was conducted by a Principal Environmental Scientist from Aurora Environmental on 13 February 2019. Lots 272 to 275 were accessible during the site inspection. All other lots were viewed from adjacent boundaries or from public roads where possible.

2 EXISTING ENVIRONMENT

2.1 TOPOGRAPHY

The Site is relatively flat and is approximately 15 m Australian Height Datum (AHD) in height (DWER, 2020a) over the majority of the Site, rising up to 20 m AHD in the north-east and south-east corners, and down to 10m AHD near the centre of the Site (Figure 2).

2.2 GEOLOGY AND SOILS

The Site is located on the eastern side of the Swan Coastal Plain. Jordan (1986) indicates that the majority of the Site is located within the Pleistocene aged Guildford Formation geological unit. The soils on the Site are mapped as unit C_s which is described as Sandy Clay: white-grey to brown, fine to coarse, sub-angular to rounded, clay of moderate plasticity, with gravel and silt layers near the scarp, and is of alluvial origin. C_s soils have low permeability and corrosion potential, low to medium slope stability and low bearing capacity. They are suitable for excavation, however, will likely require investigation to confirm geotechnical suitability for construction at a later planning stage.

Jordan (1986) also identifies an area in the south-west corner of the Site is mapped as unit M_{sc1} which is Clayey Sandy Silt; pale brown sand, angular to rounded, low cohesion, and is of alluvial origin. This soil type is associated with a high-water table and has low permeability (Jordan, 1986).

Soil landscape mapping by the Department of Primary Industries and Regional Development (DPIRD), available via Western Australian Local Government Association's (WALGA, 2020) Environmental Planning Tool, shows that the Site is predominantly located within the Pinjarra Soil Landscape Zone which comprises alluvial deposits between the Bassendean Dunes Zone and the Darling Scarp as well as colluvial and shelf deposits adjacent to the Darling Scarp. The soils are broadly described as clayey to sandy alluvial soils with wet areas.

The Soil Landscape Unit mapping has been further refined into a series of sub-units. The mapping shows that there are five sub-units present at the Site. All five sub-units belong to the Pinjarra Landscape Zone (Figure 2).

Pinjarra Landscape Zone

- 212Pj_P1d – Flat to very gently undulating plain with deep acidic mottled (or effectively duplex) soils. Shallow pale sand to sandy loam over clay, imperfect to poorly drained and moderately susceptible to salinity.
- 212Pj_P3 – Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.
- 212Pj_P4 – Poorly drained flats, sometimes with gilgai micro-relief and with moderately deep to deep black, olive grey and some yellowish-brown cracking clays and less commonly non-cracking friable clays with generally acidic sub-soils.
- 212Pj_P5 – Poorly drained flats, commonly with gilgai micro-relief and with deep black-grey to olive-brown cracking clays with subsoils becoming alkaline.

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- 213Pj_SWP6b – Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well-drained soils associated with prior stream deposits. Soils are uniform brownish sands.

2.2.1 Land Capability Mapping

The DPIRD web mapping service (Australian Government, 2020) provides information on land quality aspects based on the analysis and interpretation of the best available soil-landscape mapping dataset. The following land qualities are mapped for the Site.

Ease of excavation refers to the ease of excavating soil for building construction or earthworks, usually from 30-150 cm deep. The ease of excavation is based on characteristics such as depth to rock, slope, stone within profile, rock outcrop, waterlogging risk, surface condition and soil texture (van Gool *et al.*, 2005).

The majority of the Site is mapped as:

- **L2** 3-10% of the map unit has a very low to low rating; and
- **M1** 10-30% of the map unit has a very low to low rating.

Smaller areas of the Site are mapped as:

- **L1** <3% of the map unit has a very low to low rating;
- **M2** 30-50% of the map unit has a very low to low rating; and
- **H2** >70% of the map unit has a very low to low rating.

A low rating means that excavation at the Site will be more difficult compared to a high rating. Although the ease of excavation is based on a number of characteristics, the overall rating is based on the most limiting characteristic. For example, flatter sites have a higher rating (as they are more easily excavated) however if they are also prone to water logging (which makes excavation difficult) they will have an overall low rating.

Land Instability Risk assesses the potential for rapid movement of a large volume of soil through slope failure, shifting sand dunes, wave erosion and subsidence of karst material. Three factors are essential for landslips to occur, a threshold slope of 27%, presence of through-flow and a range of soil factors (van Gool *et al.*, 2005).

As the land is relatively flat there is a limited risk of a landslip occurring. Therefore, the entire Site and surrounds are mapped as:

- **L1** <3% of map unit has a moderate to high hazard.

Microbial Purification relates to the ability of soil used for on-site effluent disposal to remove micro-organisms which may be detrimental to public health. It is essentially a measure of the permeability and aeration within a soil profile, which influences its ability to remove undesirable micro-organisms from septic effluent and provide suitable conditions for the oxidation of some organic and inorganic compounds added to the soil as effluent (van Gool *et al.*, 2005). If site drainage is very poor soils will be insufficiently aerated for bacterial breakdown of effluent components.

The entire Site and surrounds are mapped as:

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- **H2** >70% of the map unit has a very low to low rating.

A low rating suggests the soil may not be suitable for on-site effluent disposal.

Phosphorus Export Risk refers to the likelihood that phosphorus (usually applied as fertilizer) moves from a given land unit to where it can contribute to eutrophication of surface water. The phosphorus can move either dissolved in water or attached to soil particles (van Gool *et al.*, 2005).

The phosphorus export risk does not consider movement into deep groundwater and is based on soil properties such as water erosion hazard, flood hazard, landform and depth to highest seasonal water table (van Gool *et al.*, 2005).

The majority of the Site is mapped as:

- **L1** <3% of map unit has a high to extreme phosphorus export risk.

This suggests that the majority of soils mapped onsite are not likely to freely export phosphorus from the Site.

Flood Risk mapping assesses flood frequency based on landform and average rainfall. A 'flood' is the temporary covering of land by moving water derived from overflowing streams and/or runoff from adjacent slopes (van Gool *et al.*, 2005).

The entire Site and surrounds are mapped as:

- **L1** <3% of the map unit has a moderate to high flood risk.

Site drainage potential refers to the relative drainage conditions of an area of land independent of the climate. Site drainage potential provides an assessment of the suitability of the land for installing artificial drainage to remove excess water and reduce waterlogging and inundation.

Site drainage potential is influenced by the internal drainage of the soil profile, which considers the permeability of the least permeable layer or the water table depth. It is also affected by the landscape position (van Gool *et al.*, 2005).

The majority of the Sites is mapped as:

- **H2** >70% of map unit has very poor to poor potential.

Waterlogging Risk mapping is based on average rainfall, landscape position and soil permeability. Waterlogging is excess water, in terms of saturated soil layers, in the root zone accompanied by anaerobic conditions. In saturated soils biological activity rapidly uses the available oxygen, retarding oxygen and water uptake and restricting root and plant growth. Waterlogging for extended periods near the surface (e.g., <30 cm) can result in poor crops or plant death. The ability to tolerate different periods of waterlogging varies greatly between crops. Also in many situations, the presence of a saturated layer or water table deeper in the soil can be advantageous because a water supply is available to the plant and adequate air is available in the topsoil to maintain root activity. In the agricultural areas of WA, waterlogging is widespread and a major factor reducing crop and pasture yields, especially in wet years (van Gool *et al.*, 2005).

The majority of the Site is mapped as:

- **H2** >70% of map unit has a moderate to very high waterlogging risk.

Water Erosion Risk is the inherent susceptibility of the land to the loss of soil as a result of water movement across the surface. It is a significant problem in WA affecting the long-term sustainability of agriculture in some areas and is a major source of water pollution including siltation and eutrophication, particularly in high rainfall areas. It is also an important cause of soil fertility decline as soil nutrients tend to be concentrated near the surface. Water erosion risk is based on soil properties including organic carbon content, slaking, dispersion, water repellence, soil structure, permeability and soil moisture (van Gool *et al.*, 2005).

The entire Site and surrounds are mapped as:

- **L1** <3% of map unit has a high to extreme water erosion risk.

Wind Erosion Risk is the inherent susceptibility of the land to the loss of soil as a result of wind movement across the surface. Wind erosion has many adverse effects including sandblasting damage to crops, loss of macro and micro-nutrients, long-term loss of productivity, and atmospheric pollution.

All soils are subject to wind erosion given certain conditions. The key is the level of disturbance by mechanical or animal action required to bring a soil to an erodible condition. The risk is assessed by considering surface texture and surface condition (van Gool *et al.*, 2005).

The majority of the Site is mapped as:

- **L1** <3% of map unit has a high to extreme wind erosion risk;
- **L2** 3-10% of map unit has a high to extreme wind erosion risk; and
- **M1** 10-30% of map unit has a high to extreme wind erosion risk.

2.3 ACID SULFATE SOILS

ASS are naturally occurring soils and sediment containing iron sulphides. Soils containing iron sulphides are generally found in a layer of waterlogged soil or sediment and are benign in their natural state. However, when disturbed and exposed to air, they oxidise and produce sulphuric acid, iron precipitates and concentrations of dissolved heavy metals such as aluminium, iron and arsenic.

The Site is mapped as Class 2 - moderate to low risk of ASS within 3m of the natural soil surface, but high to moderate risk of ASS beyond 3m of natural soil surface (DWER, 2020a).

2.4 WETLANDS AND WATERWAYS

2.4.1 Wetlands

Figure 3 shows the geomorphic wetland mapping for the Site. The entire Site is mapped as a Multiple Use wetland (UFI 16021) with a 4.85 ha area of conservation category wetland (UFI 14817) along the Mundijong Road reserve, from just west of King Road to the Site boundary along Gangemi Road (Australian Government, 2020) (Figure 3).

The DBCA describe multiple use wetlands as ‘*wetlands with few important ecological attributes and functions remaining*’ (DBCA, 2020b). Their use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning. Generally, multiple use wetlands do not represent a constraint to development.

The DBCA describe conservation category wetlands (CCWs) as ‘*wetlands which support a high level of attributes and functions.*’ These wetlands are the most valuable wetlands and any activity that may lead to further loss or degradation (including development or clearing) is considered inappropriate (DBCA, 2020b). The CCW within the study area (refer to Figure 3) was noted during the site inspection as comprising an extensive infestation of *Watsonia* (*Watsonia meriana* var. *bulbillifera*) and being poorly vegetated. The ecological values of this wetland have been substantially compromised and in its current condition is not commensurate with the CCW classification. It appears that the CCW values associated with this wetland are on the southern side of Mundijong Road which would not be impacted by development of the Site.

An assessment and application to reclassify the portion of the CCW within the Site is being considered by Watson Property Group. The assessment will involve mapping the vegetation types and condition, potential presence of threatened flora or ecological communities and collection of site photos. This information would be compiled and submitted to the DBCA for review and assessment as a formal request to modify the Geomorphic Wetlands of the Swan Coastal Plain dataset. Until the issue of the CCW has been assessed, the area will need to be retained with a 50 m buffer.

The Site is also within the catchment of the Peel-Yalgorup System which is listed as one of Australia’s 65 Ramsar wetlands. Ramsar wetlands are sites that are recognised under the Convention on Wetlands of International Importance (Ramsar Convention) as being of international significance in terms of ecology, botany, zoology, limnology or hydrology, and are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2.4.2 Waterways

The Site is within the Serpentine sub-catchment of the Peel-Harvey Estuary system. The Peel-Harvey Estuary system has a long history of water quality problems, largely related to the release of nutrients from agricultural activities within its catchment. The *Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992* (Government of Western Australia, 1992) sets out environmental quality objectives for the protection of the Peel-Harvey Estuary. The median annual load of total phosphorus (TP) flowing into the Estuary from the Serpentine River was set at less than 21 tonnes per annum. Water quality monitoring of the Serpentine River (water column and sediments) has shown there are high levels of phosphorus which is contributing to adverse impacts on the River system and the downstream Peel-Harvey Estuary (EPA, 2008). The *Water Quality Improvement Plan (WQIP) for the Rivers and Estuary of the Peel-Harvey System – Phosphorus Management* (EPA, 2008) notes that significant reductions of phosphorus are required in the Serpentine catchment, i.e., the median annual load of phosphorus from the Serpentine Catchment is 69 tonnes per annum and the desired target is 21 tonnes per annum. The majority of this phosphorus export to the estuary system is attributable to grazing including intensive animal agriculture, feedlots and grazing areas (EPA, 2008).

The Department of Water's (DoW, 2011) hydrological and nutrient modelling report for the Peel Harvey catchment examines the nutrient input reductions necessary to achieve the targets loads. The DoW (2011) sets input targets (based on past practice) to a maximum of 45 kg/ha/year for nitrogen for rural and urban residential land uses, and 6.5kg/ha/year for phosphorus.

Manjedal Brook / Oakland main drain, a non-perennial minor water course runs along the southern boundary of the Site (DWER, 2018).

During the site inspection, two major drains were noted within the Site, along with a series of shallow spoon drains that have been constructed to drain the paddocks and alleviate waterlogging and inundation during wet periods.

It was noted during the site inspection that the Site is low-lying with soils that are likely to have low permeability and therefore, are likely to be waterlogged or inundated during wet months. Waterlogging and inundation contribute to reduced productivity from agricultural activities such as cropping.

2.4.3 Flood Risk

The DWER's floodplain mapping provides guidance about land potentially impacted by major flooding events. The floodplain risk mapping (Figure 4) indicates that the central portion of the Site is not at risk of flooding (Australian Government, 2020). However, the outer portions, notably in the north-east, south-west and north-west corners of the Site, may be prone to flooding during the 100-year ARI event at existing ground levels.

Figure 4 shows the entire Site is mapped as a DWER 1 in 100 AEP floodplain development control area (Australian Government, 2020). This means that development controls may be applied to ensure an adequate level of flood protection is provided to any proposed development of the Site.

No areas of the Site are mapped as a floodway or flood fringe (Australian Government, 2020).

2.5 GROUNDWATER

The Site is located within the Serpentine Groundwater Area as proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act) (DWER, 2018).

The Site is underlain by the following aquifers in order of increasing depth:

- Superficial Swan - the superficial aquifer on the Swan Coastal Plain extends from Geraldton in the north to Busselton in the south. The groundwater level is close to the surface in the south and in the centre of the coastal plain. The aquifer thickness increases progressively from east to west (DoW, 2012).
- Leederville Formation – a major aquifer that extends from north of Lancelin to Augusta in the south, overlain by the superficial Swan formation. The Upper and Lower Leederville aquifers are generally unconfined, but may become confined due to the interbedded shale, clay and sandstone layers. Groundwater is generally fresh; however, salinity may be higher beneath and immediately adjacent to the Peel-Harvey estuary due to leakage of saline water from the overlying superficial aquifer (DoW, 2012).

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- Yarragadee North – the Yarragadee is the largest aquifer in the Perth Basin, reaching 3000m thickness and covering an area from north of Dongara to the Serpentine area south of Perth. It is confined by the Leederville Formation in the south (DoW, 2012).

With regard to groundwater availability for licensing, the Superficial Swan and Leederville aquifers currently have allocation available in the area (DWER, 2020d). The following groundwater licences are currently allocated to lots within the Site for abstraction from the Leederville Aquifer:

- Licence #183236 – Lot 800 Leipold Road Oldbury – licence allocation 30,000KL;
- Licence #153416 – Lot 2 Leipold Road Oldbury – licence allocation 37,600KL;
- Licence #64642 – Lot 1 Leipold Road Oldbury – licence allocation 31,350KL;
- Licence #106059 – Lot 50 on Plan 42883, Oldbury – licence allocation 92,130KL; and
- Licence #159783 – Lot 51 on Plan 42883, Oldbury – licence allocation 4,650KL.

The Perth Groundwater Map (DWER, 2020a) provides some groundwater level information, depicting minimum groundwater levels, but no details in relation to maximum groundwater levels. The groundwater contours in the Perth Groundwater Map (Figure 5) show that a deep drain north of Leipold Road appears to be influencing local groundwater levels. In general, groundwater levels appear to be at their deepest in the western half of the Site and shallower in the eastern portion.

The groundwater levels in the Perth Groundwater Map need to be interpreted with some caution with respect to accuracy of the data and ground elevation information. Further investigations are recommended to refine maximum groundwater levels for the Site, to inform the civil engineering design for future development ensuring that risks posed by shallow groundwater levels are adequately considered.

Whilst there are numerous DWER bores within the Site, only some of these have information on groundwater levels. Figure 5 shows the location of DWER groundwater bores. The four bores within or near the Site that have groundwater information are (DWER, 2020b):

- 61410148 – located south-east of the border of the Site;
- 61410130 – located west of the south-west corner of the Site;
- 61410131 – located north of the north-west corner of the Site; and
- 61410151 – located north of the north-east corner of the Site.

Appendix 1 show the groundwater levels recorded at these four bores. The general trend across all bores is a decline in water level, this being most apparent for bore 61410148 located on the southern border of the Site. This trend is consistent with observations from other localities in the south-west of Western Australia where groundwater levels have been declining since the mid-1970's due to a reduction in average annual rainfall over this period.

Based on the available records, the maximum groundwater level recorded since 1975 for Bore 61410148 is approximately 14 m AHD. With the ground elevation at this location being 16.02 m AHD, this represents a depth to groundwater for the Superficial Aquifer of approximately 2 m below ground level. For Bore 61410130, the maximum groundwater level recorded since 1975 was approximately 11.3 m AHD and the ground elevation at this location is 11.694 m AHD, representing a depth to groundwater of 0.394 m below ground level.

The data suggests that groundwater levels may be shallow at the Site. However, further monitoring to inform the preparation of a Local Water Management Strategy (LWMS) is recommended with a greater number of bores to be installed and monitored across two winters. The monitoring program should also capture groundwater level data from the DWER bores near the Site (particularly Bore 61410148) to provide a reference point for the newly installed bores and potentially enable a correction factor to be applied to determine an appropriate maximum groundwater level across the Site.

The groundwater beneath the Site is classified as brackish (1,000-3,000mg/L) (DWER, 2020a).

Further detail regarding groundwater and drainage considerations for urban development of the Site are contained within the District Water Management Strategy prepared by Oversby Consulting, accompanying the proposed MRS Amendment.

2.6 FLORA AND VEGETATION

2.6.1 *Beard's Vegetation Mapping*

Broad scale (1:250,000) pre-European vegetation mapping of the area has been completed by Beard (1979) at an association level. The mapping indicates that Association 968 (Medium woodland Jarrah Marri and Wandoo) was originally across the Site.

A vegetation association is considered under-represented if there is less than 30% of its original distribution remaining. From a representation and biodiversity perspective (not taking into account any other land degradation issues) there are several criteria being applied to vegetation (EPA, 2000):

- the threshold level below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European (pre-1750) extent of vegetation association;
- a level of 10% of the original extent is regarded as being a level representing 'Endangered'; and
- clearing which would put the threat level into the class below should be avoided.

At the State level, Vegetation Association 968 has greater than 30% of its pre-European extent remaining, however within the Shire of Serpentine-Jarrahdale only 4.60% of the pre-European extent of Association 968 remains (DBCA, 2019).

2.6.2 *Vegetation Complexes*

Hedde *et al.* (1980) mapped the Perth area vegetation at a finer scale than Beard (1979). Vegetation complexes indicate patterns of vegetation at a regional scale, and are based upon factors such as landform, soil and climate.

Pre-European Vegetation at the Site is mapped as (Australian Government, 2020):

- *Guildford Complex* - The majority of the Site is mapped as the Guildford Complex which is described as a mixture of open forest to tall open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) - *Eucalyptus marginata* (Jarrah) and woodland of *Eucalyptus wandoo* (Wandoo) (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum)). Minor components include *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark).

- *Serpentine River Complex* – A small area in the north-west corner of the Site is mapped as the Serpentine River Complex described as a closed scrub of *Melaleuca* species and fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark) along streams.

There are no intact areas of native vegetation within the Site. The only native vegetation remaining comprises scattered paddock trees of Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) and Swamp Sheoak (*Casuarina obesa*). Due to on-going agricultural uses (such as cattle grazing) at the Site, there are no areas of natural regeneration occurring.

Given the current site conditions, the vegetation at the Site has been assessed as Completely Degraded. Opportunities to incorporate what little native vegetation exist into future development of the Site can be explored through later, more detailed stages of the planning process, such as structure planning and subdivision approval.

2.6.3 Conservation Significant Vegetation

Table 1 lists the Commonwealth Threatened Ecological Communities (TEC) identified in the Protected Matters Search Tool (PMST) report (Appendix 2) as potentially occurring within a 2 km buffer of the Site.

TABLE 1: COMMONWEALTH THREATENED ECOLOGICAL COMMUNITIES WITHIN 2KM OF THE SITE

THREATENED ECOLOGICAL COMMUNITY	EPBC ACT STATUS	TYPE OF PRESENCE
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within
<i>Corymbia calophylla</i> – <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
<i>Corymbia calophylla</i> – <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal plain	Endangered	Community known to occur within area
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological	Critically Endangered	Community may occur within area

Due to the Completely Degraded structure and condition of the vegetation at the Site, the above TECs are not present. Therefore, the Site does not contain any regionally significant vegetation.

There are State-listed TECs, and one Priority Ecological Community (PEC) mapped (inclusive of buffers) that marginally encroach into the south-east and north-west corners of the Site (Figure 6). The areas of the ecological communities within the Site do not contain any intact areas of native vegetation and therefore are regarded as Completely Degraded. These areas are no longer representative of any TECs or PECs. During the site inspection the northern portion of the Mundijong Road reserve (and abutting the southern boundary of the Site) was noted as containing a deep surface drain, extensive infestation of *Watsonia* (*Watsonia meriana* var. *bulbillifera*) and being poorly vegetated.

2.6.4 Conservation Significant Flora

The conservation significant flora identified in the NatureMap Species Report (Appendix 3) and the PMST Report (Appendix 2) as potentially occurring within 2 km of the Site are listed in Table 2.

TABLE 2: CONSERVATION SIGNIFICANT FLORA SPECIES WITHIN 2KM OF THE SITE

SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT ¹ / DBCA
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> <i>long peduncle</i> variant	-	-	Priority 1
<i>Andersonia gracilis</i>	Slender Andersonia	Endangered	Vulnerable
<i>Caladenia huegelii</i>	King Spider-orchid	Endangered	Critically Endangered
<i>Diuris micrantha</i>	Dwarf Bee-orchid	Vulnerable	Vulnerable
<i>Diuris purdiei</i>	Purdie's Donkey-orchid	Endangered	Endangered
<i>Drakaea elastica</i>	Glossy-leaved Hammer Orchid	Endangered	Critically Endangered
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	Vulnerable	Endangered
<i>Eucalyptus x balanites</i>	Cadda Road Mallee	Endangered	Critically Endangered
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	Narrow curved-leaf Grevillea	Endangered	Endangered
<i>Lepidosperma rostratum</i>	Beaked Lepidosperma	Endangered	Endangered
<i>Stylidium aceratum</i>	-	-	Priority 3
<i>Synaphea</i> sp. <i>Fairbridge Farm</i>	Selena's Synaphea	Critically Endangered	Critically Endangered
<i>Synaphea</i> sp. <i>Serpentine</i>	-	Critically Endangered	Critically Endangered
<i>Tetraria australiensis</i>	Southern Tetraria	Vulnerable	Vulnerable

It is highly unlikely that any of the conservation significant flora species listed in Table 2 would be present at the Site due to previous clearing, the long history of grazing and the Completely Degraded condition of vegetation at the Site.

2.6.5 Weed Species

During the site inspection the vegetation along the northern side of Mundijong Road was observed to be impacted by a dense infestation of the weed species *Watsonia* (*Watsonia meriana* var. *bulbillifera*).

The WA declared pest species *Gomphocarpus fruticosus* (Narrow leaf cotton bush) was also observed on site (Plate 1). Declared plants are regulated by DPIRD under the *Biosecurity and Agriculture Management Act 2007*.

Cotton bush is most conspicuous in summer and autumn when mature plants have flowers and fruits. It can be found in pastures, around creeks and wetlands, on roadsides and other areas with disturbed soil. Cotton bush invades pastures and can form dense thickets many hectares in size. It is toxic to livestock but is rarely eaten (DPIRD, 2020).

¹ Biodiversity Conservation Act 2016

PLATE 1: NARROW LEAF COTTON BUSH OBSERVED IN THE SOUTHERN PORTION OF THE SITE**2.6.6 Bush Forever**

Bush Forever is a strategic plan which formally commenced in 2000 to protect approximately 51,200 ha of regionally significant bushland, representing, where achievable, a target of at least 10% of each of the original 26 vegetation complexes of the Swan Coastal Plain portion of the Perth Metropolitan Region (WAPC, 2000).

Bush Forever Site 360 (Mundijong and Watkins Roads Bushland, Mundijong/Peel Estate) traverses the southern boundary of the Site (Figure 6). Bush Forever Site 360 occupies a total area of 73.8 ha (some not shown on Figure 6), with 4.85 ha mapped within the Site (Australian Government, 2020). During the site inspection the vegetation along the northern side of Mundijong Road was observed to be impacted by a dense infestation of *Watsonia* (*Watsonia meriana* var. *bulbillifera*) and was more sparsely vegetated in part due to the deep open drain that runs along the southern boundary of the Site. However, the vegetation on the southern side of Mundijong Road was observed to be in better condition.

2.6.7 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are specified areas, or a class of area declared by the Minister for the Environment under Section 51B of the *Environmental Protection Act 1986* (EP Act).

ESAs are mapped as encroaching into the Site (Figure 6). These ESAs are attributable to the mapped CCW, Bush Forever Site and TEC in the Mundijong Road reserve. Generally, the extent of ESA mapping includes a buffer and is therefore often overstated in terms of area. Given the ESA mapped within the Site is devoid of intact native vegetation, it is unlikely that this area is actually representative of an ESA.

2.7 FAUNA

The conservation significant fauna species identified in the NatureMap Species Report (Appendix 3) and the PMST Report (Appendix 2) as potentially occurring within 2 km of the Site are listed in Table 3. Marine species have been excluded from Table 3.

TABLE 3: CONSERVATION SIGNIFICANT FAUNA SPECIES WITHIN 2KM OF THE SITE

SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT / DBCA
BIRDS			
<i>Botaurus poiciloptilus</i>	Australasian Bittern	Endangered	Endangered
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered	Critically Endangered
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	Vulnerable	Vulnerable
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	Endangered	Endangered
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Endangered	Endangered
<i>Leipoa ocellata</i>	Malleefowl	Vulnerable	Vulnerable
<i>Numenius madagascariensis</i>	Eastern Curlew	Critically Endangered	Critically Endangered
<i>Rostratula australis</i>	Australian Painted-snipe	Endangered	Endangered
MAMMALS			
<i>Bettongia penicillata ogilbyi</i>	Woylie	Endangered	Critically Endangered
<i>Dasyurus geoffroii</i>	Chuditch	Vulnerable	Vulnerable
<i>Isoodon fusciventer</i>	Southwestern brown bandicoot / Quenda	-	Priority 4
<i>Notamacropus eugenii</i> subsp. <i>derbianus</i>	Tammar Wallaby	-	Priority 4
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	Critically Endangered	Critically Endangered
<i>Setonix brachyurus</i>	Quokka	Vulnerable	Vulnerable

The Environmental Planning Tool (WALGA, 2020) indicates that the Site:

- Contains confirmed (buffered) roosting area for Carnaby's Black Cockatoo in the north-west corner of the Site;
- Is within the known foraging area of Baudin's Black Cockatoo (DSEWPaC, 2012);
- Is within the known breeding and non-breeding range of Carnaby's Black Cockatoo (DSEWPaC, 2012); and
- Is within the known range of the Forest Red-tailed Black Cockatoo (DSEWPaC, 2012).

Due to the degraded condition of the available habitat, the Site contains very few values for native fauna. No conservation significant fauna species were observed during the site inspection. Of those species listed in Table 3, the three species of Black Cockatoos may occasionally be present within the Site. A thorough assessment of all properties and potential habitat trees was not possible as part of the site inspection. However, the scattered paddock trees observed on Lots 272-275 were generally 5m or less in height with the occasional tree up to 7m – 8m tall. None of the trees observed during the site assessment contained hollows that would support Black Cockatoo breeding.

The scattered Marri trees in the paddock areas provide limited foraging resources which the Black Cockatoos may opportunistically feed upon as they move through the area. The loss of these trees

would not represent a significant impact on the species and could be adequately compensated through selection of appropriate plant species for use in landscape treatments onsite as part of future planning and design and where possible retention of mature trees.

Regional ecological linkages are a network of natural areas that provide “stepping stones” for species to migrate and disperse between patches of remnant vegetation. Habitat fragmentation is a key threatening process leading to loss of biodiversity, so it is important to protect and enhance ecological linkages. A notional regional ecological linkage (associated with Bush Forever Site 360) extends into the southern boundary of the Site along Mundijong Road (WALGA, 2020).

The Perth Regional ecological linkages were identified and mapped by the Perth Biodiversity Project in 2003. A notional regional ecological linkage (associated with Bush Forever Site 360) extends into the southern boundary of the Site along Mundijong Road. Since they were identified, changing land uses may have impacted on the long-term feasibility of some of these regional linkages (WALGA, 2020).

2.8 ABORIGINAL HERITAGE

The Aboriginal Heritage Inquiry System (DPLH, 2020) shows there are no registered Aboriginal heritage sites on the Site or within a 1km radius of the Site. Table 4 lists the registered sites that are located within 2km of the Site.

TABLE 4: REGISTERED ABORIGINAL SITES WITHIN 2KM OF THE SITE

SITE	NAME	TYPE	APPROX. LOCATION
449	South-East Corridor 02	Artefacts/Scatter	3 km north-east of the Site
450	South-East Corridor 03	Artefacts/Scatter	2.6 km north-east of the Site
18187	Tonkin Highway – Mundijong Road Scatter #11	Artefacts/Scatter	2.6 km east of the Site
18188	Tonkin Highway – Mundijong Road Scatter #12	Artefacts/Scatter	2.6 km east of the Site

2.9 BUSHFIRE RISK

Designated bushfire prone areas have been identified by the Fire and Emergency Services Commissioner as being subject, or likely to be subject, to bushfire attack (DFES, 2020). A bushfire prone area is identified by the presence of and proximity to bushfire prone vegetation and includes both the area containing the bushfire prone vegetation and a 100m buffer zone immediately surrounding it.

The entire Site is mapped within a bushfire prone area (Australian Government, 2020) and may require additional planning and building requirements when developing the Site. State Planning Policy 3.7 *Planning in Bushfire Prone Areas* (WAPC, 2015) defines ‘bushfire risk’ as “*the chance of a bushfire igniting, spreading and causing damage to people, property and infrastructure.*”

A strategic hazard assessment for the Site has been conducted by Lush Fire and Planning and is provided in the bushfire management plan accompanying the MRS Amendment.

2.10 LAND USE AND CONTAMINATION RISK

2.10.1 Land Use

The Site is currently used for low intensity agriculture including cattle grazing and the keeping of horses. It largely comprises open paddocks with occasional scattered trees, with some dwellings and stables/sheds.

Historical aerial photography from Landgate (2020) dating back to 1953 was reviewed to identify activities conducted at the Site that may cause contamination. The 1953 image shows that the entire Site had already been cleared of vegetation and was being used for agriculture. There have been no significant changes in land use at the Site over the last six decades with the only exception being the extraction of clay on Lot 275 Mundijong Road, which commenced in approximately 1974. Appendix 4 shows the development of clay mining on Lot 275 in 1974, 1981 and 2018 respectively.

A Development Approval (DA) from the Shire of Serpentine-Jarrahdale was granted on 23 October 2014 to conduct rehabilitation works on Lot 275 (inclusive of filling the former clay pits with imported fill material). In 2014, Australian Civil Haulage (ACH) was commissioned to assist with the rehabilitation works by filling the clay pits and levelling out the remainder of the Site. The clay pits have been progressively filled with imported fill material. However, during the placement of the fill material minor fragments of plastic, PVC piping, scrap metal, brick and green waste such as wood chips were identified (SERS, 2017).

A Works Approval application was submitted to the DWER on 14 February 2018 to construct and operate a Category 62 Solid Waste depot on Lot 275 to excavate, screen and stockpile material that had been backfilled in the clay pits. The Works Approval was approved in December 2018. The operation involves excavating the backfilled material (approximately 12,000m³), screening the material onsite to separate the non-conforming material for offsite disposal from the reusable material. The screened material is to be stockpiled onsite for a maximum period of one year.

It should be noted that the area affected by the clay pits (approximately 6.3 ha) represents only 0.73% of the overall Site.

2.10.2 Surrounding Land Use

Recent aerial photography was reviewed to identify land uses which have the potential to be regarded as inconsistent with sensitive land uses such as residential. The surrounding land uses identified, and the EPA (2015) recommended buffer distances associated with those land uses are outlined in Table 5 and shown in Figure 7.

A buffer, as defined in State Planning Policy 2.5 (WAPC, 2016), is the designation of land in which sensitive land uses are constrained. It is not the purpose of separation distances to sterilise land from development; non-sensitive land uses can be located within the area between the source of emissions and sensitive land use (EPA, 2015).

Sensitive land uses are those land uses where people live or regularly spend time, and which are therefore sensitive to emissions from industry. They include residences, hospitals and nursing homes, short-stay accommodation, schools, child care facilities, shopping centres, playgrounds, and some public buildings. Some commercial and institutional land uses which require high levels of amenity may also be regarded as sensitive to particular emissions (EPA, 2015).

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TABLE 5: SURROUNDING LAND USES

AREA	LAND USE
West	<p>West of the Site is rural zoned land, primarily used for agricultural activities. Other land uses of note include:</p> <ul style="list-style-type: none"> • King Road Brewery is immediately west of the Site (west of King Road). Breweries can be sources of gases, noise, dust and odour emissions. According to the EPA (2015), breweries generally require buffers of between 200m and 500m depending on the size of the brewery and the type of product being manufactured. • To the north of the Brewery is Lot 102 (766) King Road, which has been unlawfully used for several years to store and stockpile demolition waste. In mid-2019, the Shire successfully prosecuted the landowner and operators of this facility for conducting an unapproved use on the property, resulting in significant penalties being awarded against those parties. Unapproved fill is now being removed and the subject land being remediated to comply with Shire directives. As a result, there are no off-site impacts from this property that would impinge on urbanisation of the Site. • Approximately 950m north-west of the Site is a site which appears to have a number of old greenhouses. Greenhouses using composts or manures generally require a buffer of between 200 and 300m (EPA, 2015). • Approximately 1 km north-west of the Site there appears to be a poultry farm. Generic buffers for Poultry operations range from 300m – 1,000m (EPA, 2015). The Site appears to be sufficiently separated from this poultry farm.
North	<p>Land to the north of the Site is zoned rural and is primarily used for agricultural activities. Other land uses of note include:</p> <ul style="list-style-type: none"> • North of Leipold Road are rural activities which appear to be similar to those at the Site i.e., horse keeping and stock grazing. • A waste recycling facility (?) on Lot 54 King Road is located approximately 300 m north of the north-western corner of the Site. The site appears to be used as a waste type of transfer station. It is difficult to determine who is operating the facility and the types of wastes received. The generic buffer for a solid waste depot is 200m (EPA, 2015). • Timber Mill (Jarrahwood Australia) - approximately 600m north (36 Bird Road, Oldbury) which manufactures Jarrah timber products. The generic buffer for a timber sawmill ranges from 500m to 1,000m depending on the size of the mill. • Bulk haulage rail is north of the Site. Its closest point to the Site is approximately 650m from the north-western corner of the Site. • Plant nursery (163 Boomerang Road, Oldbury) – small plant nursery approximately 800m north of the Site. The generic buffer requirement for plant nurseries (no composting onsite) is 100m (EPA, 2015). • West Australian Large-Scale Off-road Association (9 Bird Road, Oldbury) – off-road remote controlled vehicle racing club is approximately 1 km north of the Site.
East	<p>Currently the majority of the land to the immediate east of the Site between Gangemi and Kargotich Roads is being used for agricultural purposes.</p> <p>The land east of Kargotich Road has been identified for future industrial development (The West Mundijong Industrial Zone). It is understood the West Mundijong Industrial Zone is intended to attract significant and strategic industrial operations some of which may generate off-site impacts and buffer requirements to achieve desired separation distances from 'sensitive' land uses (such as residential development).</p>

TABLE 5: SURROUNDING LAND USES

AREA	LAND USE
	It is understood that the land to the immediate west of the West Mundijong Industrial Area between Kargotich and Gangemi Roads is to be retained as a rural zoning and will act as an effective 1km buffer to the Site.
South	<p>Land to the south of the Site is currently used for agricultural purposes. Our desktop research has identified that land south of Mundijong Road appears to be used for agricultural purposes and primarily associated with cattle farming.</p> <p>Of note are the following:</p> <ul style="list-style-type: none"> • 848 (Lot 123) Mundijong Road - Peel Feedlot (for sheep) which is a Category 55 Prescribed Premises (Livestock Sale Yard or Holding Pen); and • Lot 25 Lightbody Road - Serpentine-Jarrahdale Holding Yards a Category 1 Prescribed Premises (Cattle Feedlot). <p>Sale yards, holding pens and feedlots have the potential to cause noise, dust and odour emissions which can impact local amenity. The buffer distance required between these, and sensitive land uses can vary depending on the size of the facility. The EPA (2015) recommends a separation distance of 1,000m for noise, dust and odour for sheep feedlots. For cattle feedlots, the EPA (2015) recommends a separation distance of 1,000m for noise and dust impacts and the use of an S-Factor calculation to determine a suitable buffer to manage odour impacts.</p> <p>Additionally, Mundijong Road is expected to remain a strategic east-west transit corridor in future, in which case, future planning stages for urbanization of the Site will need to address the likely impacts of road noise and how these will be mitigated through subdivision and development.</p>

Further investigation of the surrounding land uses and specifically the buffer requirement for each is recommended so that the amenity of future landholders within the Site is not compromised. Less sensitive land uses should be planned for the portion of the Site impacted by land use buffer requirements.

2.10.3 Contamination

According to the DWER's Contaminated Sites Database (DWER, 2020c) there are no registered contaminated sites within the Site or within a 5km radius of the Site. Given that the Site has had continuous use for low intensity agriculture for more than 60 years, the risk of widespread contamination being present is regarded as low.

2.11 PREVIOUS EPA ADVICE

The West Mundijong Industrial Precinct Scheme Amendment (1298/41) which rezoned land from Rural to Industrial in the MRS was referred to the EPA under Section 48A of the *Environmental Protection Act 1986*. This amendment covered 449 ha of land situated immediately east of the Site.

The EPA considered that the scheme amendment was unlikely to have a significant effect on the environment and did not require formal assessment under Part IV of the EP Act. The key environmental factors relevant to the scheme amendment included: Flora and Vegetation, Inland Waters and Amenity (Social Surroundings).

The EPA considered that the environmental impacts associated with the development of the area subject to the amendment can be adequately managed through local scheme provisions, noting that

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in particular provisions relating to noise impacts and wetland management would be required. The EPA considered that structure planning can also manage industrial design to minimise impacts to surrounding land uses.

In relation to the Flora and Vegetation factor, the EPA noted that the amendment area contains the Guildford vegetation complex which is mapped as having less than 10% remaining on the Swan Coastal Plain. The EPA's view was that this vegetation should be protected and included as an ecological linkage at the structure planning stage.

The EPA also indicated that the area mapped as a CCW (Manjedal Brook) be managed and protected by a minimum buffer of 50m.

The proposed development of the industrial area has the potential to impact the amenity of adjacent landholders. As such the EPA outlined their expectation that an adequate separation between the intended industrial development and sensitive land uses would be provided.

Following the scheme amendment there have been various reports prepared for the West Mundijong Industrial Area. These include:

- District Structure Plan Report (TME, 2013);
- District Water Management Strategy (TME, 2015a);
- Feasibility Study (TME, 2015b) originally prepared in 2012;
- Local Water Management Strategy (Oversby Consulting, 2020); and
- Draft Local Structure Plan (Shire of Serpentine Jarrahdale, 2021).

It is difficult to determine the potential separation requirements for future uses in the Industrial Area based on the notional plans that have been prepared for the Industrial Area. Herring Storer Acoustics (2012) recommended that uses across the industrial area should be graduated with 'quieter' uses located around the periphery and the 'noisier' uses being centrally located as a principle to reduce adverse impacts upon surrounding land uses. A District Structure Plan (Appendix 5) includes a drainage corridor between approximately 200m and 600m wide along Kargotich Road which forms the western boundary. This drainage corridor will be of benefit in terms of providing further separation of potential industrial uses and the Site in addition to the existing 1 km separation between Kargotich and Gangemi Roads.

3 PROPOSAL DESCRIPTION

The population within the Shire is expected to increase from 32,000 in 2019 to 110,000 by 2050 with the Byford and Mundijong town centres proposed to accommodate the bulk of this with 50,000 people each (SSJ, 2016).

The Shire's *SJ2050* (SSJ, 2016) and draft Local Planning Strategy (SSJ, 2019) identify the Mundijong District Structure Plan urban area will need to accommodate a population of approximately 50,000 people, requiring in excess of 17,000 dwellings by 2050 to meet the Shire's long term growth targets.

A review of the proposed Local Planning Strategy and the related Mundijong District Structure Plan has identified that the land area allocated for urban purposes in the Mundijong townsite is inadequate to cater for the forecast population growth (DPD, 2019).

To ensure adequate urban zoned land is provided for the future growth of the Mundijong townsite and its surrounds, the landowners are proposing to rezone the 647 ha Site west of Gangemi Road from Rural to Urban to be utilised for Residential development (Figure 8).

It is understood that the adjoining land to the immediate east of the Site between Gangemi and Kargotich Roads is to remain Rural under the Shire's draft Local Planning Strategy and Local Planning Scheme No. 3. This will provide an effective 1 km buffer between the West Mundijong Industrial area and the proposed residential development area west of Gangemi Road.

The additional urban precinct will yield an estimated 6,500 dwellings which would resolve the identified shortfall and accommodate Mundijong's forecast population growth, as well as providing opportunities for additional accommodation options such as potential retirement and aged care facilities.

Inclusion of the Site in the existing urban allocation will also provide additional opportunities for residents of Mundijong and the surrounding areas via significant additional public open space, recreational facilities and other amenities (DPD, 2019).

4 ENVIRONMENTAL IMPACT ASSESSMENT

The EPA's environmental principles, factors and associated objectives underpin the environmental impact assessment process and provide the basis for the EPA to assess whether a proposal or land use planning scheme's impact on the environment is acceptable.

Environmental factors are those parts of the environment that may be impacted by an aspect of a proposal. They provide a systematic approach to organizing environmental information for the purpose of environmental impact assessment.

The environmental factors relevant to the Site include:

- Flora and Vegetation;
- Terrestrial Fauna;
- Terrestrial Environmental Quality;
- Inland Waters; and
- Social Surroundings.

This impact assessment also considers the Matters of National Environmental Significance (MNES) relevant to the development of the Site. MNES are nationally and internationally important flora, fauna, ecological communities and heritage places. The EPBC Act provides a legal framework for the protection and management of MNES.

The Site itself contains few environmental constraints and is suitable to support future urban development. From an ecological perspective, the degraded nature of the Site due to historic clearing and many years of agriculture means that sensitive environments are unlikely to be adversely impacted.

The following sections describe the environmental impact assessment for each relevant environmental factor, including the EPA's objective for the environmental factor, relevant policy and guidance to be considered, potential impacts that may occur and the proposed mitigation strategies that will be used to minimise the identified impacts.

4.1 FLORA AND VEGETATION

4.1.1 EPA Objective

Flora is defined as native vascular plants and vegetation is the groupings of different flora patterned across the landscape that occur in response to environmental conditions.

The EPA's objective for this factor is to protect flora and vegetation so that biological diversity and ecological integrity are maintained.

4.1.2 Policy and Guidance

- EPBC Act;
- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Management Act 2007* (BAM Act);

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- Environmental Factor Guideline – Flora and Vegetation (EPA, 2016a); and
- State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region (WAPC, 2010)

4.1.3 Receiving Environment

There are no areas of intact native vegetation within the Site. The only remaining native vegetation is comprised of scattered trees (Plate 2). Due to continued farming in the area, there appears to be no areas of natural regeneration occurring. The declared pest plant Narrow leaf cotton bush was also observed on site. For these reasons, the Site has been assessed as being Completely Degraded and it is considered that there is minimal risk of rare plants or conservation significant ecological communities being present at the Site.

At an association level the mapping indicates that Vegetation Association 968 (Medium woodland Jarrah, Marri and Wandoo) was originally across the Site. A vegetation association is considered under-represented if there is less than 30% of its original distribution remaining. The 2018 Statewide Vegetation Statistics (DBCA, 2019) indicate there is 32% of the pre-European extent remaining of Association 968, but only 4.6% within the Shire of Serpentine-Jarrahdale.

At a finer scale, the pre-European vegetation mapped for the Site includes the Guildford Complex (covers the majority of the Site including the areas mapped as Bush Forever and CCW), Serpentine River Complex (in the north-west of the Site) and the Beermullah Complex (a very small area in the north-east of the Site). According to the *2013 Native Vegetation Extent by Vegetation Complexes on the Swan Coastal Plain South of Moore River* (WALGA, 2013) the following extents of these vegetation complexes remain on the Pinjarra Plain:

- Guildford Complex – 5.87%;
- Serpentine River Complex – 10.82%; and
- Beermullah Complex – 6.91%.

The Guildford and Beermullah vegetation complexes have less than 10% of their original extent remaining on the Pinjarra Plain. However, no intact areas of native vegetation were observed on the Site, therefore no vegetation representative of these complexes remains on the Site.

PLATE 2: EXAMPLE OF SCATTERED TREES ON SITE



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A small portion (4.85 ha) of Bush Forever Site 360 is mapped within the southern boundary of the Site (Figure 6). This same area is also mapped as a conservation category wetland (CCW) (UFI 14817). However, during the site inspection the vegetation corresponding to the Bush Forever site and CCW along the northern side of Mundijong Road was observed to be impacted by various weed species, most notably *Watsonia* (*Watsonia meriana* var. *bulbillifera*), and was more sparsely vegetated in part due to the deep open drain that runs along the southern boundary of the Site (Plate 2).

PLATE 3: SOUTHERN BOUNDARY OF THE SITE

Table 6 details the Bush Forever Sites that are mapped within a 2km radius of the Site.

TABLE 6: BUSH FOREVER SITES MAPPED WITHIN A 2KM RADIUS OF THE SITE

BF SITE	NAME	TOTAL AREA (ha)	SIGNIFICANT VEGETATION/WETLANDS	APPROXIMATE LOCATION
360	Mundijong and Watkins Roads Bushland, Mundijong/Peel Estate	73.8	<ul style="list-style-type: none"> • 2 Southern wet shrublands (WA listed TEC) • 3a <i>Eucalyptus calophylla</i> – <i>Kingia australis</i> woodlands on heavy soils (State & EPBC listed TEC) • 3c <i>Eucalyptus calophylla</i> – <i>X preissii</i> woodlands and shrublands (State & EPBC listed TEC) • 8 Herb rich shrublands in clay pans (State & EPBC listed TEC) • 9 Dense shrublands in clay flats (State & EPBC listed TEC) • 10a Shrublands on dry clay flats (WA & EPBC listed TEC) 	Within the southern boundary of and adjacent to the Site

TABLE 6: BUSH FOREVER SITES MAPPED WITHIN A 2KM RADIUS OF THE SITE

BF SITE	NAME	TOTAL AREA (ha)	SIGNIFICANT VEGETATION/WETLANDS	APPROXIMATE LOCATION
			<ul style="list-style-type: none"> FCT20b <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain (WA listed TEC) Mapped CCWs (UFIs 14779, 14817, 7998) 	
368	Lowlands Bushland – Eastern Block, Peel Estate	1,034.1	<ul style="list-style-type: none"> 21c Low lying <i>Banksia attenuata</i> woodlands or shrublands (WA listed PEC and forms part of EPBC listed Banksia TEC) Mapped CCWs (UFIs 14781, 7296) and REWs (14744, 7244) 	1.5 km south of the Site
68	Jackson Road Bushland, Peel Estate	19.3	<ul style="list-style-type: none"> Mapped REWs (UFIs 7190 and 14741). 	400m north of the Site
70	Duckpond Bushland, Peel Estate	8.8	<ul style="list-style-type: none"> No vegetation types were recorded/inferred. 	1.8 km west of the Site

4.1.4 Potential Impacts

The development of the Site for urban purposes will not directly impact any intact areas of native vegetation. However, it may require clearing of scattered isolated trees, though this will only be known when further, more detailed design occurs in later stages of the planning process. On this basis, the development of the Site may potentially impact the limited flora and vegetation present in the following ways:

Direct Impacts

- Permanent loss of scattered native trees due to clearing.

Indirect Impacts

- Introduction and/or spread of weeds, dieback and pest animals to Bush Forever Site 360 (which is also identified as an ESA);
- Changes to site hydrology through groundwater abstraction or changes in surface water flows impacting upon the CCW (UFI 14781) intersecting and adjacent to the Site (which is also identified as an ESA); and
- Dust deposition during clearing and construction.

4.1.5 Mitigation

The following mitigation measures are recommended for the Site:

- Retain mature native trees in areas of open space or road reserves where finished site levels permit.

- Implement Water Sensitive Urban Design strategies consistent with *Better Urban Water Management* (WAPC, 2010) to ensure post-development hydrology is similar to pre-development conditions.
- Indirect impacts such as the introduction or spread of weeds and dieback or dust deposition on vegetation will require actions to be implemented during clearing and construction. These impacts are best managed through the implementation of hygiene measures and conventional dust suppression techniques at the construction stage.

4.1.6 Recommendations

As planning progresses, it is recommended that the 'Avoid, Minimise and Mitigate' hierarchy is applied i.e. where possible avoid clearing native trees. However, if clearing is unavoidable, then measures to minimise the extent of clearing and manage the impacts of clearing and construction should be investigated.

Landscaping within open space areas should utilise locally native species which have lower nutrient and irrigation requirements.

As the Site is within a Bushfire Prone Area, more detailed bushfire management plans should be prepared during future stages of the planning process, consistent with State Planning Policy requirements and building on the strategic hazard assessment prepared by Lush Fire and Planning.

4.2 TERRESTRIAL FAUNA

4.2.1 EPA Objective

Terrestrial fauna are defined as animals living on land or using land (including aquatic systems) for all or part of their lives. Terrestrial fauna includes vertebrate and invertebrate species.

The EPA's objective for this factor is to protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

4.2.2 Policy and Guidance

- EPBC Act;
- BC Act; and
- Environmental Factor Guideline –Terrestrial Fauna (EPA, 2016d).

4.2.3 Receiving Environment

Due to the degraded condition of the available habitat, the Site contains very few values for native fauna. Three species of Black Cockatoo may occasionally utilise remnant trees at the Site, however no conservation significant fauna species were observed during the site inspection.

The scattered paddock trees observed on Lots 272-275 were generally 5m or less in height with the occasional tree up to 7–8m tall. None of the trees observed contained hollows that would support Black Cockatoo breeding. The scattered Marri trees in the paddock areas provide very limited foraging resources which Black Cockatoos may opportunistically feed upon as they move across the landscape.

A notional regional ecological linkage, associated with Bush Forever Site 360, extends into the southern portion of the Site along Mundijong Road. However, the vegetation in this area is considered Completely Degraded.

Areas adjacent to the Site are also devoid of vegetation that provides habitat. Areas of native vegetation in better condition associated with Bush Forever Sites (see Table 6) are located approximately 1-2km from the Site that will provide quality habitat for native fauna.

4.2.4 Potential Impacts

The development of the Site for urban purposes may potentially impact fauna and the limited fauna habitat present in the following ways:

Direct Impacts

- Permanent loss of potential Black Cockatoo habitat trees; and
- Fauna injury or mortality during future clearing or construction.

Indirect Impacts

- Predation/competition from introduced fauna; and
- Increased noise, dust, fire and vehicle strike during construction.

4.2.5 Mitigation

The following mitigation strategies are recommended for the Site:

- Clearing of potential Black Cockatoo habitat trees should be avoided where possible. Retain native trees and shrubs in the open space areas and road reserves where finished site levels permit.
- Implement fauna management strategies during clearing and construction to prevent injuries to/death of native fauna.
- Fauna habitat can be enhanced through revegetation of cleared areas, particularly in open space areas, to increase the area of available habitat.

The loss of the existing trees would not represent a significant impact on the Black Cockatoo species and could be adequately compensated onsite through selection of appropriate plant species for use in landscape treatments and open space as part of future planning and design.

4.2.6 Recommendations

Where possible, potential Black Cockatoo habitat trees should be retained in areas of open space where finished site levels permit.

Implement measures to avoid impacts to fauna or fauna habitat during clearing and construction such as retaining existing trees where possible and the provision of fauna spotters during clearing activities.

4.3 TERRESTRIAL ENVIRONMENTAL QUALITY

4.3.1 EPA Objective

Terrestrial Environmental Quality is defined as the chemical, physical, biological and aesthetic characteristics of soils.

The EPA's objective for this factor is to maintain the quality of land and soils so that environmental values are protected.

4.3.2 Policy and Guidance

- Environmental Factor Guideline – Terrestrial Environmental Quality (EPA, 2016c);
- *Contaminated Sites Act 2003*;
- Identification and Investigation of Acid Sulfate Soils (ASS) and Acidic Landscapes (DER, 2015a); and
- Draft Environmental Assessment Guidelines for Separation Distance Between Industrial and Sensitive Land Uses (EPA, 2015).

4.3.3 Receiving Environment

The Site is located within the Guildford Formation and is predominantly within the Pinjarra Soil Landscape Zone (Figure 2). The soils are broadly described as clayey to sandy alluvial soils with wet areas. .

It was noted during the site inspection, that the Site is low-lying with soils that have a low permeability/poorly drained and likely to be waterlogged or inundated during wet months. Low permeability soils are generally not well suited for the infiltration of stormwater or wastewater. Waterlogging in the winter months is also not conducive to crop growth making agricultural enterprises less feasible.

Grazing is the existing dominant form of agricultural activity within the Site. The Land Capability Assessment (Land Assessment Pty Ltd, 2020) undertaken for the Site indicates that the degree of susceptibility to soil waterlogging and possible future salinity are factors (land qualities) which limit the capability rating for grazing over most of the Site to a 'Fair' or a 'B' category. DPIRD's contemporary terminology describes the B categories as:

- B1 >70% of the land has moderate to very high capability
- B2 50-70% of the land has moderate to very high capability

In relation to other forms of agriculture, the Site is even more limited by these factors. For horticultural activity and dryland cropping it is rated low to very low capability, or C class land described as:

- C1 – 50-70% of the land has low to very low capability
- C2 >70% of the land has low to very low capability

Land Assessment Pty Ltd (2020) concluded that the land appears unlikely to be able to support greater agricultural diversity and commercial production beyond the current level of livestock grazing activity.

The site is mapped as Class 2 - moderate to low risk of ASS within 3m of the natural soil surface, but high to moderate risk of ASS beyond 3m of natural soil surface (DWER, 2020b).

The risk of widespread contamination being present at the Site is considered low due to the long history of low-intensity agricultural activities (such as grazing). The rehabilitation of the clay extraction pits on Lot 275 (see Appendix 4) resulted in 'contaminated' fill being backfilled in the pits. However, the fill material is to be excavated and screened to remove non-conforming material for disposal off site, with the remaining material stockpiled for potential disposal or reuse (SERS, 2018).

4.3.4 Potential Impacts

Direct Impacts

The development of the Site for urban purposes may potentially impact the quality of the terrestrial environment in the following ways:

- Disturbance of ASS during excavation or dewatering; and
- Increased wind and water erosion of soil during clearing and construction.

Indirect Impacts

- Contamination of soils from stockpiling activities.

4.3.5 Mitigation

It is likely that structural fill material will be imported to the Site to establish the finished site levels. This will reduce the likelihood of disturbing ASS. Where deeper excavations (below 3m or the water table) or dewatering are required for development, preliminary ASS investigations may be required to confirm if ASS will be disturbed by construction works.

Fill material from the claypits on Lot 275 is to be excavated, screened and separated into conforming and non-conforming material stockpiles. It is understood that the proposed works at the Site includes acceptance of excess sand and construction and demolition material from building sites in the metropolitan area to fill the existing clay pits. These are to be predominantly sourced from new housing and commercial subdivisions. The waste material will be sorted, screened and raked (DWER, 2018).

In the event that other contamination is encountered during construction, an unexpected finds protocol could be used to detail how contamination will be managed and ensure compliance with the *Contaminated Sites Act 2003*. The protocol should include triggers for consultation with DWER and the Shire, and the parties responsible for the contamination (if they can be identified).

4.3.6 Recommendations

It is recommended that geotechnical investigations be undertaken to confirm soil suitability for construction at the Local Structure Plan or Subdivision stage. Soil permeability testing should be conducted as part these geotechnical investigations to assist with planning of future stormwater management.

Targeted ASS investigations can be conducted once disturbance (either dewatering or excavation) details are known. If present, an ASS Management Plan should be prepared and implemented in accordance with DWER guidance.

It will be important to demonstrate that the backfilled material for the clay pits on Lot 275 is 'clean' and suitable to support a higher use, if this area is to be developed in the future. It would be prudent to obtain geotechnical advice about construction on the backfilled pits.

Any areas of contamination identified will need to be managed in accordance with the requirements of the *Contaminated Sites Act 2003* and an unexpected finds protocol.

4.4 INLAND WATERS

4.4.1 EPA Objective

Inland Waters are defined as the occurrence, distribution, connectivity, movement and quantity (hydrogeological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality); and include both groundwater and surface water.

The EPA's objective for this factor is to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.

4.4.2 Policy and Guidance

- *Metropolitan Water Supply, Sewerage and Drainage Act 1909*;
- *Rights in Water and Irrigation Act 1914*;
- Statement of Planning Policy 2.1 - The Peel-Harvey Coastal Plain Catchment (WAPC, 2003);
- Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992;
- Environmental Factor Guideline – Inland Waters (EPA, 2018);
- Decision process for stormwater management in Western Australia, November 2017 (DWER, 2017); and
- Stormwater Management Manual for Western Australia 2004-07 (DoE, 2004).

4.4.3 Receiving Environment

The entire Site is mapped as a Multiple Use wetland (UFI 16021) with a 4.85 ha area of conservation category wetland (UFI 14817) along Mundijong Road, from just west of King Road to Gangemi Road (Australian Government, 2020). However, the area mapped as CCW was noted during the site inspection as comprising an extensive infestation of *Watsonia meriana* var. *bulbillifera* and being poorly vegetated.

Based on the current DBCA wetland mapping, the CCW will need to be retained and a buffer of 50m provided, unless the wetland is reclassified and downgraded to a lower management category.

Table 7 lists the Conservation Category and Resource Enhancement wetlands that occur within a 2km radius of the Site.

TABLE 7: CONSERVATION CATEGORY AND RESOURCE ENHANCEMENT WETLANDS MAPPED WITHIN A 2KM RADIUS OF THE SITE

WETLAND UFI	MANAGEMENT CATEGORY	APPROXIMATE LOCATION
14817	Conservation	Along southern boundary of the Site, partially within Site boundary (4.9 ha)

TABLE 7: CONSERVATION CATEGORY AND RESOURCE ENHANCEMENT WETLANDS MAPPED WITHIN A 2KM RADIUS OF THE SITE

WETLAND UFI	MANAGEMENT CATEGORY	APPROXIMATE LOCATION
14742	Conservation	1km west of King Road
14732	Resource Enhancement	1.4km west of King Road
14859	Conservation	900m north of Leipold Road
14857	Resource Enhancement	900m north of Leipold Road
14856	Resource Enhancement	900m north of Leipold Road
14862	Resource Enhancement	1.2km north of Leipold Road
14741	Resource Enhancement	450m north of Leipold Road
7190	Resource Enhancement	450m north of Leipold Road
14945	Conservation	2.2km east of Gangemi Road
14747	Conservation	1.4km south of Mundijong Road
14779	Conservation	1.8km west of King Road

The Site is within the Serpentine sub-catchment of the Peel-Harvey Estuary which is part of the Peel Yalgorup system, a Ramsar site and MNES. The Peel-Harvey Estuary has a long history of water quality problems, largely related to the release of nutrients from agricultural activities within its catchment.

Water quality monitoring of the Serpentine River (water column and sediments) has shown there are high levels of phosphorus which is contributing to adverse impacts on the River system and the downstream Peel-Harvey Estuary. The majority of this phosphorus export to the estuary system is attributable to grazing including intensive animal agriculture, feedlots and grazing areas (EPA, 2008).

Manjedal Brook / Oakland main drain, a non-perennial minor water course runs along the southern boundary of the site (DWER, 2018). Two major drains along with a series of shallow spoon drains have been constructed on the Site to drain the paddocks and alleviate waterlogging and inundation during wet periods.

DWER's Floodplain risk mapping shows the outer portions, notably in the north-east, south-east, south-west and north-west corners of the Site, may be prone to flooding during the 100-year ARI event at existing ground levels. The entire Site is mapped as a DWER 1 in 100 AEP floodplain development control area (Australian Government, 2020).

The Site is located within the Serpentine Groundwater Area as proclaimed under the RIWI Act (DWER, 2018). DWER bore data suggests that groundwater levels may be shallow at the Site (0.39 - 2 m below ground level). The Perth Groundwater Map (DWER, 2020) shows groundwater levels appear to be at their deepest in the western half of the Site and shallower in the eastern portion. The groundwater beneath the Site is mapped as brackish (1,000-3,000mg/L).

4.4.4 Potential Impacts

The change of land use from rural to urban has the potential to impact the Site in the following ways:

Direct Impacts

- Altered water quality due to disturbance of ASS;
- Changes to groundwater and surface water quality associated with the change in land use from agriculture to urbanisation;
- Abstraction of groundwater or dewatering for construction purposes may lower groundwater levels affecting private and public groundwater users and wetlands;
- Obstruction of or changes to surface water flows and water quality; and
- Alteration of hydrological regimes and water quality of the mapped CCW.

4.4.5 Mitigation

Based on current wetland mapping, the CCW will need to be retained with a 50m buffer, unless a reclassification of the wetland management category is achieved and the Bush Forever designation of this area is resolved. A Wetland Management Plan should be prepared at the Local Structure Plan if this area is to be retained.

A District Water Management Strategy has been prepared and accompanies the MRS Amendment. The DWMS outlines how water sensitive urban design (WSUD) principles will be incorporated into the development. A street drainage network will convey stormwater to treatment and detention areas prior to release off site (Porters, 2019). Drainage basins will be landscaped where possible in line with WSUD principles. It is expected the existing open drains on Site will be realigned or contoured to become drainage features and incorporated into the development (Porters, 2019).

Finished levels across the Site will need to ensure there is sufficient separation to maximum groundwater levels (potentially achieved via use of fill and sub-soil drains) as well as sufficient clearance to the 100-year flood levels.

Any dewatering or groundwater abstraction will be regulated under the *Rights in Water and Irrigation Act 1914*.

4.4.6 Recommendations

As the Site is within the catchment of the Peel-Harvey Estuary system, it will be important to demonstrate the water quality improvement measures that will be implemented to manage nutrient export from the Site. In accordance with the provisions of the Statement of Planning Policy 2.1 Peel Harvey Coastal Plain Catchment (WAPC, 2003), all proposed residential lots will be required to be connected to a reticulated sewerage system.

Subdivision proposals will need to make provision for a drainage system that maximises the consumption and retention of drainage onsite. Drainage should be designed to retain nutrients onsite in most years. Biological wetland filters, or other means of drainage water retention or treatment approved by the EPA, will need to be incorporated into the drainage design. Future development of the Site will need to ensure that there is sufficient land set aside for drainage management.

It should be noted that Conservation reserves (CCW and buffer) are not appropriate as biological wetland filters (WAPC, 2003).

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Areas of open space will require a Nutrient and Irrigation Management Plan which identifies appropriate irrigation, fertiliser regimes and vegetation patterns (WAPC, 2003).

It is recommended that the Better Urban Water Management framework (WAPC, 2008) be followed during the planning stages. A District Water Management Strategy (DWMS) has been prepared and accompanies MRS Amendment. This should be followed by a Local Water Management Strategy (LWMS) at the local structure planning stage and an Urban Water Management Plan (UWMP) at subdivision. At a broad level, these documents will need to:

- Summarise the pre-development groundwater and surface water conditions;
- Identify key areas of ecological value (such as wetlands, waterways, etc.);
- Describe the soil conditions at the Site;
- Discuss existing and required water and wastewater infrastructure;
- Outline proposed approach to management of groundwater levels (if required);
- Outline how surface run off will be managed, noting the expectation that post-development discharge rates should be approximately similar to pre-development conditions;
- Identify irrigation requirements and potential sources;
- Describe water measures to be implemented in regard to water quality improvement and water efficiency;
- Provide a post-development monitoring framework; and
- Outline the steps for implementation, noting key responsibilities.

Groundwater and surface water conditions will require further investigation via a monitoring program to better define pre-development water quality as well as maximum groundwater levels and groundwater flow direction.

4.5 SOCIAL SURROUNDINGS

4.5.1 EPA Objective

For social surroundings to be considered in environmental impact assessment (EIA), there must be a clear link between a proposal or scheme's impact on the physical or biological surroundings and the subsequent impact on a person's aesthetic, cultural, economic or social surroundings.

For the purpose of EIA, amenity values include visual amenity and the ability for people to live and recreate within their surroundings without any unreasonable interference with their health, welfare, convenience and comfort.

The EPA's objective for this factor is to protect social surroundings from significant harm.

4.5.2 Policy and Guidance

- *Aboriginal Heritage Act 1972;*
- *Environment Protection (Noise) Regulations 1997;*
- *Heritage of Western Australia Act 1990;*
- Environmental Factor Guideline – Social Surroundings (EPA, 2016b);

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- Australian Standard 2436-2010: Guide to noise control on construction, demolition and maintenance sites;
- A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and other Related Activities (DEC, 2011);
- Australian Standard 2670.2 Evaluation of Human Exposure to Whole–Body Vibration; and
- Australian Standard 2436-2010 (R2016) Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.

4.5.3 Receiving Environment

An analysis of the current surrounding land uses has identified a number of possible activities that could result in emissions (such as noise, dust and odour) that may impact local amenity at the Site. The EPA's *Draft Environmental Assessment Guidelines for the Separation Distances between Industrial and Sensitive Land Uses* (EPA, 2015) provides generic buffer distances to various uses. The generic buffer distances are not intended to be absolute separation distances; rather they are a default distance. Section 2.10.2 outlines the generic buffer distances for the relevant land uses as described by the EPA (2015).

The Aboriginal Heritage Inquiry System (DPLH, 2020) shows there are no registered Aboriginal heritage sites on the Site or within a 1.5km radius of the Site.

4.5.4 Potential Impacts

The development of the Site for urban purposes has the potential for the following impacts:

Direct Impacts

- Disturbance of an unregistered Aboriginal heritage site; and
- Increased dust levels during clearing and construction which may impact visual amenity and/or cause respiratory problems.

Indirect Impacts

- Residential lots within the development receiving noise, dust or odour emissions associated with adjacent land uses including the future industrial development to the east and feedlots to the south of the Site.

4.5.5 Mitigation

It is understood the land to the immediate east of the Site between Gangemi and Kargotich Roads (Figure 8) is to remain a rural zoning therefore providing an effective 1km buffer between the West Mundijong industrial area and the proposed medium density residential development area west of Gangemi Road.

The EPA expects that new planning schemes and scheme amendments, involving the siting of new sensitive land uses near existing industry, demonstrate how they have incorporated adequate separation distances into planning mechanisms such as buffers (EPA, 2015).

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The Peel Feedlot – a Category 55 licensed premise (livestock saleyard or holding pen) is located at 848 Mundijong Road, Mardella and is operated by Rural Export & Trading (WA) Pty Ltd. The facility has an assessed design capacity of 2,000,000 animals per annum.

It is understood sheep are transported to the site to become accustomed to pellet feed whilst awaiting short haul transshipment to Fremantle Port for overseas shipment (DER, 2015b). Most of the sheep are held in raised holding sheds which are approximately 500m south of Mundijong Road. Small numbers of sheep may be rotated within paddocks as required. Two evaporation ponds are approximately 200m south of Mundijong Road. The EPA (2015) recommends a buffer distance of 1,000m for livestock saleyards or holding pens to manage the risks associated with noise, dust and odour. DWER's Guidelines Odour Emissions (DWER, 2019) also recommends a screening distance of 1,000m for Category 55 premises for odour impact mitigation. A lesser buffer will need to be justified through the provision of a site-specific study.

The Serpentine Jarrahdale Holding Yards – a Category 1 licensed premise (Cattle Feedlot) is located on Lot 25 on Plan 3269 Lightbody Road, Mardella and is operated by Ausvision Rural Services Pty Ltd. The facility is approved to handle up to 5,000 cattle at any one time. Most of the cattle are to be held in the holding sheds, with no more than 37 head of cattle permitted to be held outside at any one time (DER, 2013). The holding sheds (at their closest point) are approximately 780 m south of Mundijong Road and the evaporation pond is approximately 1,100m south of Mundijong Road.

For cattle feedlots, the EPA (2015) recommend a buffer distance of 1,000m for noise and dust impacts, and an S-Factor calculation for odour impacts. S-factor equations take into account livestock numbers and site factors including design and management; receptor type; topography and vegetation cover. The extent of the buffer required for odour management is dependent upon the feedlot capacity and site-specific factors such as site management practices (most notably manure management). The DWER's Guideline Odour Emissions (DWER, 2019) also recommends a screening distance determined by an S-factor calculation for cattle feedlots based on the S-factor approach provided in the *National Guidelines for Beef Cattle Feedlots in Australia* (Meat & livestock Australia, 2012).

During future stages of the planning process, site-specific odour, noise and/or dust studies will be required to establish appropriate buffers to the Peel Feedlot (sheep) and Serpentine Jarrahdale Holding Yards (cattle) located south of the Site, if the proponent is seeking to reduce the EPA (2015) recommended separation distance of 1,000m. These studies will also need to consider any recommended separation distances or buffers associated with other external land uses that could impact the Site in the future.

Dust suppression measures will need to be employed during the construction phase of the project.

An Aboriginal Heritage Management Protocol should be prepared, outlining procedures to be applied if during works potential Aboriginal heritage sites/artefacts are identified. Any Aboriginal objects identified during construction activities will be recorded, described and reported to the DPLH.

4.5.6 Recommendations

Most issues to do with amenity relating to noise, odour and dust can be avoided with appropriate separation distances. The application of separation distances between industry and sensitive land uses, through the land use planning system, can ensure that both intended and unintended emissions do not adversely impact on people.

Further investigation of the surrounding land uses and specifically the buffer requirement (refer to Table 5) for each land use is recommended so that the amenity of future landholders within the Site is not compromised. Less sensitive land uses should be planned for the portion of the Site impacted by land use buffer requirements.

A reduction in these buffers will need to be supported by site specific technical studies to demonstrate that the amenity of landholders within the Site will not be adversely impacted by a smaller buffer.

4.6 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

4.6.1 *Relevant Policies and Guidelines*

The relevant policies and guidelines that were considered as part of the assessment of the MNES include:

- Department of Environment, Water, Heritage and the Arts (DEWHA) (2013) Significant Impact Guidelines 1.1 – Matters of National Environmental Significance.
- Department of Sustainability, Environment, Water, Populations and Community (DSEWPaC) (2012) EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

4.6.2 *Receiving Environment*

The PMST Report (DAWE, 2020) identified the following MNES that may occur in or may relate to the search area which included the Site with a 2km buffer:

Ecological Communities

- Clay Pans of the Swan Coastal Plain;
- *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain;
- *Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal plain;

Threatened Species

- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo);
- *Calyptorhynchus baudinii* (Baudin's Cockatoo);
- *Calyptorhynchus latirostris* (Carnaby's Cockatoo); and

Wetlands of International Significance

- Peel-Yalgorup System.

The majority of the MNES identified in the PMST Report are not relevant to the Site due to the absence of suitable habitat and the long history of grazing.

None of the ecological communities listed above are present at the Site (which is completely degraded of vegetation) however, there are known occurrences of these communities nearby. A referral to the DAWE is unlikely to be required if it can be demonstrated that the ecological communities will not be directly or indirectly impacted as a result of developing the Site.

No conservation significant fauna species were observed during the site inspection. The three species of Black Cockatoo may occasionally be present within the Site as it is within their modelled distribution (DSEWPac, 2012). However, the scattered trees within the Site provide only very limited Black Cockatoo foraging resources. The potential loss of these trees and the subsequent reduction in foraging resources is unlikely to be seen as a significant impact on the three species.

Although the Site is located in the Serpentine River sub-catchment of the Peel-Yalgorup system, the rezoning of the Site is unlikely to have a significant impact on the Peel-Yalgorup system, particularly if a water sensitive urban design approach is adopted.

4.6.3 Potential Impacts

The development of the Site for urban purposes may impact the MNES in the following ways:

Direct Impacts

- Permanent loss of potential Black Cockatoo habitat trees; and
- Black Cockatoo injury or mortality during future clearing or construction.

Indirect Impacts

- Black Cockatoo predation/competition from introduced fauna; and
- Increased noise, dust, fire, vehicle strike during clearing and construction.

The Significant Impact Guidelines (DoE, 2013) state that a significant impact is an impact which is important, notable or of consequence while having regards to its context or intensity. An assessment for each species of Black Cockatoo has been conducted using the Significant Impact Guidelines (DoE, 2013) to evaluate the significance of the impact associated with the removal of scattered paddock trees. Table 8 outlines the results of the assessments.

The results of the significance assessments confirm the potential loss of scattered trees and the subsequent reduction in Black Cockatoo foraging resources is unlikely to have a significant impact on the three species.

TABLE 8: SIGNIFICANCE ASSESSMENT FOR THREE SPECIES OF BLACK COCKATOO

SIGNIFICANT IMPACT CRITERIA	LIKELIHOOD (KNOWN, LIKELY, POSSIBLE, UNLIKELY)			JUSTIFICATION
	CARNABY'S COCKATOO	BAUDIN'S COCKATOO	FOREST RED-TAILED BLACK COCKATOO	
Lead to a long-term decrease in the size of a population.	Unlikely	Unlikely	Unlikely	The clearing of scattered potential habitat trees is unlikely to result in a long-term decrease in the size of the population of any of the three species. The trees observed during the Site inspection on Lots 272-275 are currently not suitable for Black

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TABLE 8: SIGNIFICANCE ASSESSMENT FOR THREE SPECIES OF BLACK COCKATOO

SIGNIFICANT IMPACT CRITERIA	LIKELIHOOD (KNOWN, LIKELY, POSSIBLE, UNLIKELY)			JUSTIFICATION
	CARNABY'S COCKATOO	BAUDIN'S COCKATOO	FOREST RED- TAILED BLACK COCKATOO	
				<p>Cockatoo breeding as there are no trees with hollows.</p> <p>More than 1,100 ha of vegetation (potential habitat) exists within two Bush Forever Sites that are within a 2km radius of the Site.</p> <p>BF Site 360 is 73.8 ha in total and partially within the Site (4.85 ha) with another 69 ha external to the Site along Mundijong Road extending to the Watkins Road Nature Reserve east of the Site. The vegetation of the Reserve includes woodlands dominated by Marri and/or Jarrah and Banksia, as well as wetland and dampland vegetation.</p> <p>BF Site 368 is approximately 1.5km south of the Site and contains 1,034 ha including wetland and <i>Banksia</i> vegetation types (Government of Western Australia, 2000).</p>
Reduce the area of occupancy of the species.	Unlikely	Unlikely	Unlikely	The removal of scattered potential habitat trees will not reduce the area of occupancy of any of the species. All three Black Cockatoo species are highly mobile and can forage over a large area. They would be unlikely to rely on vegetation within the site for foraging purposes.
Fragment an existing population into two or more populations.	Unlikely	Unlikely	Unlikely	The removal of potential habitat trees will not fragment any population of the three species. All three Black Cockatoo species are highly mobile, and the small size of the proposed clearing will not create a barrier to movement across the region.
Adversely affect habitat critical to the survival of an	Unlikely	Unlikely	Unlikely	The Recovery Plan for Carnaby's Black Cockatoo (DPAW, 2013) identifies the following habitat as

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TABLE 8: SIGNIFICANCE ASSESSMENT FOR THREE SPECIES OF BLACK COCKATOO

SIGNIFICANT IMPACT CRITERIA	LIKELIHOOD (KNOWN, LIKELY, POSSIBLE, UNLIKELY)			JUSTIFICATION
	CARNABY'S COCKATOO	BAUDIN'S COCKATOO	FOREST RED- TAILED BLACK COCKATOO	
ecological community.				<p>being critical to the survival of the species:</p> <ul style="list-style-type: none"> • Eucalypt woodlands that provide nest hollows for breeding, together with nearby foraging, roosting and watering points. • Woodlands sites known to have supported breeding in the past. • Vegetation that provides food resources as well as the site for nearby watering and night roosting. <p>The Recovery Plan for Forest Red-tailed Black Cockatoos and Baudin's Black Cockatoo (DEC, 2008) identifies the following habitat as being critical to the survival of the species:</p> <ul style="list-style-type: none"> • All Marri <i>Corymbia calophylla</i>, Karri <i>Eucalyptus diversicolour</i> and Jarrah <i>Eucalyptus marginata</i> forests; Woodlands and remnants in the south-west of Western Australia. <p>During the site inspection the scattered paddock trees present on Lots 272-275 were observed to be generally 5m or less in height with the occasional tree up to 8m. None of the trees contained hollows that would support black cockatoo breeding. The scattered Marri trees in the paddock areas provide very limited foraging resources.</p> <p>Foraging habitat is considered important for Black Cockatoos on the Swan Coastal Plain. The removal of scattered paddock trees will result in a very small loss of habitat. However, 1,100 ha of potential foraging habitat exists adjacent to or close to the Site in BF Sites 360 and 368.</p>

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TABLE 8: SIGNIFICANCE ASSESSMENT FOR THREE SPECIES OF BLACK COCKATOO

SIGNIFICANT IMPACT CRITERIA	LIKELIHOOD (KNOWN, LIKELY, POSSIBLE, UNLIKELY)			JUSTIFICATION
	CARNABY'S COCKATOO	BAUDIN'S COCKATOO	FOREST RED- TAILED BLACK COCKATOO	
Disrupt the breeding cycle of a population.	Unlikely	Unlikely	Unlikely	The loss of scattered trees from the Site will not disrupt the breeding cycle of any population of Black Cockatoos. The trees observed during the site inspection do not contain any hollows and currently do not provide breeding habitat for the three species. It is very unlikely these trees will be used for nesting in the future.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely	Unlikely	Unlikely	The removal of scattered paddock trees is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat. The trees on the Site provide very limited foraging habitat for Black Cockatoos. More than 1,100 ha of vegetation (potential habitat) exists within two Bush Forever Sites that are within a 2km radius of the Site in Bush Forever Sites 360 and 368.
Result in invasive species that are harmful to endangered species becoming established in the species habitat.	Unlikely	Unlikely	Unlikely	The removal of scattered potential habitat trees will not introduce an invasive species that may be harmful to Black Cockatoos.
Introduce disease that may cause the species to decline	Unlikely	Unlikely	Unlikely	The development of the site is unlikely to introduce a disease which could adversely impact the three Black Cockatoo species.
Interfere with the recovery of an ecological community	Unlikely	Unlikely	Unlikely	The quantity of habitat proposed to be cleared (scattered paddock trees) is only likely to support few individuals of Black Cockatoos. Therefore, the removal of these trees is unlikely to interfere with the recovery of any of the three species of Black Cockatoo.

4.6.4 Mitigation

The following mitigation strategies are recommended for the Site:

- Clearing of potential Black Cockatoo habitat trees should be avoided where possible. Retain native trees and shrubs in the open space areas and road reserves where finished site levels permit.
- Implement fauna management strategies during clearing and construction to prevent injuries to/death of Black Cockatoos.
- Black Cockatoo habitat can be enhanced through revegetation of cleared areas, particularly in open space areas, to increase the area of available habitat.

4.6.5 Recommendations

Where possible, potential Black Cockatoo habitat trees should be retained in areas of open space where finished site levels permit.

The loss of the existing trees would not represent a significant impact on the Black Cockatoo species and could be adequately compensated onsite through selection of appropriate plant species for use in landscape treatments and open space as part of future planning and design.

Implement measures to avoid impacts to fauna or fauna habitat during clearing and construction such as retaining existing trees where possible and the provision of fauna spotters during clearing activities.

5 ENVIRONMENTAL APPROVALS

The main environmental approvals for projects can be split into State and Commonwealth approvals. These are described in further detail below.

5.1 STATE APPROVALS PROCESS

5.1.1 Scheme Amendment

The rezoning of the Site will firstly require an amendment to the MRS followed by an amendment to the Shire of Serpentine-Jarrahdale's Town Planning Scheme. The process to amend the MRS is outlined in Plate 4 below. This process includes a step where the amendment is referred to the EPA for consideration under the *Environmental Protection Act 1986*. The EPA considers the environmental impact of the amendment and determines if a formal assessment (Environmental Review) is needed. This takes place prior to the amendment being advertised for public comment.

PLATE 4: METROPOLITAN REGION SCHEME AMENDMENT PROCESS



Given the EPA decision to not assess the scheme amendment for the West Mundijong Industrial Area and the similarities of the Site (with respect to relevant environmental factors) there is a lower risk that the MRS amendment for the Site would be assessed by the EPA.

5.1.2 *Rights in Water and Irrigation Act 1914*

The *Rights in Water and Irrigation Act 1914* (RIWI Act) governs the regulation and rights associated with water resources in Western Australia. The Act is administered by the DWER who issues licences and permits to:

- Take water (for groundwater abstraction or for dewatering);
- Construct wells (including bores and soaks); and
- Interfere with the bed and banks of a watercourse.

In accordance with Schedule 1, Division 2, clause 7(2) of the RIWI Act, the DWER ensures the proposed taking and using of water are ecologically sustainable and environmentally acceptable. Approvals to construct a groundwater bore and to abstract groundwater for irrigation purposes will need to be obtained if the Site is developed.

5.2 COMMONWEALTH APPROVALS PROCESS

The Commonwealth EPBC Act provides the DAWE the authority to assess an action that may significantly impact a matter of national environmental significance. A significant impact is defined as an impact which is important, notable, or of consequence, having regard to its context or intensity (DoE, 2013).

Scheme Amendments are not considered 'actions' under the EPBC Act and therefore do not require referral to and assessment by the DAWE (OEPA, 2015) as part of the Scheme Amendment process. Section 524 of the EPBC Act defines things that are not actions in relation to government bodies – this applies to decisions by a State or an agency of a State (DSEWPaC, 2013).

Subdivisions are considered 'actions' and must be referred to the Commonwealth if they may have a significant impact on MNES. The EPBC Act applies to 'actions' which:

- have a 'significant impact' on 'matters of national environmental significance';
- are undertaken by Commonwealth government agencies and have a significant impact on the environment anywhere in the world; or
- are undertaken by any person and have a significant impact on Commonwealth land (even if the activity is not actually carried out on the Commonwealth land).

If a proposal fits one of these descriptions, it will be required to be referred to the DAWE. If the proposal is not consistent with any of the above descriptions, the environmental impact assessment provisions of the EPBC Act will not apply and there is no need to obtain the approval of the Commonwealth Minister for the Environment (EDO, 2012).

Based on the findings of the assessment against the significant impact criteria (Section 4.6.3), it is Aurora Environmental's opinion that the clearing of scattered potential Black Cockatoo habitat trees on the Site would not cause a significant impact on the three Black Cockatoo species, therefore a referral under the EPBC Act is not recommended.

6 SUMMARY

Aurora Environmental has assessed the Site's environmental attributes and values. The assessment found the Site contains few environmental constraints that would prevent future development. From an ecological perspective, the degraded nature of the Site due to previous clearing and many years of low intensity agricultural use mean that sensitive environments are unlikely to be adversely impacted by rezoning.

Based upon the environment assessment, the following matters should be considered in the development of the Site:

- Soil permeability is anticipated to be low and potentially not suitable for infiltration of stormwater. Testing should be conducted to inform stormwater management options.
- Implement a pre-development groundwater and surface water monitoring program to capture pre-development water quality data and groundwater levels. It is expected that standard engineering solutions such as filling and sub-soil drainage will be required to achieve adequate separation from shallow groundwater levels and 100-year flood levels. These solutions will be further explored and refined through subsequent planning stages, consistent with the approach to urban development elsewhere in the Shire and the south metropolitan sub-region more broadly.
- Implement the Better Urban Water Management framework. A DWMS has been prepared in support of the MRS Amendment. A local water management strategy (LWMS) may be prepared at the local structure plan stage and an urban water management plan (UWMP) can be prepared as a condition of subdivision.
- Provide a buffer of 50m to the mapped conservation category wetland (CCW) along Mundijong Road, which is also a Bush Forever Site, and prepare a management plan for the treatment of the buffer/interface with the proposed development at the Site. The buffer should be reflected in future structure plans and the management plan could be prepared at local structure plan stage or as a condition of subdivision. The retention of this area may be revised pending an investigation to reclassify this portion of the CCW where the wetland/Bush Forever values are degraded and not commensurate with CCW values.
- Conduct a targeted ASS investigation if there is potential to disturb ASS and if required prepare and implement an ASS and Dewatering Management Plan. The requirement for an ASS investigation should be reviewed once disturbance details (such as dewatering and excavation) is known. This is best undertaken at the subdivision stage when more detailed engineering design has been completed.
- Prepare more detailed bushfire management plans during future stages of the planning process, consistent with State Planning Policy requirements and building on the strategic hazard assessment prepared by Lush Fire and Planning.
- During future stages of the planning process, site-specific odour, noise and/or dust studies will be required to establish appropriate buffers to the Peel Feedlot (sheep) and Serpentine Jarrahdale Holding Yards (cattle) located south of the Site, if the proponent is seeking to reduce the EPA (2015) recommended separation distance of 1,000m. These studies will also need to consider any

Environmental Assessment

Various Lots Bound by Mundijong, Gangemi, Leipold and King Roads, Oldbury

recommended separation distances or buffers associated with other external land uses that could impact the Site in the future.

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Various Lots Bound by Mundijong, Gangemi, Leipold and King Roads, Oldbury

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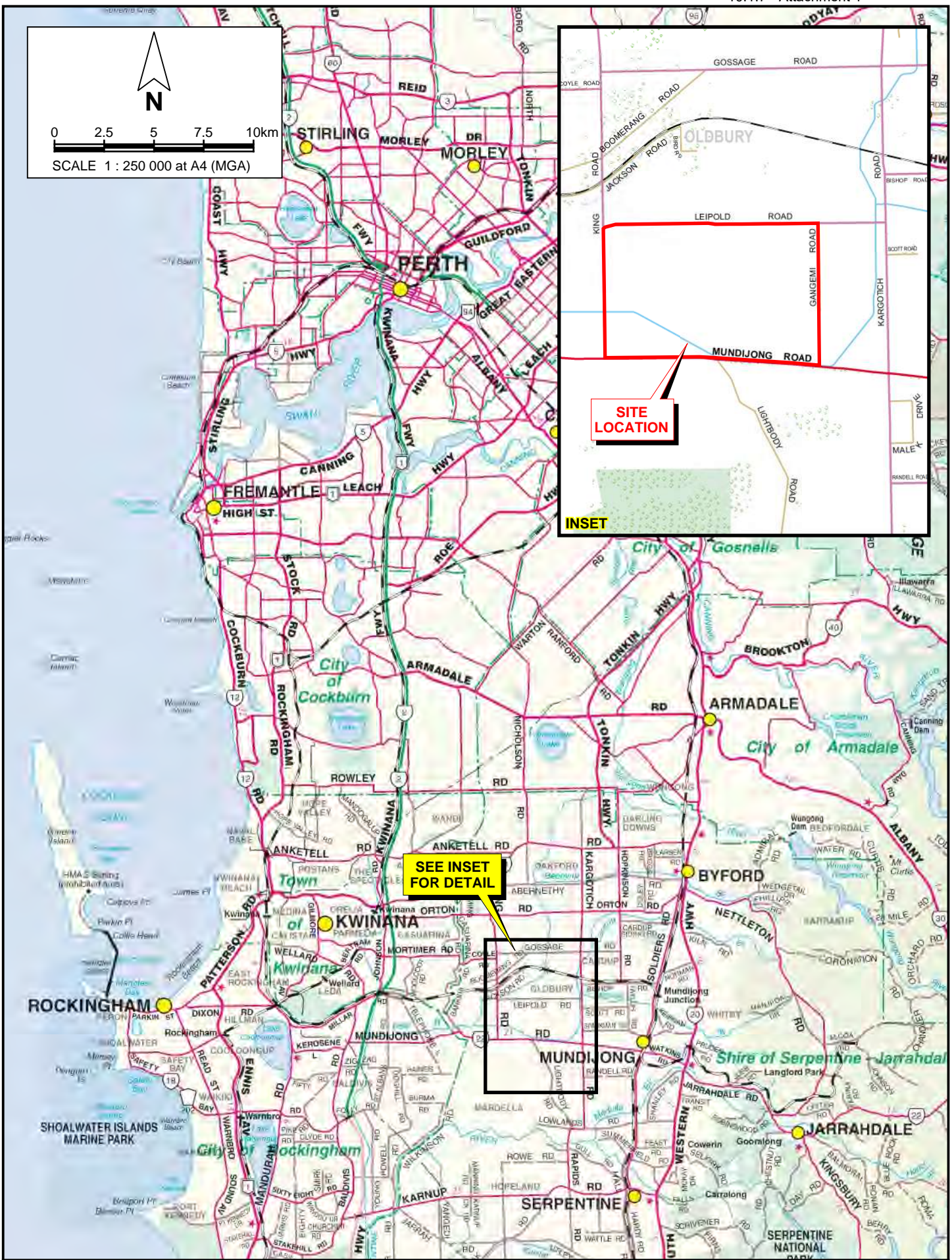
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FIGURES



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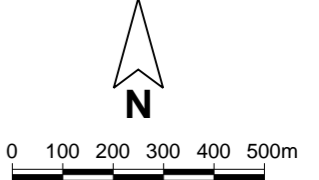
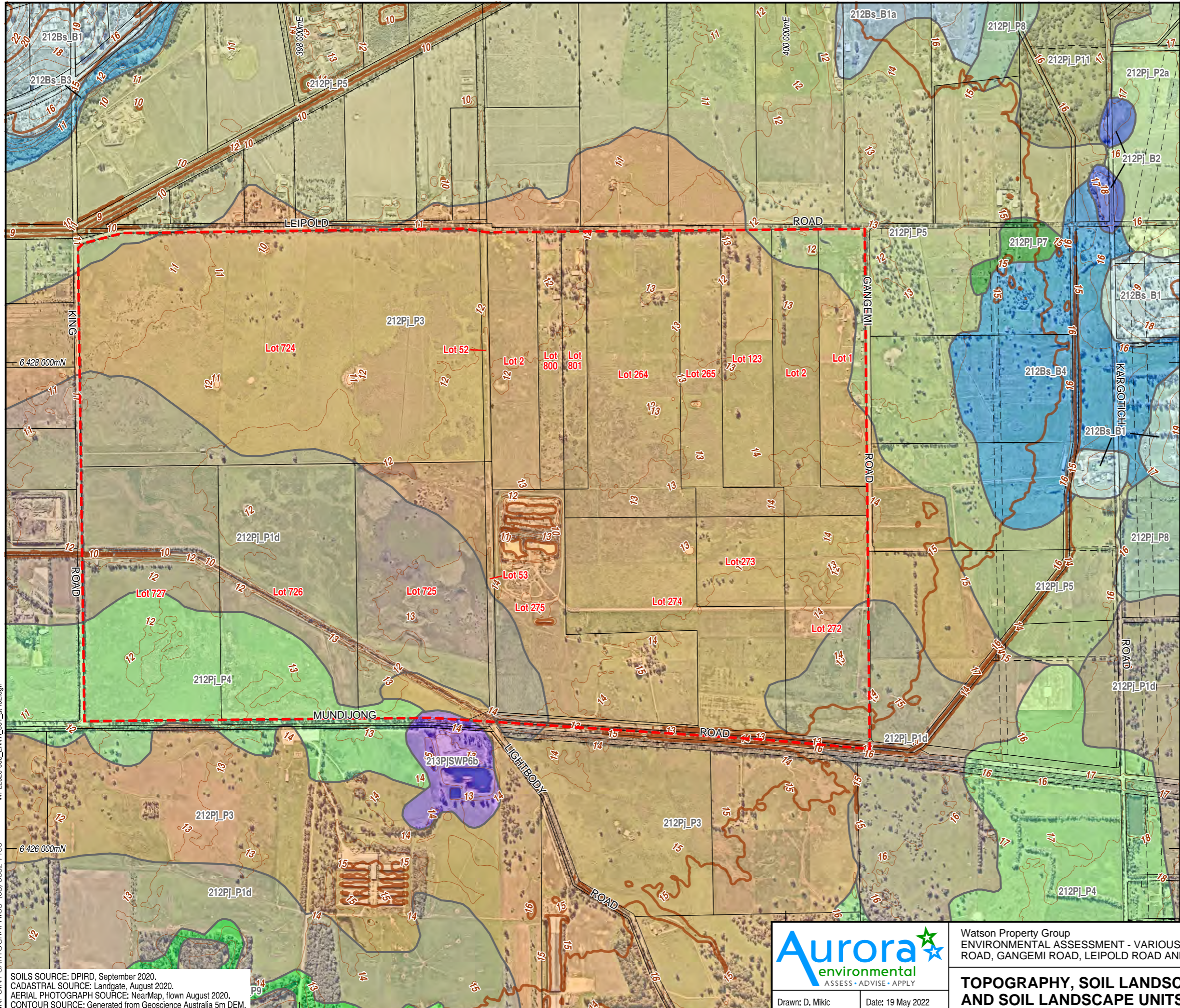
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ENVIRONMENTAL ASSESSMENT - VARIOUS LOTS BOUND BY MUNDIJONG ROAD, GANGEMI ROAD, LEIPOLD ROAD AND KING ROAD, OLDBURY

SITE LOCATION

Figure 1

Job: WPL2020-003



SCALE 1 : 15 000 at A3 (MGA)

Legend

- - - Site Boundary
- Cadastral Boundary
- Easement Boundary
- Topographic Contour

Soil Types

- 212Bs_B1 - Bassendean B1 Phase**
Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
- 212Bs_B1a - Bassendean B1a Phase**
Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.
- 212Bs_B3 - Bassendean B3 Phase**
Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.
- 212Bs_B4 - Bassendean B4 Phase**
Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.
- 212Pj_B2 - Pinjarra, B2 Phase**
Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.
- 212Pj_P1d - Pinjarra P1d Phase**
Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and moderately susceptible to salinity.
- 212Pj_P2a - Pinjarra P2a Phase**
Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam with a silcrete hardpan at 50-100 cm depth generally on top of an olive-grey clay.
- 212Pj_P3 - Pinjarra P3 Phase**
Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.
- 212Pj_P4 - Pinjarra P4 Phase**
Poorly drained flats, sometimes with gilgai microrelief and with moderately deep to deep black, olive grey and some yellowish brown cracking clays and less commonly non-cracking friable clays with generally acidic subsoils.
- 212Pj_P5 - Pinjarra P5 Phase**
Poorly drained flats, commonly with gilgai microrelief and with deep black-grey to olive-brown cracking clays with subsoils becoming alkaline.
- 212Pj_P7 - Pinjarra P7 Phase**
Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and gley sandy duplex and effective duplex soils.
- 212Pj_P8 - Pinjarra P8 Phase**
Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline gley and yellow duplex soils to uniform bleached or pale brown sands over clay.
- 212Pj_P9 - Pinjarra P9 Phase**
Shallowly incised stream channels of minor creeks and rivers with deep acidic mottled yellow duplex soils.
- 213PjSWP6b - Pinjarra P9b Phase**
Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well drained soils associated with prior stream deposits. Soils are uniform brownish sands.
- 212Pj_P11 - Pinjarra P11 Phase**
Shallow brown loamy soils or less commonly, very shallow sands over ironstone pavement which is a clear barrier to drainage.

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PINPOINT CARTOGRAPHICS (08) 9562 7136

SOILS SOURCE: DPIRD, September 2020.
 CADASTRAL SOURCE: Landgate, August 2020.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown August 2020.
 CONTOUR SOURCE: Generated from Geoscience Australia 5m DEM.

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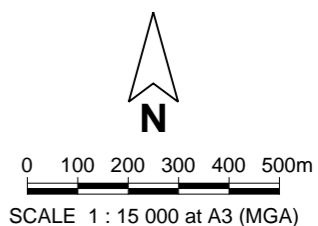
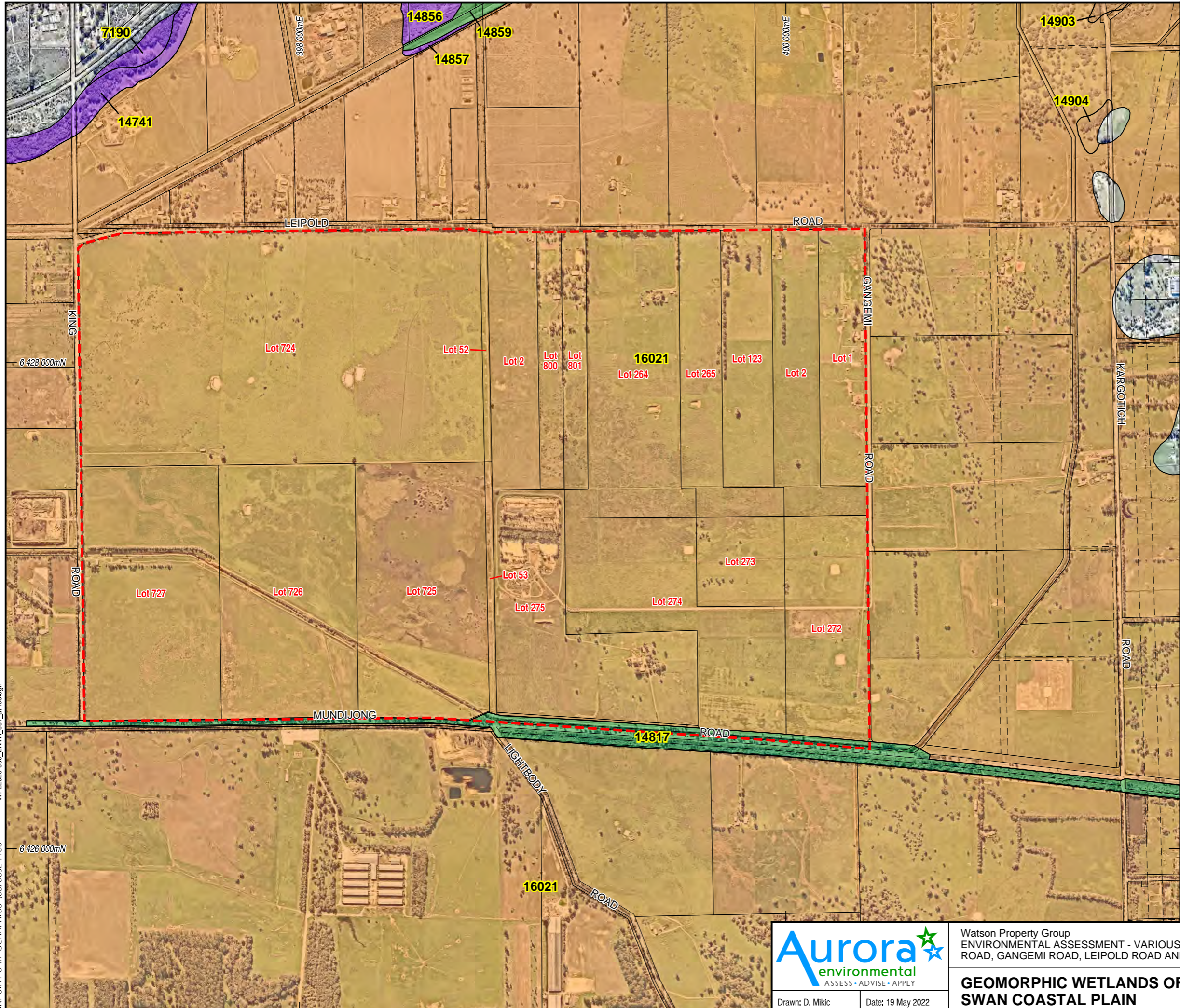
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TOPOGRAPHY, SOIL LANDSCAPE SYSTEMS AND SOIL LANDSCAPE UNITS

Figure 2

Job: WPL2020-003



- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - Easement Boundary
- Geomorphic Wetlands**
- Conservation Category
 - Resource Enhancement
 - Multiple Use
 - 7190** Wetland UFI Number

WETLAND SOURCE: DBCA, February 2020.
 CADASTRAL SOURCE: Landgate, August 2020.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown August 2020.

PINPOINT CARTOGRAPHICS (08) 9562 7136 WPL2020-003_ENVVA_001_at103.dgn

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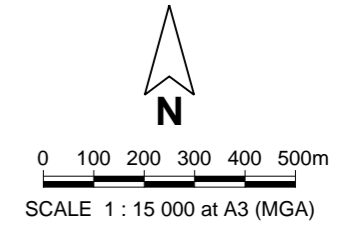
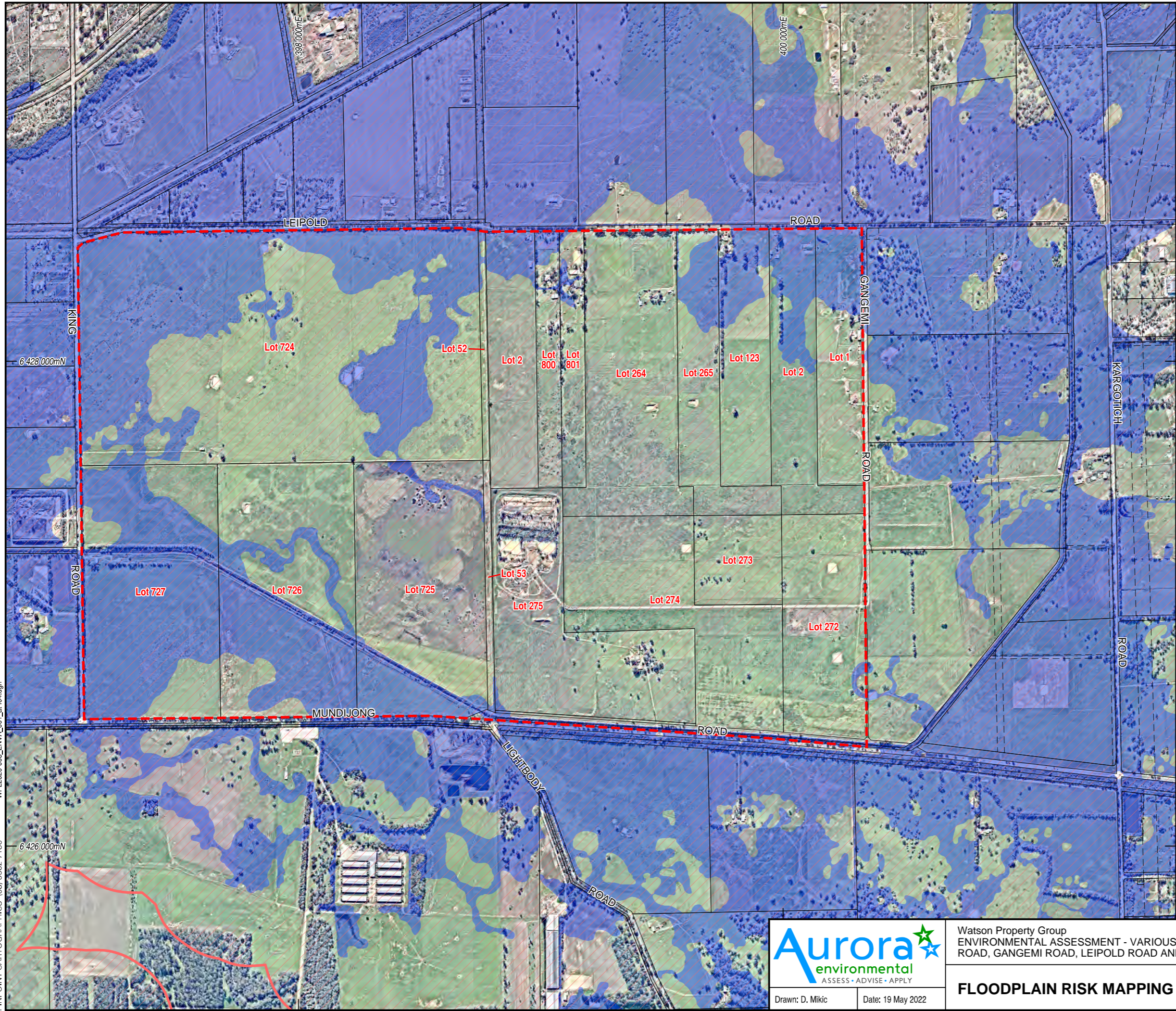
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GEOMORPHIC WETLANDS OF THE SWAN COASTAL PLAIN

Figure 3

Job: WPL2020-003



- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - Easement Boundary
 - 1 in 100 (1%) AEP Floodplain
 - 1 in 100 (1%) AEP Floodplain Development Control Area

PINPOINT CARTOGRAPHICS (08) 9562 7136 WPL2020-003_ENVVA_001_at104.dgn

CADASTRAL SOURCE: Landgate, August 2020.
 FLOOD MAPPING SOURCE: DWER, September 2020.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown August 2020.

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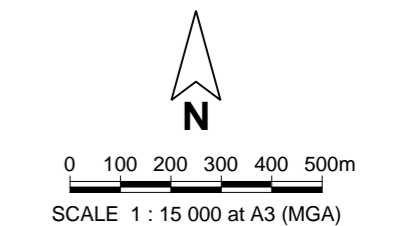
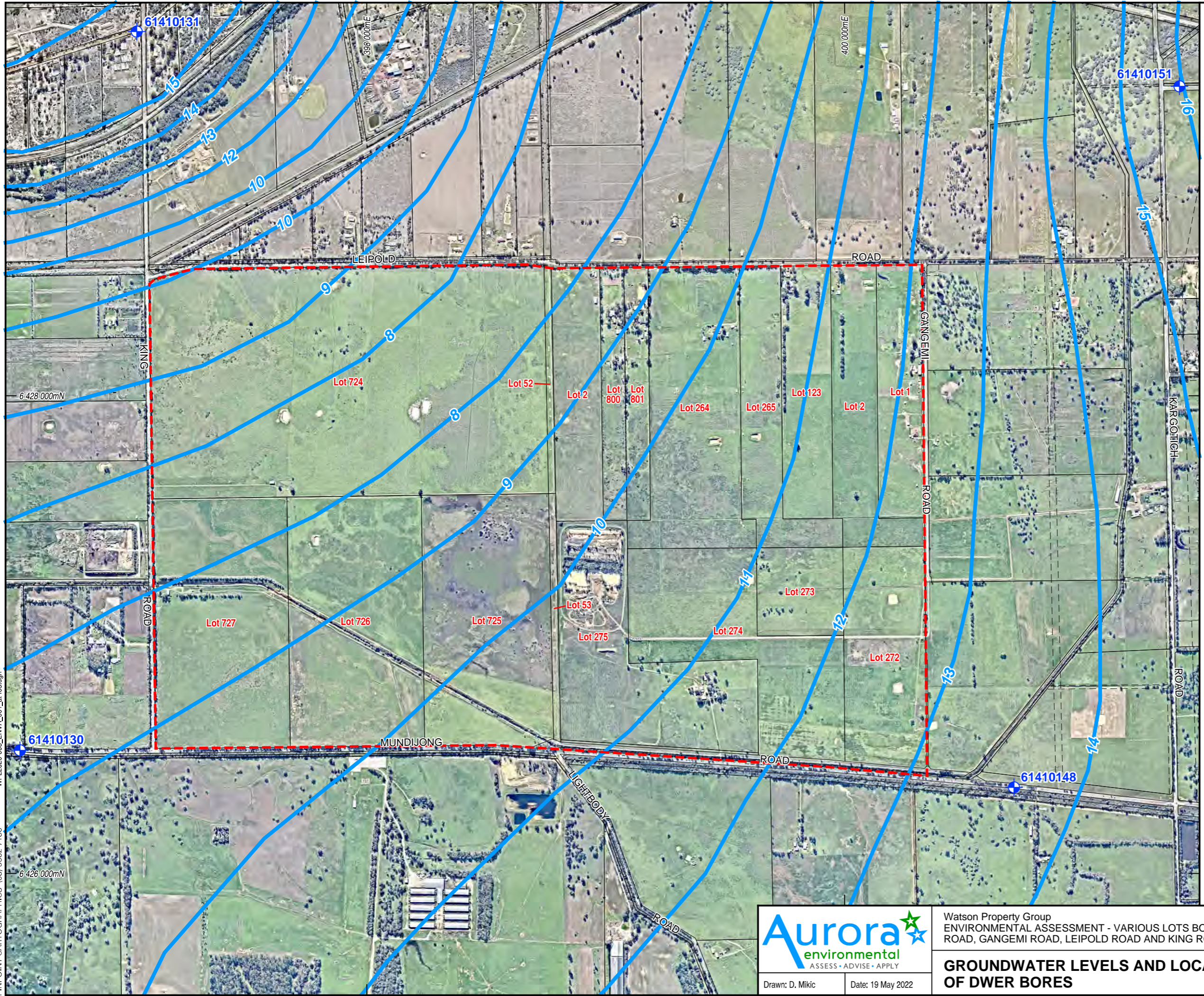
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FLOODPLAIN RISK MAPPING

Figure 4

Job: WPL2020-003



- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - - - Easement Boundary
 - Groundwater Contour (m AHD)
 - ⊕ DWER WIN Bore Location

CADASTRAL SOURCE: Landgate, August 2020.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown August 2020.

PINPOINT CARTOGRAPHICS (08) 9562 7136 WPL2020-003_ENVVA_001_at105.dgn

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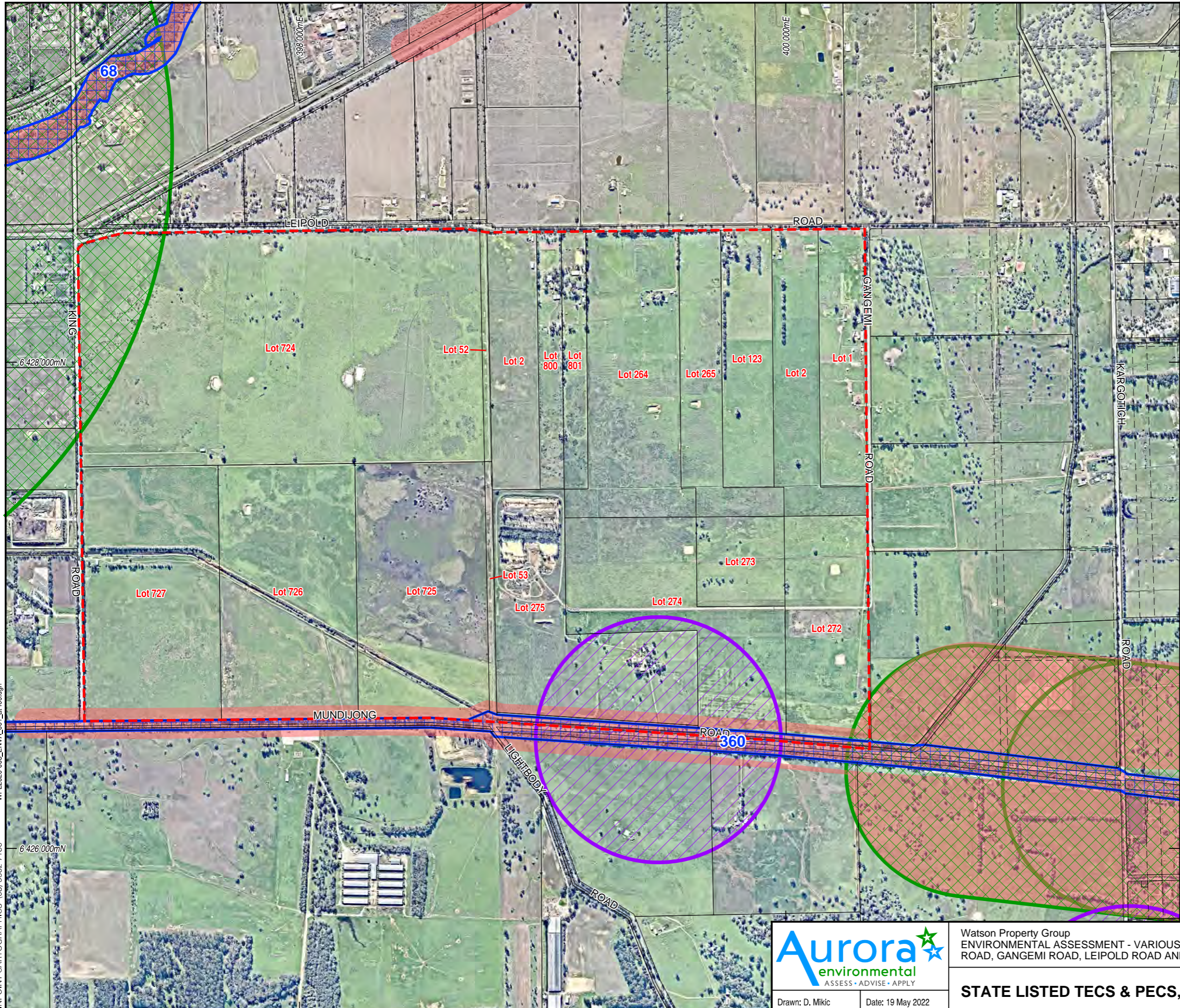
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GROUNDWATER LEVELS AND LOCATION OF DWER BORES

Figure 5

Job: WPL2020-003



Legend

- - - Site Boundary
- Cadastral Boundary
- Easement Boundary
- Threatened Ecological Community
- Priority Ecological Community
- Environmentally Sensitive Area
- Bush Forever Site

ESA SOURCE: DWER, September 2020.
 TEC/PEC SOURCE: DBCA, September 2020.
 CADASTRAL SOURCE: Landgate, August 2020.
 BUSH FOREVER SOURCE: DPLH, September 2020.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown August 2020.

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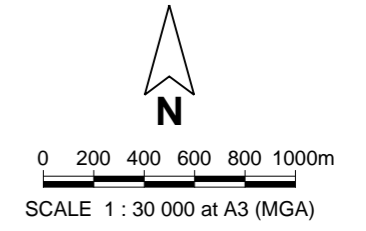
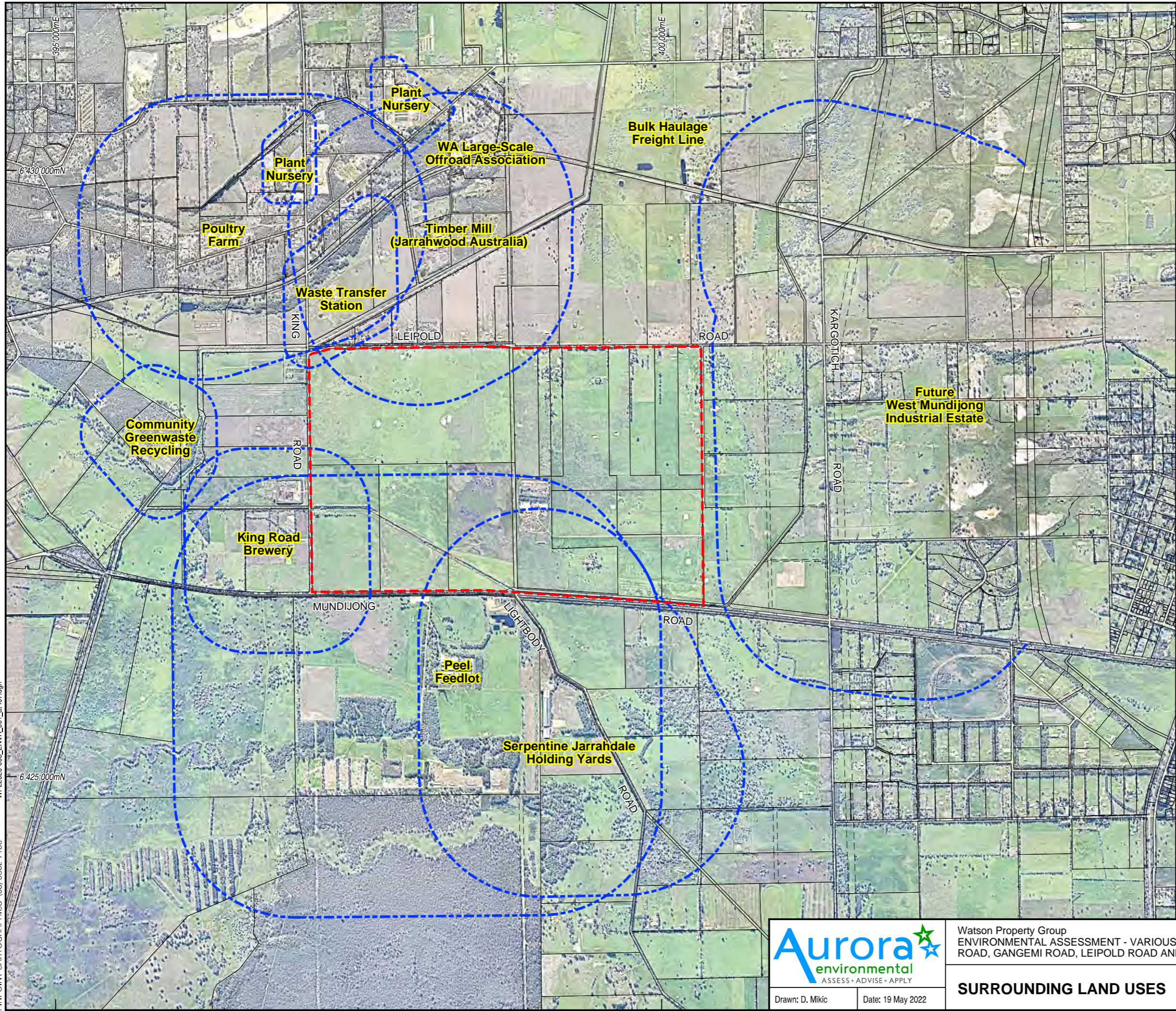
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STATE LISTED TECS & PECS, ESA, BUSH FOREVER

Figure 6

Job: WPL2020-003

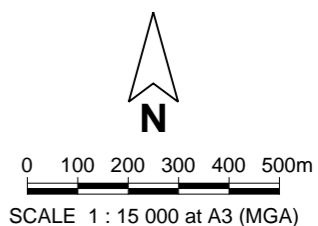
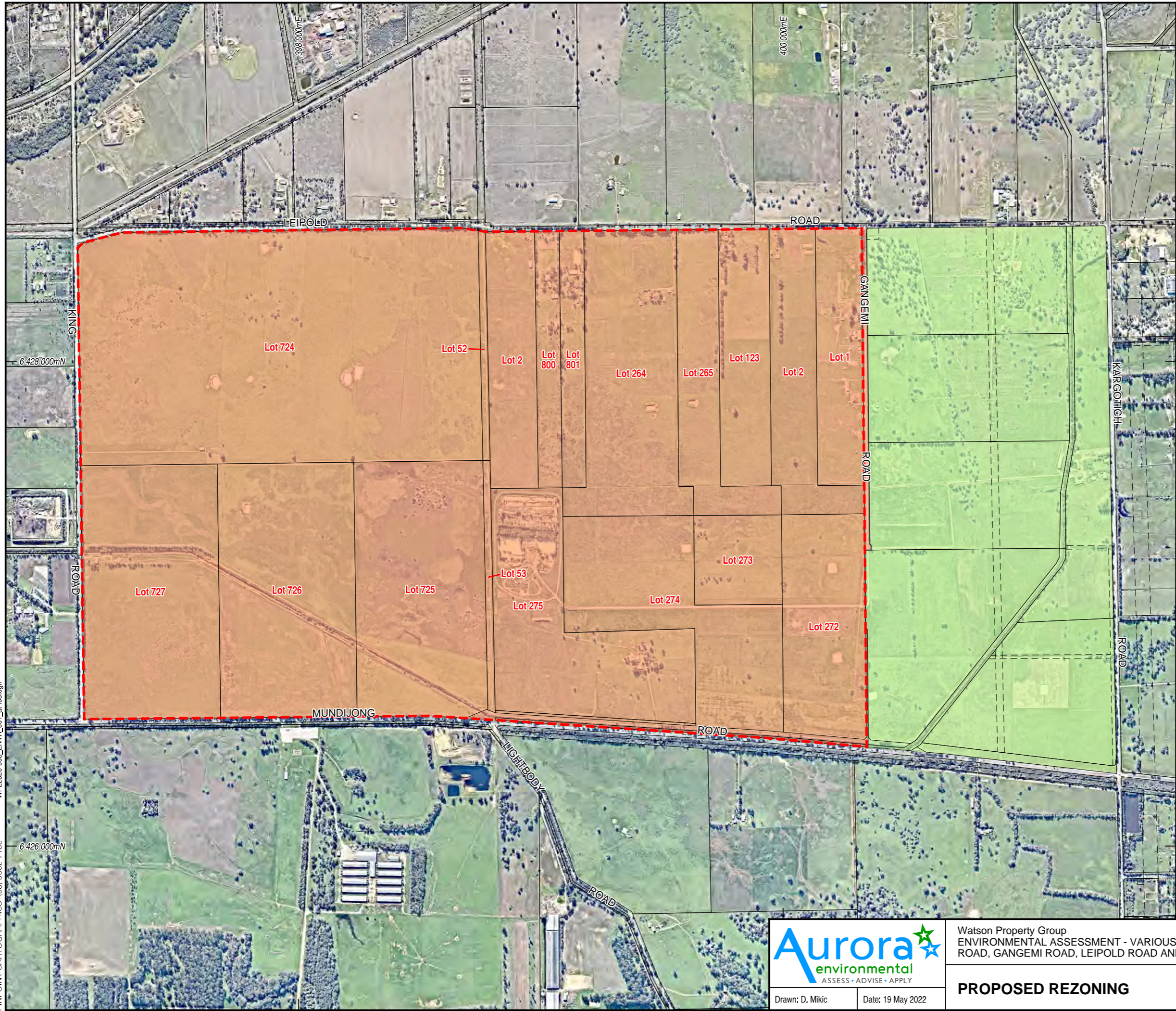


- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - Easement Boundary
 - Recommended Land Use Buffer (EPA, 2015)

PINPOINT CARTOGRAPHICS (08) 9562 7136 WPL2020-003_ENVVA_001_at107.dgn

CADASTRAL SOURCE: Landgate, August 2020.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown August 2020.

<p>Aurora environmental ASSESS • ADVISE • APPLY</p>	<p>Watson Property Group ENVIRONMENTAL ASSESSMENT - VARIOUS LOTS BOUND BY MUNDIJONG ROAD, GANGEMI ROAD, LEIPOLD ROAD AND KING ROAD, OLDBURY</p>	Figure 7
	<p>SURROUNDING LAND USES</p>	<p>Job: WPL2020-003</p>
<p>Drawn: D. Mikic</p>	<p>Date: 19 May 2022</p>	



- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - - - Easement Boundary
 - Medium Density Residential (R20 Zoning)
 - Area to be Retained Under Rural Zoning

PINPOINT CARTOGRAPHICS (08) 9562 7136 WPL2020-003_ENVA_001_at108.dgn

CADASTRAL SOURCE: Landgate, August 2020.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown August 2020.

Aurora environmental
ASSESS • ADVISE • APPLY

Drawn: D. Mikic Date: 19 May 2022

Watson Property Group
ENVIRONMENTAL ASSESSMENT - VARIOUS LOTS BOUND BY MUNDIJONG ROAD, GANGEMI ROAD, LEIPOLD ROAD AND KING ROAD, OLDBURY

PROPOSED REZONING

Figure 8

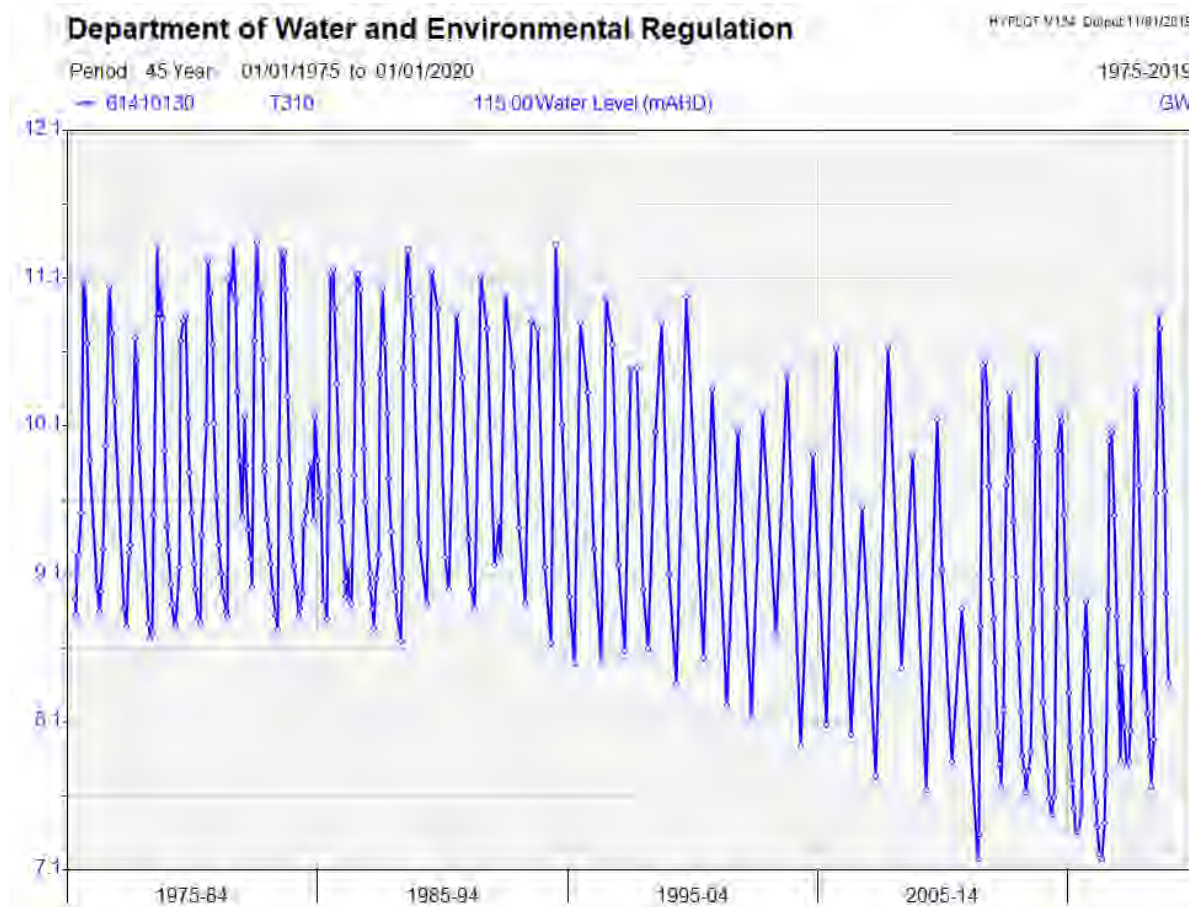
Job: WPL2020-003

APPENDIX 1

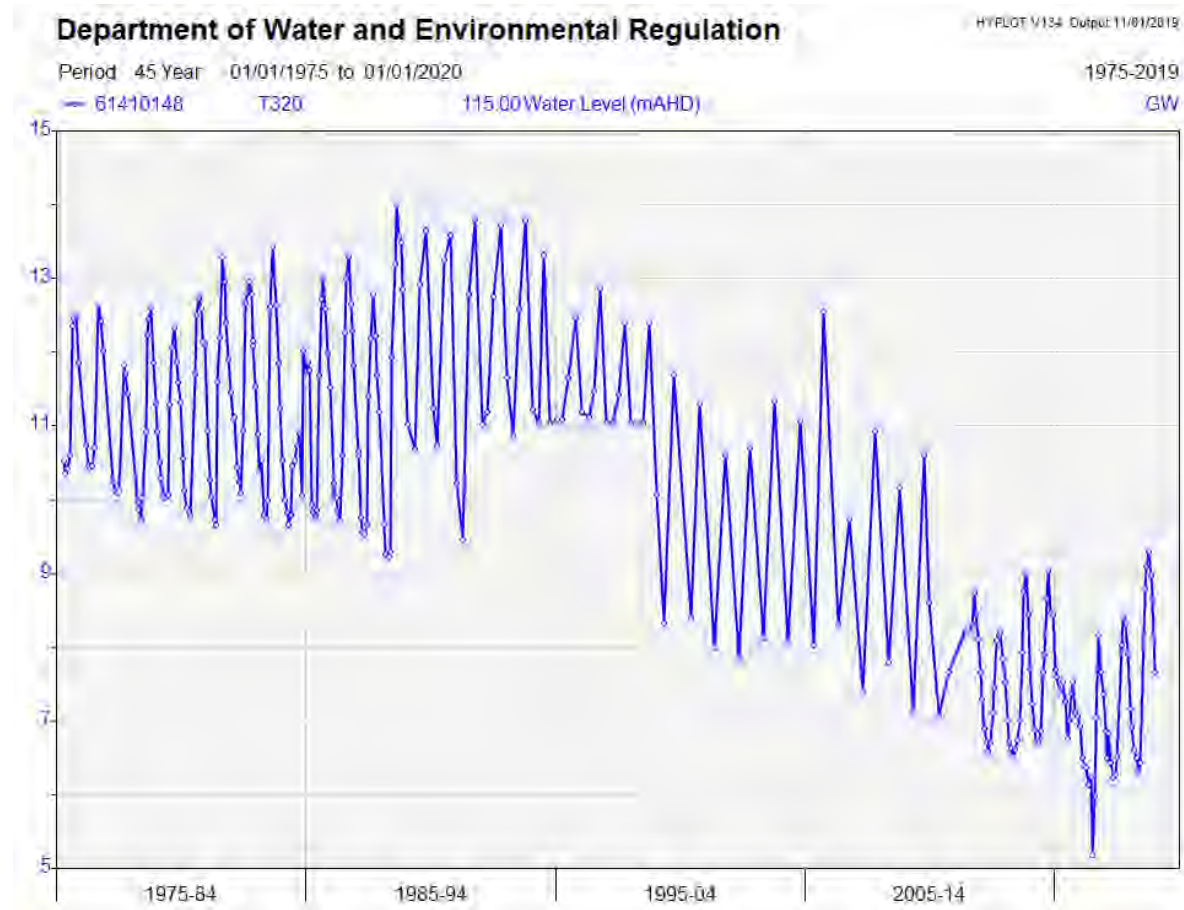
DWER Bore Logs

APPENDIX 1: DWER BORES HYDROGRAPHS

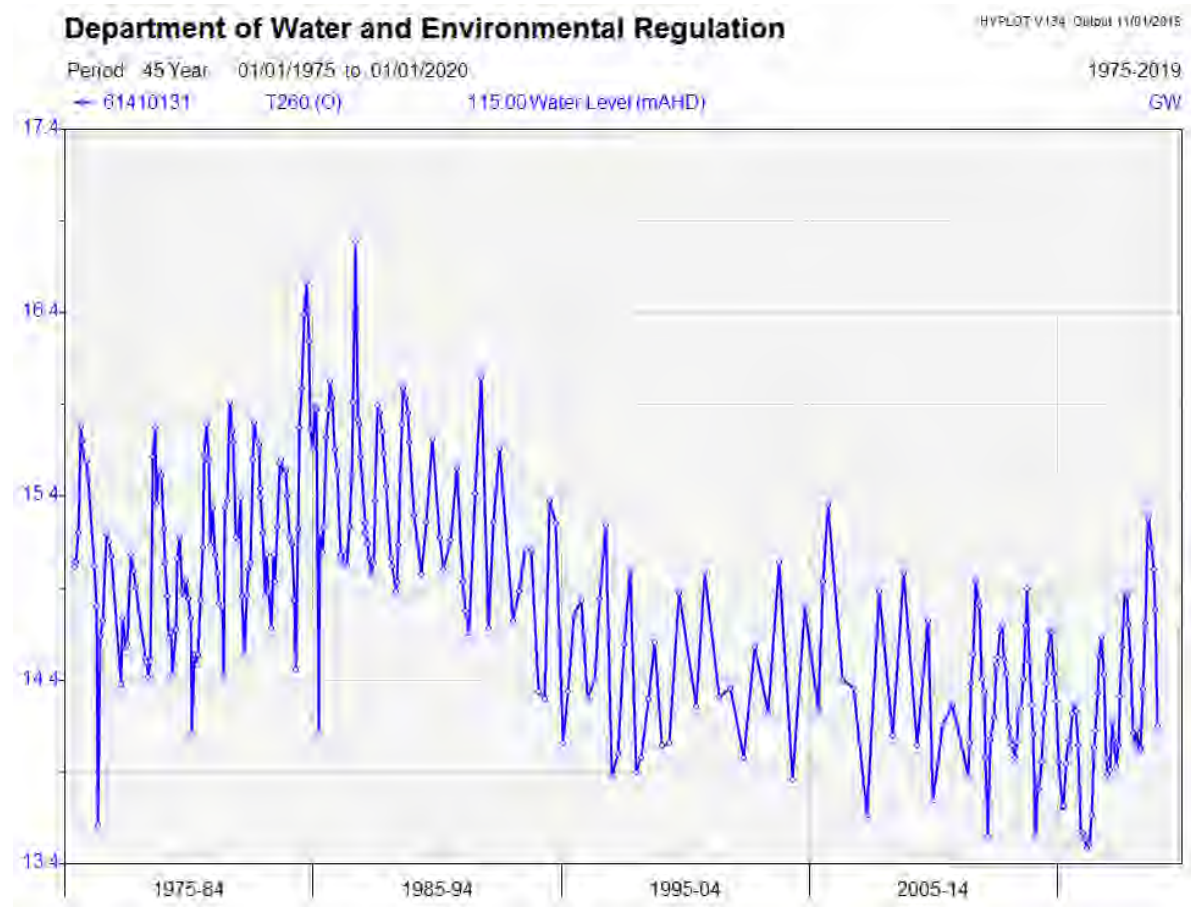
HYDROGRAPH BORE 61410130



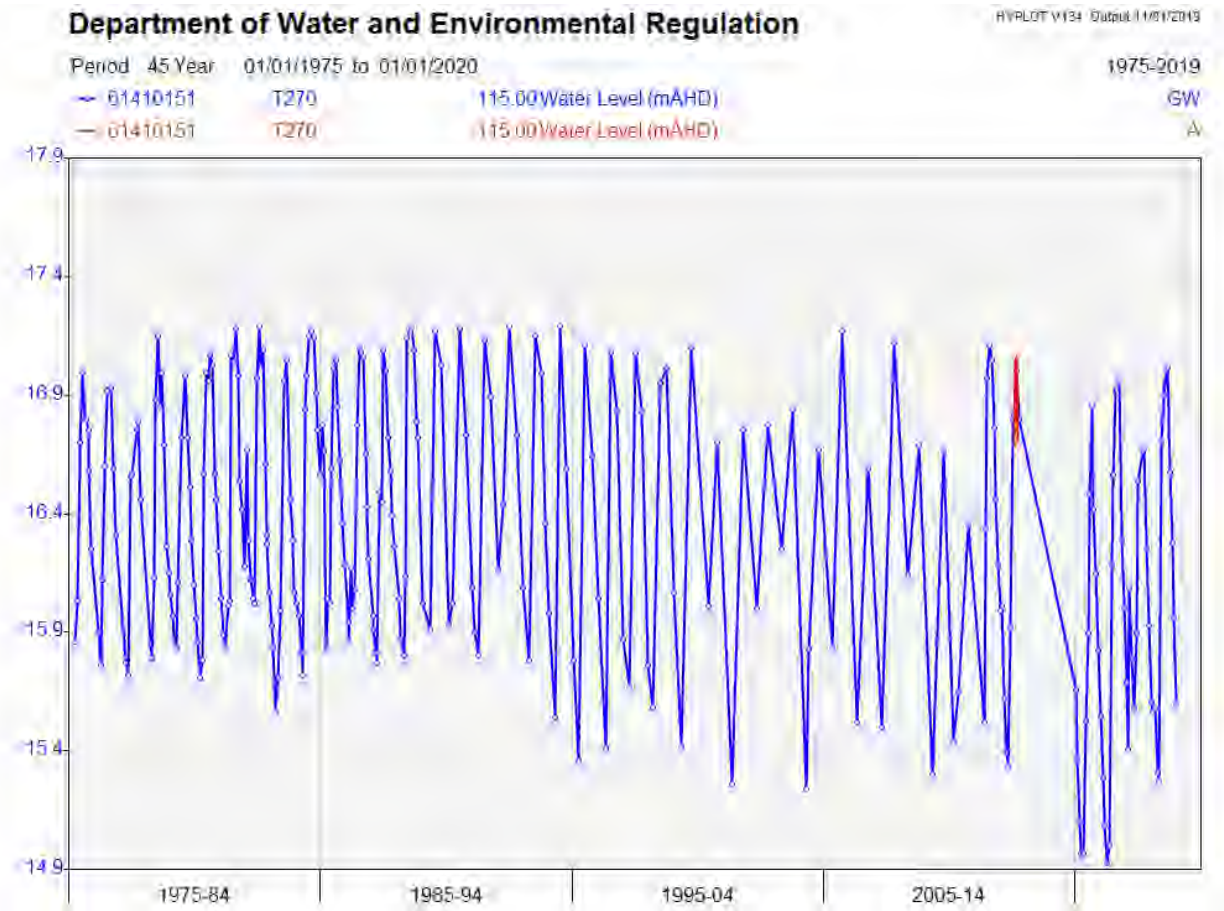
HYDROGRAPH BORE 61410148



HYDROGRAPH BORE 61410131



HYDROGRAPH BORE 61410151



APPENDIX 2

Protected Matters Search Tool Report



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 20/08/20 17:16:30

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

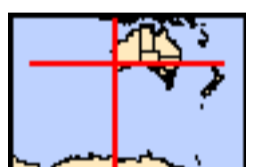
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 2.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	24
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	36
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [\[Resource Information \]](#)

Name	Proximity
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Mammals

Name	Status	Type of Presence
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroi Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		habitat may occur within area Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur

Name	Status	Type of Presence
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		within area Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom,		Species or species

Name	Status	Type of Presence
Common Broom, French Broom, Soft Broom [20126]		habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.2851 115.92976

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
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- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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 Department of the Environment
 GPO Box 787
 Canberra ACT 2601 Australia
 +61 2 6274 1111

APPENDIX 3

NatureMap Species Report

NatureMap Species Report

Created By Guest user on 21/09/2020

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 55' 47" E, 32° 17' 06" S
Buffer 2km
Group By Kingdom

Kingdom	Species	Records
Animalia	8	11
Plantae	124	291
TOTAL	132	302

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Animalia				
1.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
2.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
3.	48588 <i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
4.	48024 <i>Notamacropus eugenii</i> subsp. <i>derbianus</i> (Tammar Wallaby, Tammar)		P4	
5.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
6.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
7.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
8.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
Plantae				
9.	11519 <i>Acacia lasiocarpa</i> var. <i>bracteolata</i>			
10.	14932 <i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)		P1	
11.	3557 <i>Acacia stenoptera</i> (Narrow Winged Wattle)			
12.	184 <i>Aira caryophyllea</i> (Silvery Hairgrass)	Y		
13.	197 <i>Amphipogon debilis</i>			
14.	29487 <i>Anigozanthos manglesii</i> var. <i>x angustifolius</i>			
15.	1117 <i>Aphelia cyperoides</i>			
16.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
17.	<i>Astartea</i> aff. <i>fascicularis</i> sthst			
18.	17233 <i>Austrostipa campylachne</i>			
19.	233 <i>Avena barbata</i> (Bearded Oat)	Y		
20.	32576 <i>Banksia dallanneyi</i> (Couch Honeypot)			
21.	1272 <i>Borya scirpoidea</i>			
22.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
23.	245 <i>Briza minor</i> (Shivery Grass)	Y		
24.	1385 <i>Burchardia multiflora</i> (Dwarf Burchardia)			
25.	1276 <i>Caesia micrantha</i> (Pale Grass Lily)			
26.	36600 <i>Callitris pyramidalis</i> (Swamp Cypress)			
27.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
28.	1121 <i>Centrolepis aristata</i> (Pointed Centrolepis)			
29.	1132 <i>Centrolepis mutica</i>			
30.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
31.	763 <i>Chorizandra enodis</i> (Black Bristlerush)			
32.	6543 <i>Cicendia filiformis</i> (Slender Cicendia)	Y		
33.	<i>Coryza</i> sp. Mud07			Y
34.	768 <i>Cyathochaeta avenacea</i>			
35.	815 <i>Cyperus tenellus</i> (Tiny Flatsedge)	Y		
36.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
37.	16595 <i>Desmocladus flexuosus</i>			
38.	306 <i>Dichelachne crinita</i> (Longhair Plumegrass)			
39.	19649 <i>Disa bracteata</i>	Y		
40.	3092 <i>Drosera bulbosa</i> (Red-leaved Sundew)			
41.	3098 <i>Drosera glanduligera</i> (Pimpernel Sundew)			
42.	3101 <i>Drosera heterophylla</i> (Swamp Rainbow)			
43.	3109 <i>Drosera menziesii</i> (Pink Rainbow)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
44.	8911 <i>Drosera rosulata</i>			
45.	347 <i>Ehrharta calycina</i> (Perennial Veldt Grass)	Y		
46.	349 <i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
47.	376 <i>Eragrostis curvula</i> (African Lovegrass)	Y		
48.	3880 <i>Eutaxia virgata</i>			
49.	434 <i>Gastridium phleoides</i> (Nitgrass)	Y		
50.	1518 <i>Gladiolus angustus</i> (Long Tubed Painted Lady)	Y		
51.	29362 <i>Goodenia coerulea</i>			
52.	12551 <i>Goodenia micrantha</i>			
53.	1468 <i>Haemodorum laxum</i>			
54.	1472 <i>Haemodorum simplex</i>			
55.	2179 <i>Hakea marginata</i>			
56.	2214 <i>Hakea trifurcata</i> (Two-leaf Hakea)			
57.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
58.	12741 <i>Hyalosperma cotula</i>			
59.	6226 <i>Hydrocotyle callicarpa</i> (Small Pennywort)			
60.	6229 <i>Hydrocotyle diantha</i>			
61.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
62.	8086 <i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
63.	919 <i>Isolepis oldfieldiana</i>			
64.	4029 <i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			
65.	5835 <i>Kunzea micrantha</i>			
66.	17461 <i>Kunzea micrantha</i> subsp. <i>micrantha</i>			
67.	19955 <i>Lachnagrostis plebeia</i>			
68.	<i>Lepidosperma</i> aff. <i>pubisquamum</i> (#166)			
69.	<i>Lepidosperma eastern terete scps</i> (BJK&NG 232)			
70.	1078 <i>Leptocarpus coangustatus</i>			
71.	2355 <i>Leptomeria squarrulosa</i>			
72.	1085 <i>Lepyrodia glauca</i>			
73.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
74.	476 <i>Lolium perenne</i> (Perennial Ryegrass)	Y		
75.	478 <i>Lolium rigidum</i> (Wimmera Ryegrass)	Y		
76.	<i>Lolium</i> sp.			
77.	1232 <i>Lomandra micrantha</i> (Small-flower Mat-rush)			
78.	<i>Lotus</i> sp. <i>Mud3</i>			Y
79.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
80.	20297 <i>Melaleuca osullivanii</i>			
81.	5946 <i>Melaleuca pauciflora</i>			
82.	5959 <i>Melaleuca raphiophylla</i> (Swamp Paperbark)			
83.	957 <i>Mesomelaena tetragona</i> (Semaphore Sedge)			
84.	10954 <i>Microtis media</i> (Tall Mignonette Orchid)			
85.	7410 <i>Monopsis debilis</i>	Y		
86.	492 <i>Neurachne alopecuroidea</i> (Foxtail Mulga Grass)			
87.	18255 <i>Opercularia vaginata</i> (Dog Weed)			
88.	16478 <i>Pericalymma ellipticum</i> var. <i>floridum</i>			
89.	2308 <i>Petrophile seminuda</i>			
90.	1172 <i>Philydrella drummondii</i>			
91.	1173 <i>Philydrella pygmaea</i> (Butterfly Flowers)			
92.	16177 <i>Phyllangium paradoxum</i>			
93.	1556 <i>Romulea rosea</i> (Guildford Grass)	Y		
94.	40425 <i>Rytidosperma caespitosum</i>			
95.	40430 <i>Rytidosperma pilosum</i>			
96.	7619 <i>Scaevola lanceolata</i> (Long-leaved Scaevola)			
97.	<i>Schoenus</i> aff. <i>brevisetis</i> (Mud2, #135)			
98.	975 <i>Schoenus bifidus</i>			
99.	978 <i>Schoenus brevisetis</i>			
100.	1002 <i>Schoenus nanus</i> (Tiny Bog Rush)			
101.	1006 <i>Schoenus odontocarpus</i>			
102.	17614 <i>Schoenus plumosus</i>			
103.	1026 <i>Schoenus unispiculatus</i>			
104.	6 <i>Selaginella gracillima</i> (Tiny Clubmoss)			
105.	8225 <i>Siloxerus humifusus</i> (Procumbent Siloxerus)			
106.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
107.	1558 <i>Sparaxis bulbifera</i>	Y		
108.	4733 <i>Stackhousia monogyna</i>			
109.	<i>Stylidium</i> aff. <i>androsaceum</i>			
110.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
111.	7712 <i>Stylidium despectum</i> (Dwarf Triggerplant)			
112.	7742 <i>Stylidium inundatum</i> (Hundreds and Thousands)			
113.	23511 <i>Stylidium thesioides</i> (Delicate Triggerplant)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
114.	7806 <i>Stylidium utricularioides</i> (Pink Fan Triggerplant)			
115.	1036 <i>Tetragia octandra</i>			
116.	1701 <i>Thelymitra antennifera</i> (Vanilla Orchid)			
117.	1705 <i>Thelymitra crinita</i> (Blue Lady Orchid)			
118.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
119.	1351 <i>Thysanotus sparteus</i>			
120.	1481 <i>Tribonanthes australis</i> (Southern Tiurndin)			
121.	1362 <i>Tricoryne humilis</i>			
122.	4292 <i>Trifolium campestre</i> (Hop Clover)	Y		
123.	4295 <i>Trifolium dubium</i> (Suckling Clover)	Y		
124.	1139 <i>Trithuria bibracteata</i>			
125.	8255 <i>Ursinia anthemoides</i> (Ursinia)	Y		
126.	6088 <i>Verticordia huegelii</i> (Variegated Featherflower)			
127.	6107 <i>Verticordia pennigera</i>			
128.	4325 <i>Viminaria juncea</i> (Swishbush, Koweda)			
129.	722 <i>Vulpia bromoides</i> (Squirrel Tail Fescue)	Y		
130.	724 <i>Vulpia myuros</i> (Rat's Tail Fescue)	Y		
131.	18108 <i>Watsonia meriana</i> var. <i>bulbillifera</i>	Y		
132.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			

Conservation Codes

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

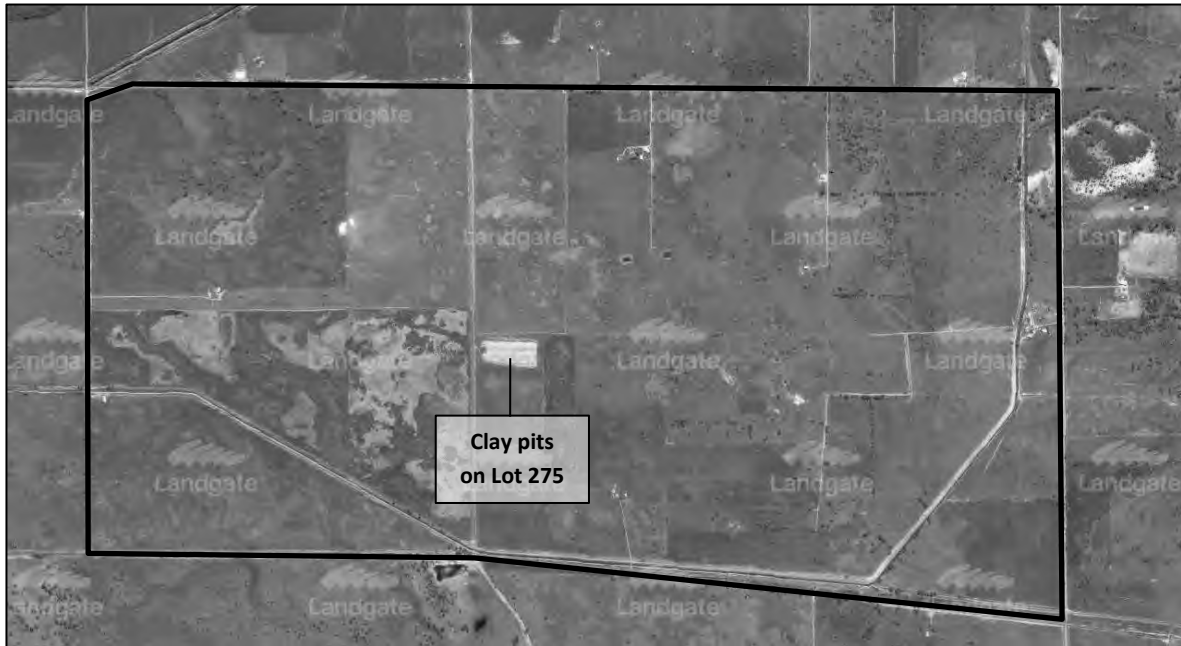


APPENDIX 4

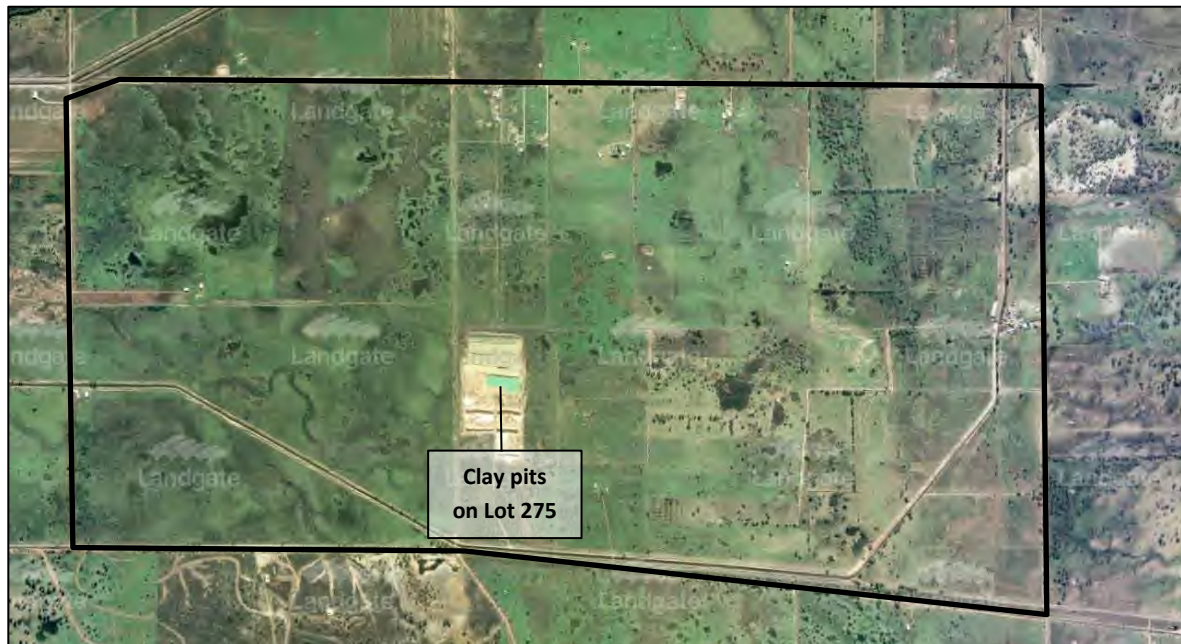
Clay Pits on Lot 275 Mundijong Road Oldbury

APPENDIX 2 – CLAY PITS ON LOT 275 MUNDIJONG ROAD OLDBURY

FIRST EVIDENCE OF DISTURBANCE ON LOT 275 (SEPTEMBER 1974)



CLAY PITS ON LOT 275 (AUGUST 1981)



PART REHABILITATION OF CLAY PITS ON LOT 275 (AUGUST 2018)



PART REHABILITATION OF CLAY PITS ON LOT 275 (FEBRUARY 2020)



APPENDIX 5

West Mundijong Industrial Area District Structure Plan



DRAFT

SJS TRIM - IN14/23985

Figure 1 - West Mundijong District Structure Plan

**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 2.7

Bushfire Hazard Level Assessment





Bushfire Management Plan (Bushfire Hazard Level Assessment)

Land bounded by Mundijong Road, Kargotich Road,
Leipold Road and King Road, Oldbury



Ref 20 - 050

Ver D

May 2022

LUSHFIRE & PLANNING

3 Paterson Rd

Pinjarra WA 6208

0418 954 873

ABN 74 232 678 543



Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference:	Land bounded by Mundijong, Kargotich, Leipold and King Roads		
Suburb:	Oldbury	State:	WA
		P/code:	6121
Local government area:	Serpentine Jarrahdale		
Description of the planning proposal:	Planning Scheme Amendment		
BMP Plan / Reference Number:	20-050	Version:	D
		Date of Issue:	5/05/2022
Client / Business Name:	WPG Landholdings No 3 Pty Ltd		

Reason for referral to DFES

	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Is the proposal any of the following special development types (see SPP 3.7 for definitions)?

Unavoidable development (in BAL-40 or BAL-FZ)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Strategic planning proposal (including rezoning applications)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Minor development (in BAL-40 or BAL-FZ)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
High risk land-use	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Vulnerable land-use	<input type="checkbox"/>	<input checked="" type="checkbox"/>

If the development is a special development as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

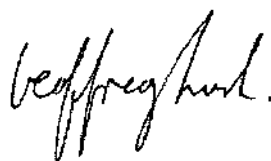
Note: The decision maker (e.g. the local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name	Accreditation Level	Accreditation No.	Accreditation Expiry
Geoffrey Lush	Level 2	BPAD 27682	28/02/2023
Company	Contact No.		
Lush Fire & Planning	0418 954 873		

I declare that the information provided in this bushfire management plan is to the best of my knowledge true and correct.

Signature of Practitioner



Date

5/05/2022

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury Summary

This bushfire management plan is prepared for land bounded by Mundijong, King, Leipold and Gangemi Roads, Oldbury (the Study Area). The study area has an area of 859 hectares and is located 3kms west of the Mundijong townsite and 7kms south west of Byford.

Contained within the study area for this report is the proposed West Mundijong Urban Precinct (the subject land), which is proposed to be developed for urban purposes. In order to achieve this, it will be necessary to modify the existing planning framework including the Metropolitan Region Scheme and Shire of Serpentine Jarrahdale Local Planning Strategy and Scheme. Given the strategic nature of this report and the size of the subject land, the bushfire assessment is in the form of a strategic Bushfire Hazard Level assessment.

The study area contains twenty-two (22) freehold lots, while the subject land contains sixteen (16) freehold lots and a drainage reserve. The subject land is generally rectangular in shape being approximately 3,260m by 2,100m. The area is currently used for broad acre farming being primarily for cattle grazing and equine establishments. It is characterised by large open paddocks with scattered trees, with dwellings located around the periphery.

There is scattered vegetation on the site and adjacent road reserves. Bush Forever Site 360 extends along Mundijong Road. The site has an elevation of between 10m AHD in the north western corner rising to 16m on the eastern boundary. Over the length of the site this is a gradient of less than 1%.

In order to develop the land for urban purposes it will be necessary to first amend the Metropolitan Region Scheme and the Shire's Local Planning Scheme, followed by further detailed planning through structure planning, subdivision applications, and development applications.

The land situated between Gangemi Road and Kargotich Road falls outside the MRS Amendment area for the proposed West Mundijong Urban Precinct. This land has nevertheless been assessed as part of this bushfire management plan because it abuts the subject land and may in future accommodate other uses which are compatible with the 1km buffer to the West Mundijong industrial area.

The western portion of the subject land, being 647 hectares situated west of Gangemi Road would be developed as medium density residential development. This would have an R20 zoning an average lot size of 450m² with associated open space, recreational areas and facilities, and neighbourhood amenities.

The environmental assessment has noted that there are no intact areas of native vegetation within the study area. The site is mapped as a Multiple Use wetland with an area of Conservation Category Wetland along Mundijong Road. Bush Forever Site 360 traverses the southern boundary of the study area. A 50m buffer is required to the conservation category wetland along Mundijong Road.

The Bushfire Hazard Level assessment identifies the vegetation with an extreme hazard rating. Within the subject land these have a combined area of approximately 35 hectares which is 4% of the total site area. All of the external boundary roads also have roadside vegetation with an extreme hazard level.

It is expected that 95% of the developed site will have either a moderate or low bushfire hazard level when developed. Large portions of the site will have a low hazard level and consequently, subdivision and development of that area would not be subject to State Planning Policy SPP3.7 Planning in Bushfire Prone Areas or the Bushfire Protection Criteria.

Bushfires occur regularly within the locality and pose a threat to life and property. The surrounding land is a mixture of urban, rural residential, and rural land uses. The rural land uses are typically large properties used for broad acre grazing with grassland being the predominant vegetation. The primary bushfire hazard is from a fast moving grass fire which can still have the potential to be a destructive fire threatening life and property. In response to this, the site has excellent district access to the subject land from multiple directions on district distributor roads.

The most significant local issue is the management of the interface with the proposed 50m wide revegetation buffer adjacent to Mundijong Road conservation category wetland, Bush Forever Site.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury Summary

This report demonstrates that the hazard level on the subject land will be reduced and permanently altered by the site being developed. The developed site is expected to generally have a low hazard level.

The Bushfire Protection Criteria in the Guidelines can be achieved now or in subsequent planning stages and the proposal complies with the objectives of State Planning Policy 3.7.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

Document Control

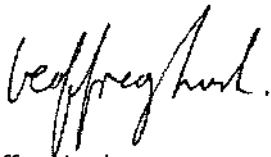
Street No	Lot No	Plan	Street Name		
	Various		Mundijong, Kargotich, Leipold and King Roads		
Locality	Oldbury	State	WA	Postcode	6121
Local Government Area	Serpentine Jarrahdale				
Project Description	Scheme Amendment				
Prepared for	WPG Landholdings No 3 Pty Ltd				

Ref No	Revision	Date	Purpose
20-028	D	05/05/2022	GPBPA Ver 1.4 Update & client edits

Name	Geoffrey Lush	Company	Lushfire & Planning
BPAD	Level 2 Practitioner	Accreditation No Expiry	27682 February 2023

Disclaimer

The measures contained in this report do not guarantee that a building will not be damaged in a bushfire. The ultimate level of protection will be dependent upon the design and construction of the dwelling and the level of fire preparedness and maintenance under taken by the landowner. The severity of a bushfire will depend upon the vegetation fuel loadings; the prevailing weather conditions and the implementation of appropriate fire management measures.



Geoffrey Lush
5 May 2022
geoffrey@lushfire.com.au



Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

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Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

1.0 Proposal Details

1.1 Introduction

This bushfire management plan is a strategic hazard assessment prepared for land bounded by Mundijong, King, Leipold and Kargotich Roads, Oldbury. The study area for this bushfire management plan comprises the proposed West Mundijong Urban Precinct and land outside of that precinct, between Gangemi and Kargotich Roads. In total, the study area is 859 hectares in area and is located 3kms west of the Mundijong townsite and 7kms south west of Byford townsite as shown Figure 1. The study area is bounded by Kargotich, Leipold, King and Mundijong Roads.

In order to develop the land for urban purposes it will be necessary to first amend the Metropolitan Region Scheme and the Shire's Local Planning Scheme, followed by further detailed planning through structure planning, subdivision applications, and development applications.

The objectives of this report are to:

- a) Demonstrate how the bushfire hazard level will be managed. This can be by avoiding development in areas with an extreme hazard level, or where unavoidable reducing this to a moderate or low hazard level. This will enable the decision-maker to ensure that appropriate bushfire risk management measures are maintained for the life of the development.
- b) To identify any bushfire management issues and any spatial impact of such issues; which should be considered; in the preparation of any modification to the Local Planning Strategy, Scheme amendment, local structure plan; subdivision and development.
- c) Demonstrate that development will comply with State Planning Policy SPP3.7 Planning in Bushfire Prone Areas; the associated Guidelines and Bushfire Protection Criteria now and/or in subsequent planning stages.

Appendix 5 of the Guidelines for Planning Bushfire Prone Areas contains a checklist for the preparation of Bushfire Management Plans. In relation to the bushfire assessment results it provides the option of either a Bushfire Attack Level (BAL) Contour Map or a Bushfire Hazard Level assessment as shown in Table 1 below. The BAL Contour Map is usually prepared when the subdivision layout is known.

Given the strategic nature of this report and the size of the subject land, the bushfire assessment is in the form of a Bushfire Hazard Level assessment.

Table 1 Bushfire Management Plan Checklist

SECTIONS	Local Planning Strategies	Scheme and Amendments	Structure Plans	Subdivision	Development Approval
3.0	Bushfire assessment results				
3.2	Assessment outputs				
BHL assessment	Yes	Yes	Yes		
		or	or		
BAL contour map		Yes	Yes	Yes	
				or	
BAL assessment				Yes	Yes



LEGEND

- STUDY AREA —
- SUBJECT LAND —

**FIGURE 1
LOCATION**



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



geoffrey@lushfire.com.au
0418 954873

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

1.2 Existing Conditions

The study area for this plan contains twenty-two (22) freehold lots and several reserves. It is rectangular in shape being approximately 4,250m by 2,100m. The proposed West Mundijong Urban Precinct is contained within the study area and comprises the landholdings west of Gangemi Road, to King Road, and north of Mundijong Road, to Leipold Road. The existing conditions are shown in Figure 2 and the cadastral information documented in Table 2.

Within and adjoining the site are several main drains including Manjedal Brook that flows south from the north eastern corner of the site and the along Mundijong Road to King. There are two 132kv transmission lines crossing the site with the eastern line in a formal easement. There is trunk water main crossing the middle of the property within a dedicated service corridor.

The area is currently used for broad acre farming being primarily for cattle grazing and equine establishments. It is characterised by large open paddocks with scattered trees, with dwellings located around the periphery. There are old clay pits on Lot 275 which are being rehabilitated.

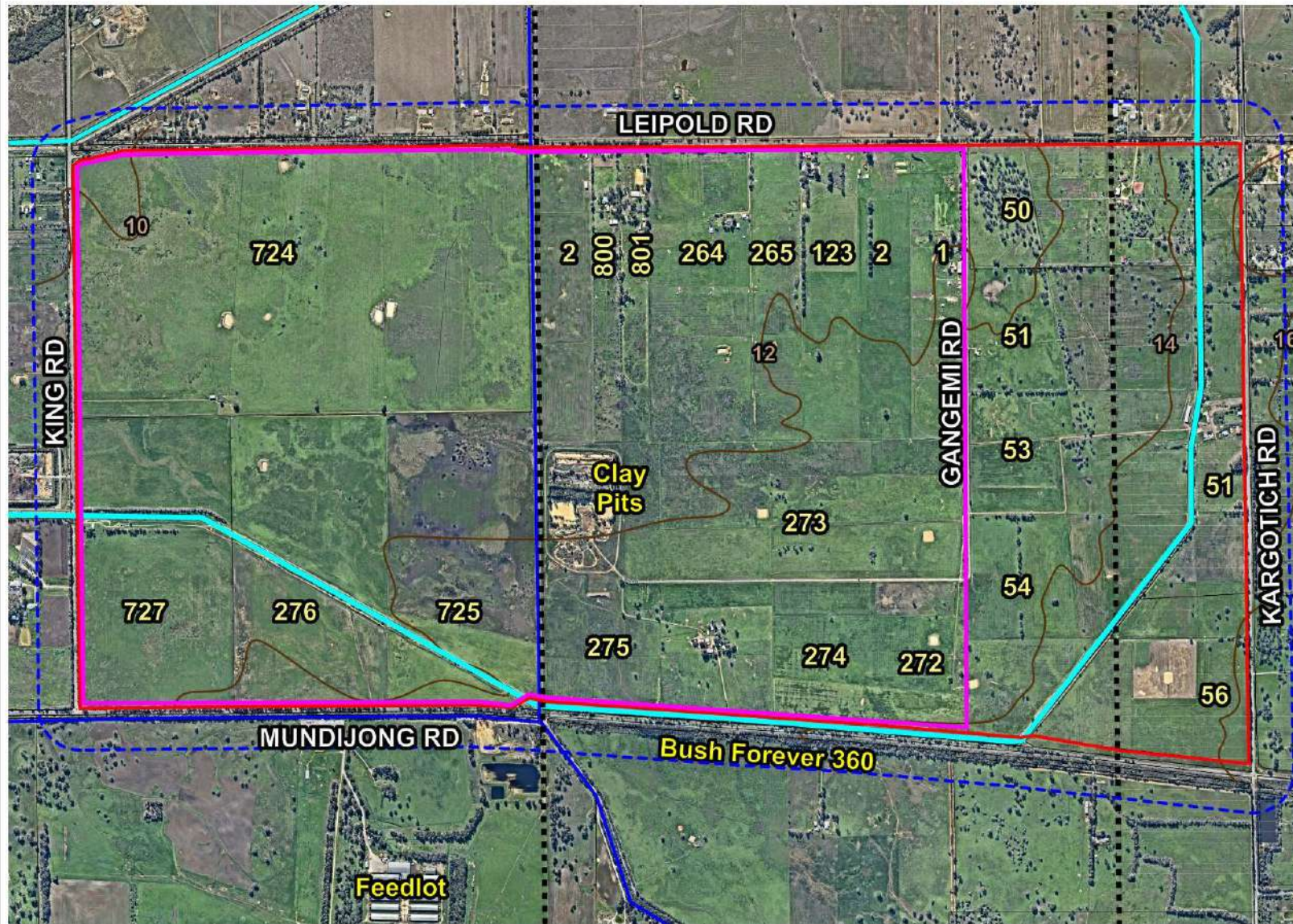
The four roads on the boundaries of the subject land are all sealed with Mundijong Road providing access to the Kwinana Freeway and South Western Highway. Kargotich Road is also a district distributor road extending from Lowlands Road, Mardella to Rowley Road, South Forrestdale. King Road also extends north to Orton Road and Leipold Road is a local sealed road.

There is scattered vegetation on the site and adjacent road reserves typically being Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) and Swamp Sheoak (*Casuarina obesa*). There are some areas of Melaleucas and planted gums for windbreaks and around dwellings and sheds. Bush Forever Site 360 extends along Mundijong Road.

The site has an elevation of between 10m AHD in the north western corner rising to 16m on the eastern boundary. Over the length of the site this is a gradient if less than 1%.

Table 2 Property Details

Number	Lot	Street	Area (ha)
	272	Mundijong Road	31.33
	273	Mundijong Road	13.37
	274	Mundijong Road	44.11
1087	275	Mundijong Road	46.72
	725	Mundijong Road	56.33
	726	Mundijong Road	58.99
771	727	Mundijong Road	58.96
729	724	King Road	158.42
467	2	Leipold Road	21.17
457	800	Leipold Road	10.60
447	801	Leipold Road	10.60
409	264	Leipold Road	46.90
	265	Leipold Road	22.58
389	123	Leipold Road	22.20
365	2	Leipold Road	24.34
331	1	Leipold Road	20.33
267	50	Leipold Road	36.43
	52	Gangemi Road	36.68
	53	Gangemi Road	35.32
	54	Gangemi Road	40.66
1164	51	Kargotich Road	28.56
	56	Kargotich Road	33.99



LEGEND

- STUDY AREA —
- SUBJECT LAND —
- 150m BUFFER - - -
- 2m CONTOURS —
- DRAIN —
- WATER PIPELINE —
- TRANSMISSION LINE - 133kv - - - - -

FIGURE 2
EXISTING CONDITIONS



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/23



geoffrey@lushfire.com.au
0418 954873

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

1.3 Bushfire Prone Land

All of the subject land and the surrounding area are designated as being bushfire prone land as shown in Figure 3. This designation triggers:

- The application of Australian Standard AS3959 Construction of Buildings in Bushfire Prone Areas under the Building Code of Australia;
- The provisions of the Planning and Development (Local Planning Schemes) Regulations 2015; and
- The application of State Planning Policy SPP3.7 Planning in Bushfire Prone Areas.

State Planning Policy SPP3.7 Planning in Bushfire Prone Areas provides in Clause 6.2 that any strategic planning proposal, that has or will, on completion, have a moderate BHL and/or where BAL-12.5 to BAL-29 applies, may be considered for approval where it can be undertaken in accordance with the following policy measures.

- a) the results of a bushfire hazard level assessment determining the applicable hazard level(s) across the subject land, in accordance with the methodology set out in the Guidelines.
- b) the identification of any bushfire hazard issues arising from the assessment; and
- c) clear demonstration that compliance with the bushfire protection criteria in the Guidelines can be achieved in subsequent planning stages.

1.4 Town Planning Framework

The subject land is zoned 'Rural' under the Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 and 'Rural' under the Metropolitan Region Scheme.

The Shire has prepared a new Local Planning Strategy which it adopted at a Special Council Meeting on the 22nd June 2020. The Western Australian Planning Commission endorsed the Draft Strategy, subject to modifications, at its meeting on 29 June 2021. The Shire's Draft Strategy map is shown in Figure 4.

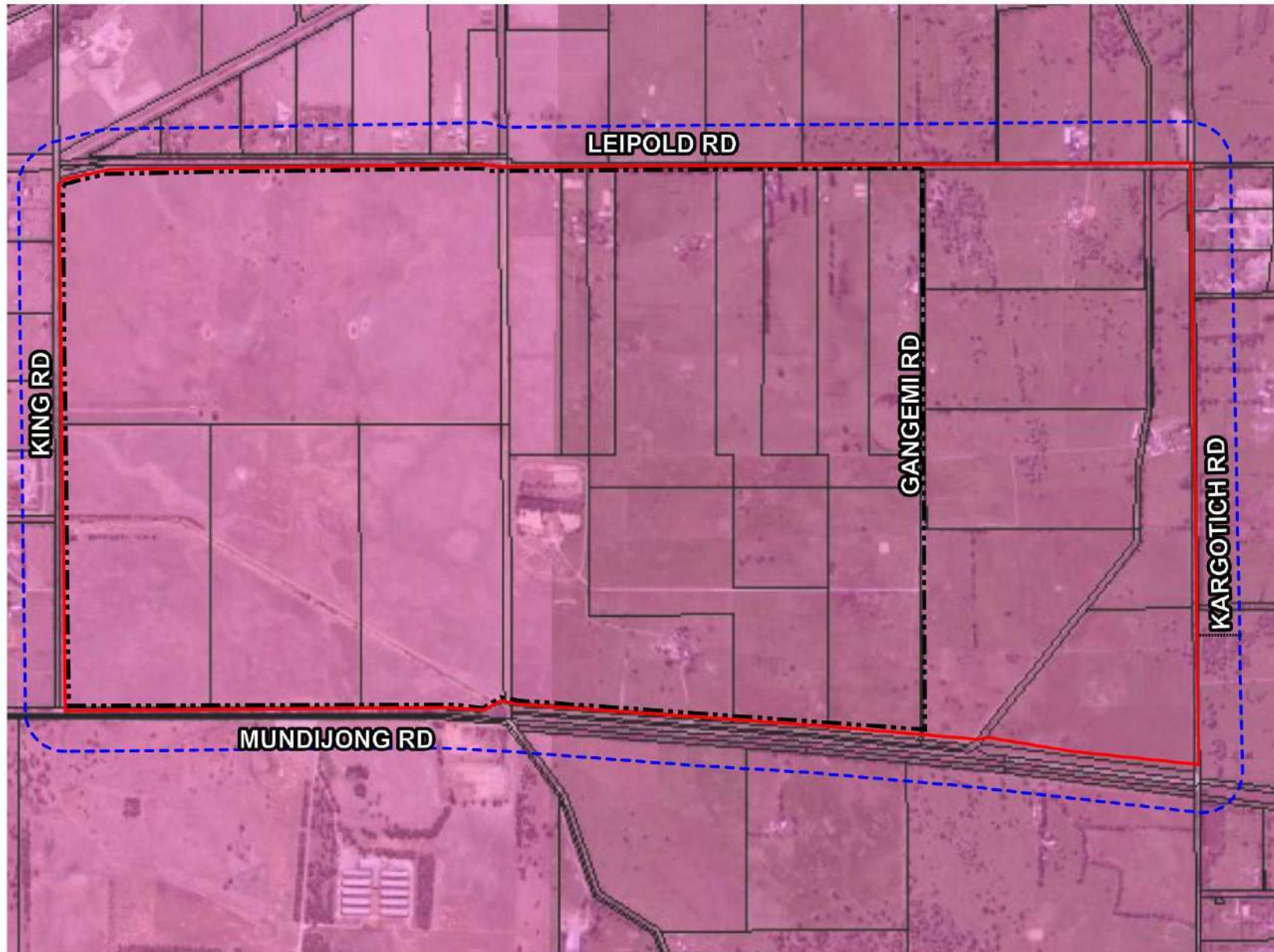
Natural Landscape and Bushfire Risk issues are contained in Section 5.4.1 and the objectives include to:

- Ensure the safety of the community from bushfire risk; and
- Achieve a balance between managing bushfire risk and preserving natural landscapes, the environment and biodiversity values

Table 26: of the Strategy has the following Strategy and Actions

STRATEGY	ACTION
d. Where development is proposed in the vicinity of bushland with regional or local values, there is a presumption that any buildings will be constructed to the appropriate Bushfire Attack Level (BAL).	4. Undertake bushfire hazard assessments as per SPP3.7 at structure planning, subdivision and development stages.
e. Not support the broad-scale clearing of vegetation as a means of addressing bushfire risk.	
f. Ensure future planning and development identified and appropriately manages bushfire risk.	

The land on the eastern side of Kargotich Road is designated in the Local Planning Strategy as 'Industry' and is subject to the West Mundijong Industrial Area – Structure Plan. This plan is shown in Figure 5 and was adopted by the Shire at its Meeting of the 15 March 2021.



LEGEND

- STUDY AREA —
- SUBJECT LAND
- 150m BUFFER
- BUSHFIRE PRONE LAND (2021)

FIGURE 3
BUSHFIRE PRONE LAND



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



geoffrey@lushfire.com.au

0418 954873

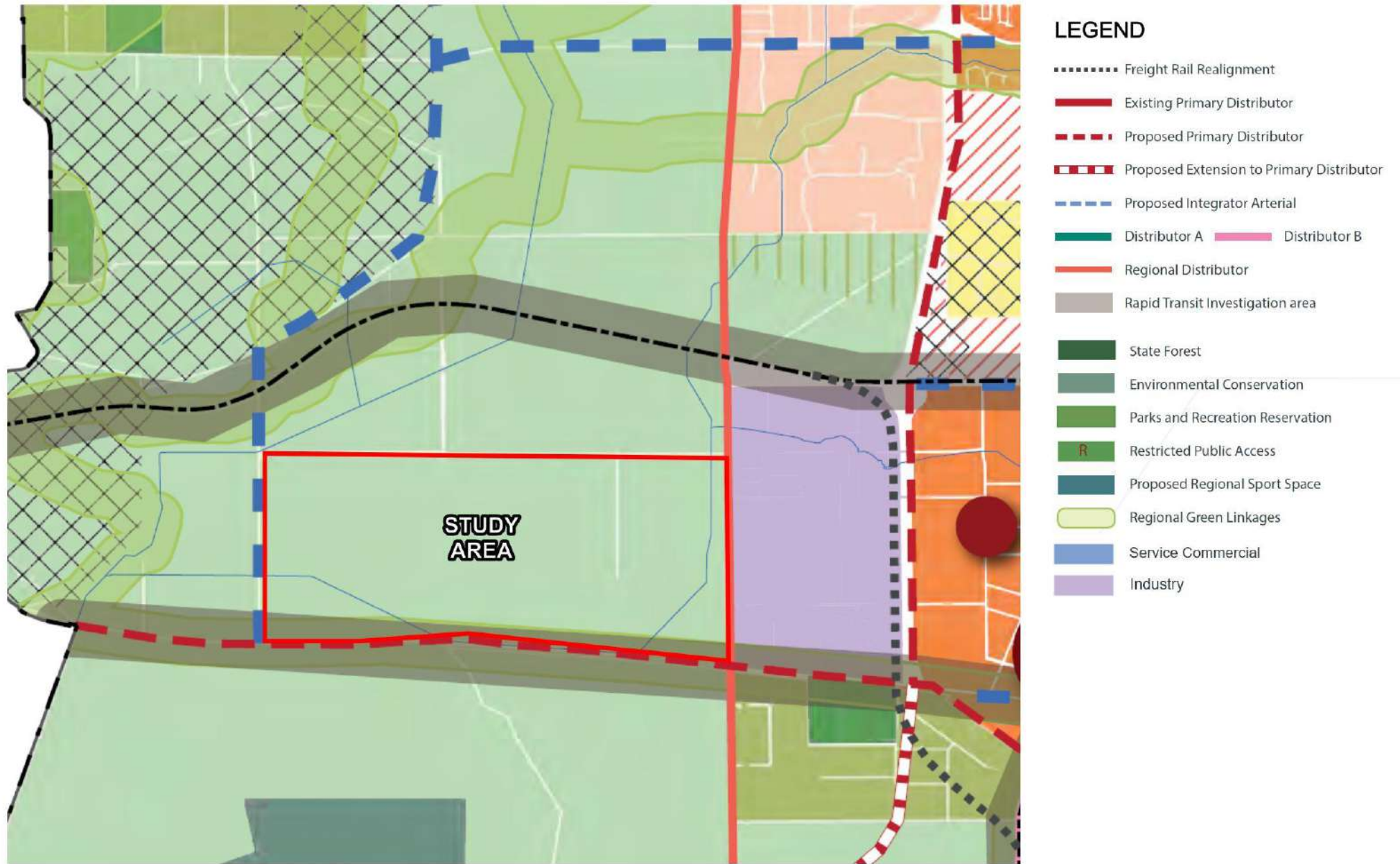


FIGURE 4
ADOPTED PLANNING STRATEGY MAP



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



geoffrey@lushfire.com.au

0418 954873

Ordinary Council Meeting - 11 December 2023



FIGURE 5
WEST MUNDIJONG STRUCTURE PLAN



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
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The key issues from these are:

- a) The classification of both Kargotich and Mundijong Roads which may limit opportunities for creating access into and from the subject land.
- b) Potential ecological linkages extending into the site;
- c) The possible revegetation of the proposed multiple use corridor on the eastern side of Kargotich Road; and
- d) The provision of road access in multiple directions.

1.5 Fire Control Notice

The Shire's 2020 / 2021 Fire Control Notice requires that:

On land greater than 1 acre (4047m²):

- Keep grasses below 150mm or if used for grazing ensure rotation of grazed and un-grazed to prevent large fire run.
- Trim all trees and bushes that overhang driveways, access ways and firebreaks to leave a 4 metre wide clearance and a clear vertical axis.
- Install firebreaks that are:
 - Immediately inside all external boundaries.
 - Immediately surrounding all agricultural buildings, sheds or group of buildings.
 - A minimum of 3 metres wide, but not wider than 5 metres.
- Maintain 20m asset protection zones around dwellings or as per your approved BAL/FMP assessment.
- Trim back all trees overhanging buildings.

On land less than 1 acre (4047m²):

- Cut all grass to less than 25mm in height.
- Trim all trees and bushes that overhang driveways, access ways and firebreaks to leave a 4 metre wide clearance and a clear vertical axis.

OR

- Install firebreaks that are:
 - Immediately inside all external boundaries.
 - Immediately surrounding all agricultural buildings, sheds or group of buildings.
 - A minimum of 3 metres wide, but not wider than 5 metres.
- Maintain 20m asset protection zones around dwellings or as per your approved BAL/FMP assessment.
- Trim back all trees overhanging buildings.

1.6 Proposed Development

In order to develop the land for urban purposes it will be necessary to first amend the Metropolitan Region Scheme and the Shire's Local Planning Scheme, followed by further detailed planning through structure planning, subdivision applications, and development applications.

The western portion of the subject land, being 647 hectares situated west of Gangemi Road comprising would be developed as medium density residential development. This would have an R20 zoning an average lot size of 450m² with associated open space, recreational areas and facilities, and neighbourhood amenities.

The land situated between Gangemi Road and Kargotich Road falls outside the MRS Amendment area for the proposed West Mundijong Urban Precinct. This land has nevertheless been assessed as part of this bushfire management plan because it abuts the subject land and may in future accommodate other uses which are compatible with the 1km buffer to the West Mundijong industrial area.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

2.0 Environmental Considerations

2.1 General

State Planning Policy 3.7 (SPP3.7) policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values. An Environmental Assessment was conducted by Aurora Environmental in 2019 which noted that:

- a) The entire study area is mapped as a Multiple Use wetland with an area of Conservation Category Wetland along Mundijong Road.
- b) There are no intact areas of native vegetation in the study area. The only native vegetation remaining comprises scattered paddock trees of Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) in low-lying areas and Swamp Sheoak (*Casuarina obesa*). Due to on-going low level agricultural uses in the study area, there are no areas of natural regeneration occurring.
- c) The study area does not contain any regionally significant vegetation and there are no Threatened Ecological Communities.
- d) Bush Forever Site 360 (Mundijong and Watkins Roads Bushland, Mundijong/Peel Estate) traverses the southern boundary of the study area.
- e) An environmentally sensitive area (ESA) encroaches into the study area and is attributable to the mapped conservation category wetland, Bush Forever site and TEC in the Mundijong Road reserve.
- f) A notional regional ecological linkage associated with Bush Forever Site 360 extends into the southern portion of the study area along Mundijong Road.
- g) The EPA has indicated that the area mapped as conservation category wetland (Manjedal Brook) be managed and protected by a minimum buffer of 50m.

The environmental features are shown in Figure 6.

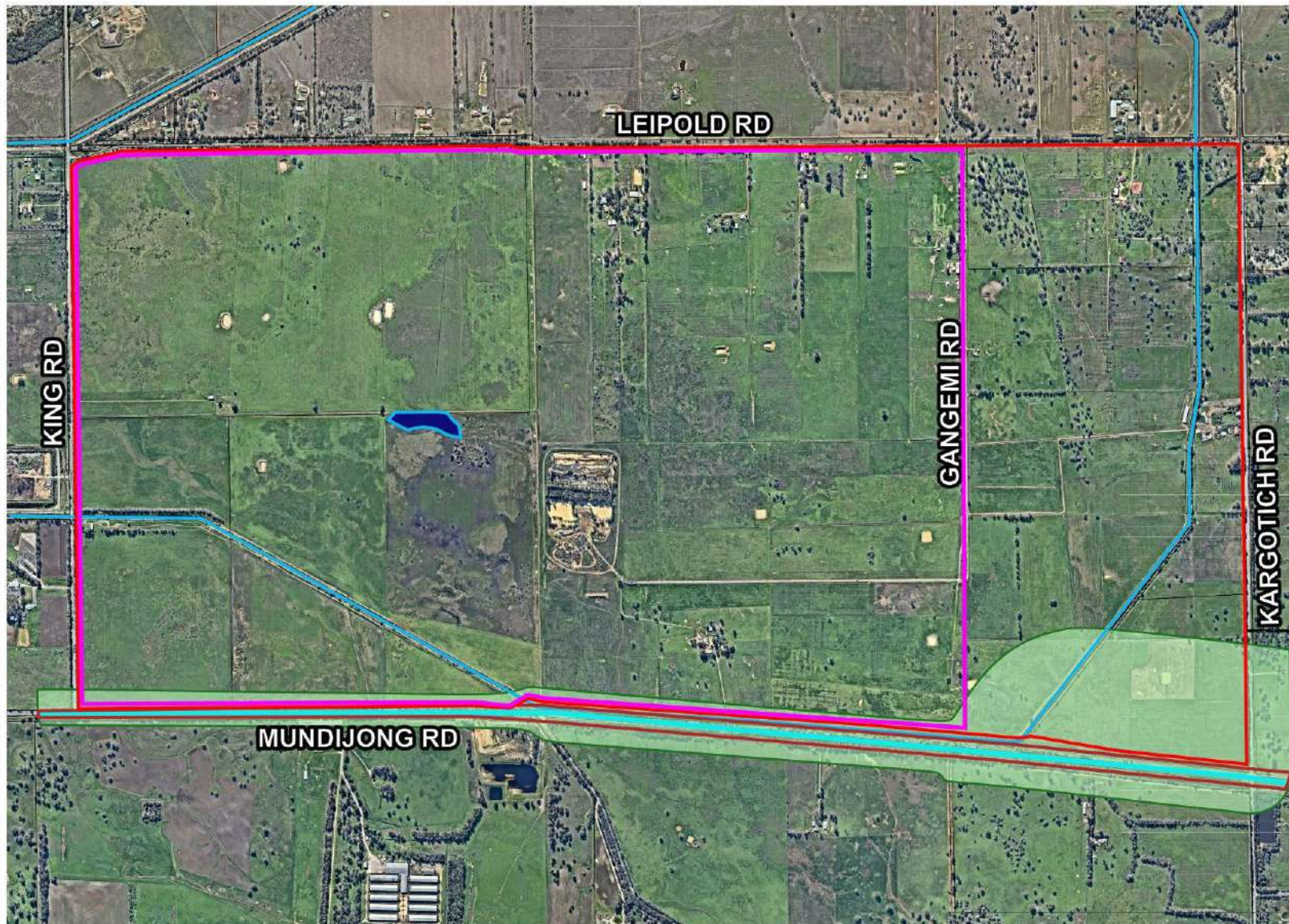
2.2 Clearing, Revegetation and Landscaping

The subject land is already predominantly cleared with only some scattered areas of paddock trees. The proposed development of:

- Medium to high density urban development on the western portion of the site necessitates the clear felling of trees/tree canopy and other flora within the development area for fill placement, drainage, geotechnical and numerous other civil engineering purposes.
- Service commercial/low density residential uses on the eastern portion of the site may allow for some minor tree retention due potentially larger lot sizes.

The potential revegetation areas may include:

- The 50m buffer to the Conservation Category wetland along Mundijong Road;
- The other external road reserves being King, Leipold and Kargotich Roads may have more continuous vegetation;
- The minor ecological linkages extending from the West Mundijong structure plan area;
- The proposed multiple use corridor on the eastern side of Kargotich Road; and
- The existing drainage lines as "living streams." However, depending upon the revegetation specifications these may not become classified vegetation.



LEGEND

- STUDY AREA —
- SUBJECT LAND —
- 105m BUFFER - - -
- ENVIRONMENTALLY SENSITIVE AREA
- BUSH FOREVER SITE 360
- CONSERVATION CATEGORY WETLAND
- DRAINAGE LINE —
- WETLAND (Not separately classified noting that the whole site is classified as a 'multiple use' wetland)

FIGURE 6
ENVIRONMENTAL FEATURES



Ref No 20-050

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3.0 Bushfire Assessment Results

3.1 Assessment Inputs - Vegetation Classification

All vegetation within 150m of the site / proposed development was classified in accordance with:

- Clause 2.2.3 of Australian Standard AS3959 Construction of Buildings in Bushfire Prone Areas;
- The Visual Guide for Bushfire Risk Assessment in Western Australia; and
- Applicable Fire Protection Australia BPAD Practice Notes.

It is noted that AS3959 (2018) commenced operation from the 1st May 2019 and this alters the classification of woodland and scrub. Woodlands are now defined as having a grassy understorey with isolated shrubs while Scrub vegetation (tall heath) has been increased from 4 to 6m height.

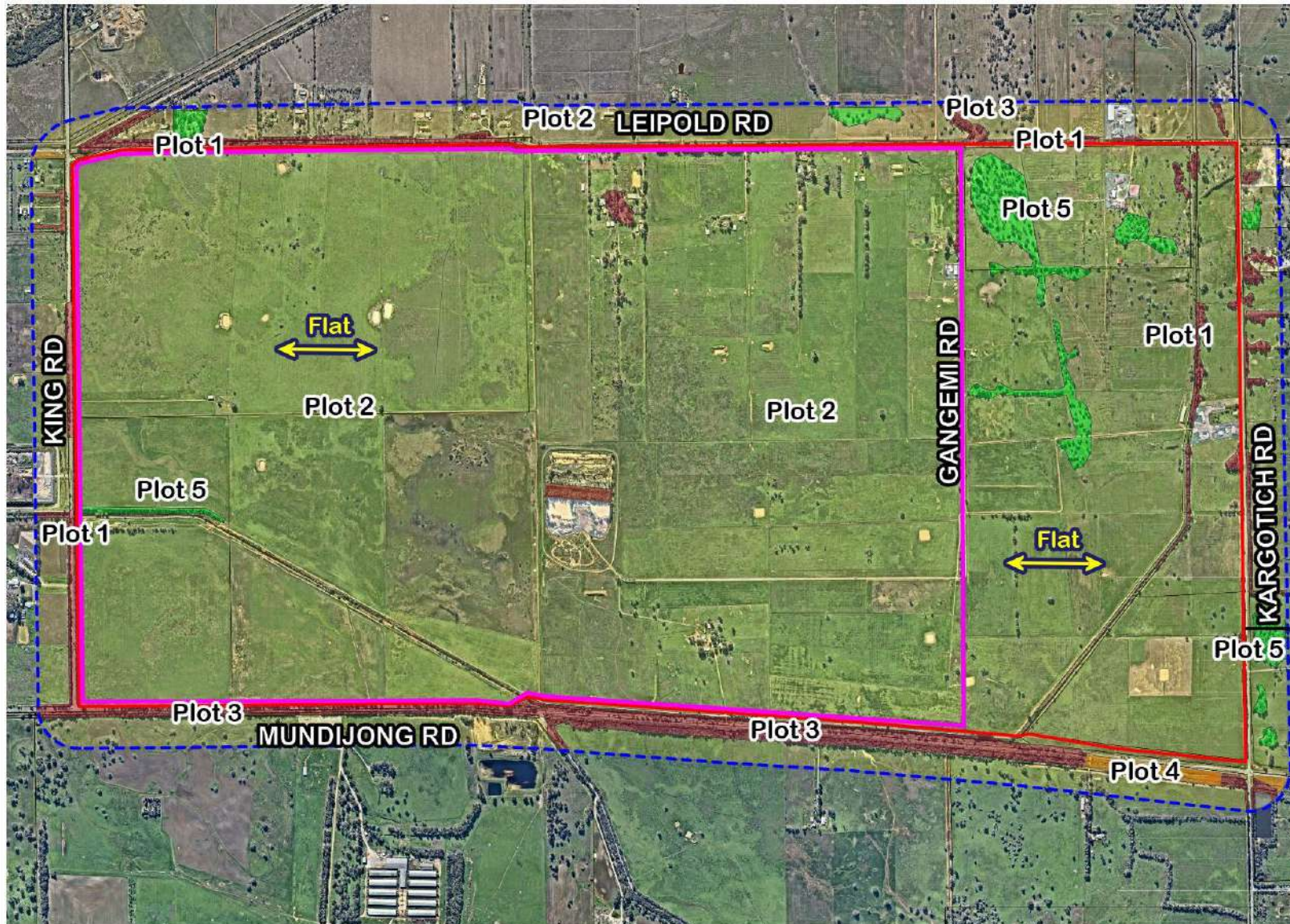
It is also noted that Amendment No 2 to AS3959 proposes the following changes to Table 2.3 Vegetation Classification:

1. In the table header, fourth column delete 'Description' and replace with 'Typical characteristics'.
2. In "A Forest", in the second row, fourth column, delete 'Trees 30 m high' and replace with 'Trees up to 30 m high'; and
3. In "B Woodland", in the fourth column, delete 'Trees 10 m–30 m high' and replace with 'Trees up to 30 m high'.

The vegetation plots are shown in Figure 7 and described in Table 3. The vegetation photographs are shown in Appendix 1. Given the large area of the subject land the vegetation plots have been generalised as referenced in

Table 3 Vegetation Descriptions

Vegetation Plot	Classification	Description
1	Class A Forest	This is primarily linear vegetation along the road verges. Both sides of the road are contiguous as there is often only a 10m separation distance. The total width may be 20m in width but is adjacent to other classified vegetation which is typically grassland. This plot also includes boundary windbreaks which are not a single line of trees and also parts of the drainage lines.
2	Class G Grassland	This is generally pasture within the subject land and the surrounding rural properties which is being used for grazing.
3	Class A Forest	This is more substantial areas of vegetation and in particular the bush forever site along Mundijong Road.
4	Class D Scrub	These area areas of scrub vegetation up- to 6m in height generally associated with the drainage areas and in particular parts of the bush forever site along Mundijong Road.
5	Class B Woodland	The woodland areas are groups of paddock trees which are generally Sheoaks with a grassland understorey that is actively being grazed by stock.



LEGEND

- STUDY AREA ———
- SUBJECT LAND ———
- VEGETATION ASSESSMENT AREA (150m from boundary of the study area) - - - - -
- UPSLOPE →
- VEGETATION CLASSIFICATION
- CLASS A FOREST ■
- CLASS B WOODLAND ■
- CLASS D SCRUB ■
- CLASS G GRASSLAND ■
- EXCLUDED 2.2.3.2(f) ■

Note

While there may be local variations, the slope across the total site is less than 1% and so is considered to be flat.

Location: Mundijong, King, Leipold, Kargotich Roads
 Details: Assessment Date: 16/09/2020
 Prepared by: G Lush
 Accreditation Level: Level 2
 Accreditation Number: BPAD 27682
 Accreditation Expiry Date: February 2023
 Date of Aerial Photo: May 2020

**FIGURE 7
VEGETATION CLASSIFICATIONS**



Ref No 20-050

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3.2 Assessment Outputs - Bushfire Hazard Level

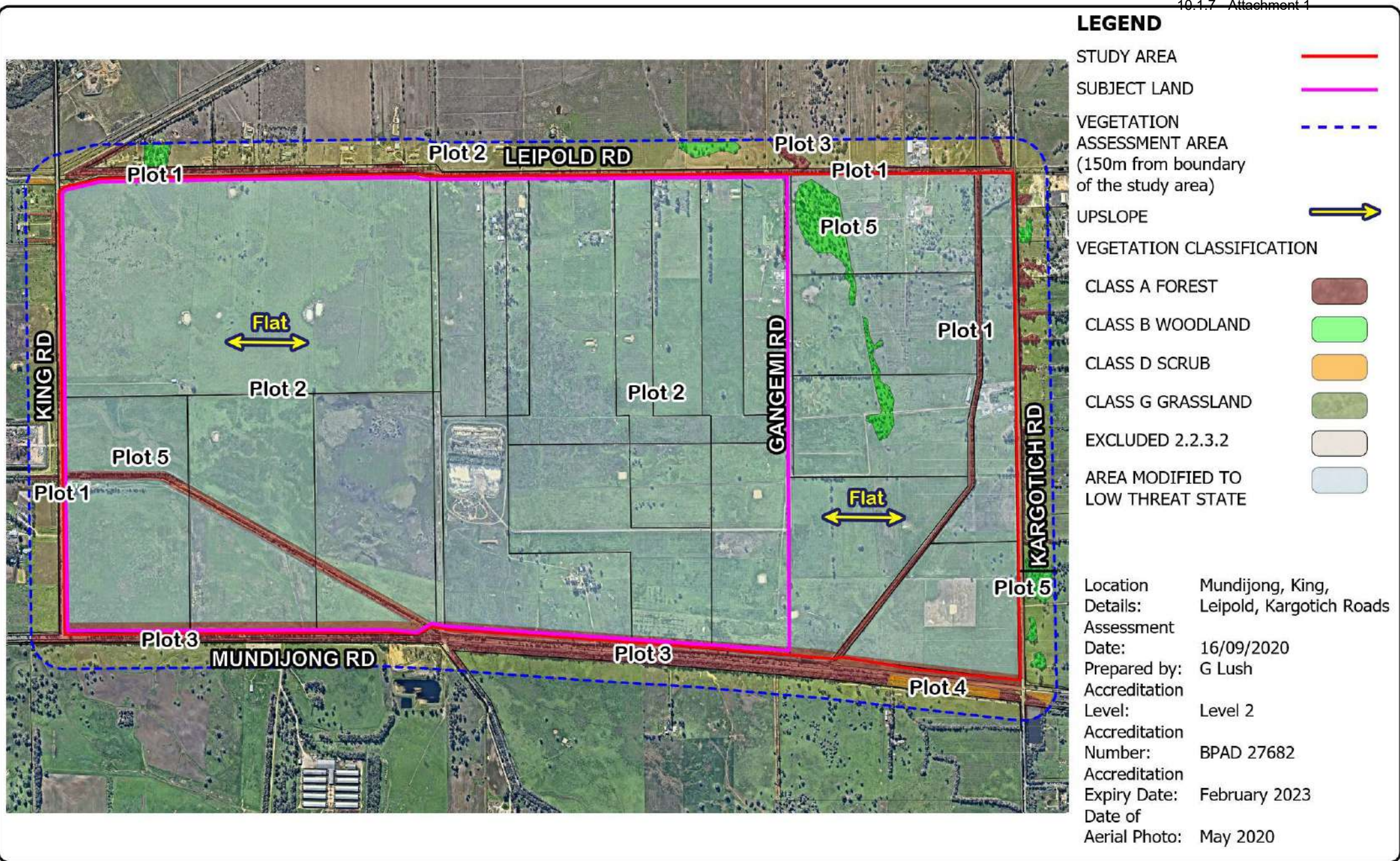
The bushfire hazard primarily relates to the vegetation on the site, the type and extent (area) of vegetation and its characteristics. The methodology for determining the bushfire hazard level is contained in the Guidelines for Planning in Bushfire Prone Areas (Section 4.1 and Appendix 2).

The classifications are as follows:

Extreme Hazard	<ul style="list-style-type: none"> • Class A Forest • Class B Woodland (05) • Class D Scrub • Any classified vegetation with a greater than 10 degree slope
Moderate Hazard	<ul style="list-style-type: none"> • Class B Open Woodland (06), Low Woodland (07) Low Open Woodland (08) Open Shrubland (09) * • Class C Shrubland • Class E Mallee/Mulga • Class G Grassland including sown pasture and crops • Vegetation that has a low hazard level but is within 100 metres of vegetation of vegetation classified as a moderate or extreme hazard.
Low Hazard	<ul style="list-style-type: none"> • Low threat vegetation, may include the following: areas of maintained lawns, golf courses, public recreation reserves and parklands, vineyards, orchards; cultivated gardens, commercial nurseries, nature strips and windbreaks. • Managed grassland in a minimal fuel condition meaning that there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short cropped grass to a nominal height of 100mm. • Non vegetated areas including waterways; roads; footpaths; buildings or rock outcrops.

The modified vegetation classifications shown in Figure 8 and are based upon the assumptions in Section 2.2 regarding clearing and revegetation. The bushfire hazard assessment levels are shown in Figure 9.

Most of the subject land is expected to have a low bushfire hazard level when developed. Depending upon the revisions to the bushfire prone mapping the land which is shown as having a low bushfire hazard level, may not be designated as being bushfire prone. Consequently, subdivision and development of that area would not be subject to State Planning Policy SPP3.7 Planning in Bushfire Prone Areas or the Bushfire Protection Criteria.



**FIGURE 8
MODIFIED VEGETATION**



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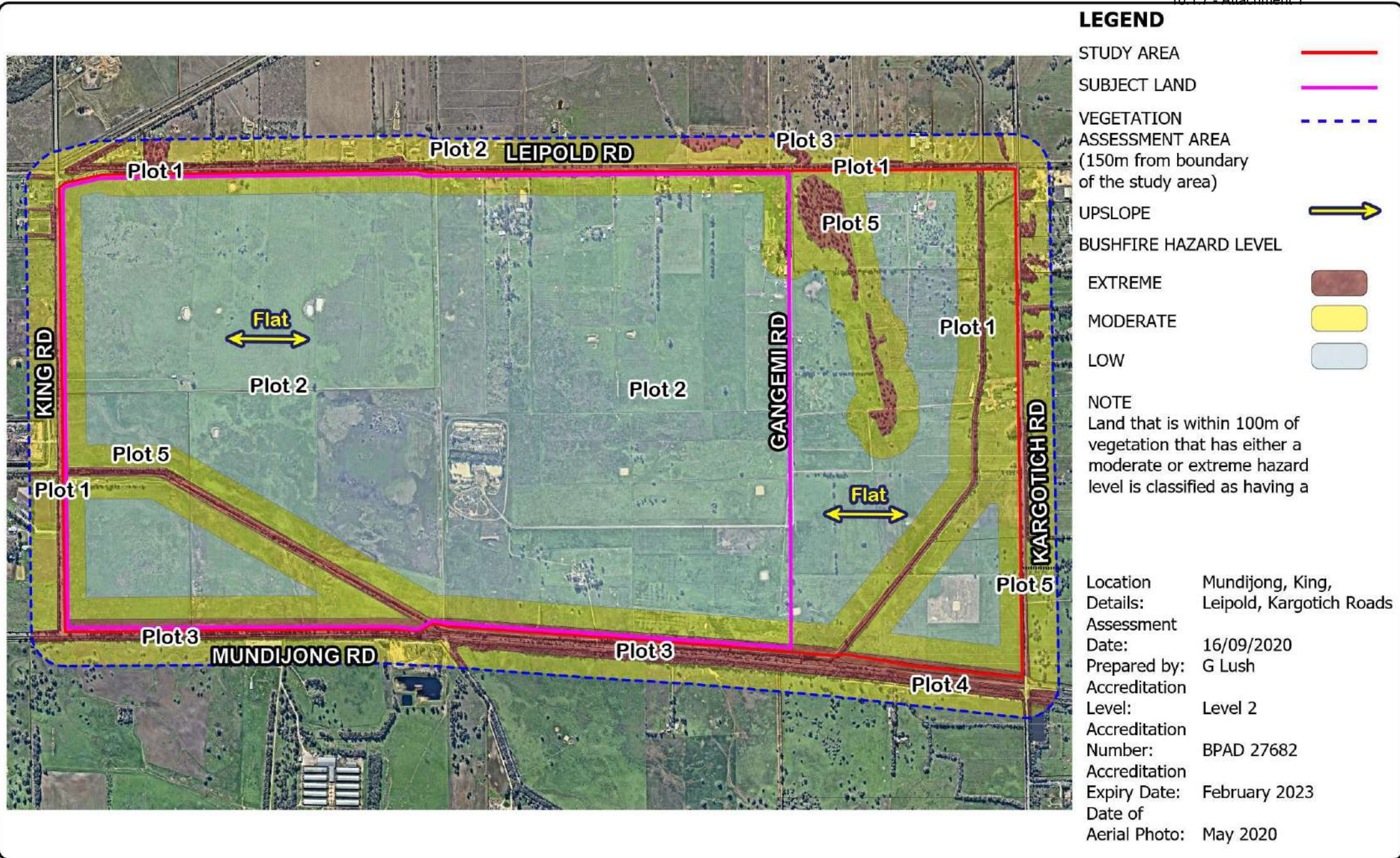


FIGURE 9
BUSHFIRE HAZARD LEVEL



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4.0 Identification of Bushfire Hazard Issues

4.1 District Context

The relationship of the subject land to the surrounding district is shown in Figure 1. The proposed development is introducing substantial values (property and people) which must be protected from the risk posed by the potential bushfire hazard. Bushfires occur regularly within the locality and pose a threat to life and property.

A bushfire can have a number of ignition sources which can originate from either natural or human causes such as:

- Lighting strikes;
- Unattended camp fire;
- Discarded match or cigarette;
- Dry grass in contact with vehicle exhausts;
- Sparks from grinders, slashing or other mechanical operations;
- Backyard rubbish burning;
- Hazard reduction burns;
- Powerlines sparking in strong winds or falling;
- Pole top fires; and
- Deliberate arson.

The surrounding land is a mixture of urban, rural residential, and rural land uses. The rural land uses are typically large properties used for broad acre grazing. The surrounding land is predominantly grassland with dispersed bushland which is both in blocks and also linear bushland along road reserves.

The most significant area of bushland within the locality is situated approximately 2.5kms south west of the site and this is approximately 900 hectares.

The primary bushfire hazard is from a fast moving grass fire which can still have the potential to be a destructive fire threatening life and property. The likelihood of this occurring increases when there is a high chance of ignition due to the amount of fuel, the extent of vegetation curing (drying out) the temperature; relative humidity and wind speed.

The main bushfire threat would be a fire from the south or south west which has the potential to be large scale "landscape" fire which extends for over a kilometre and is likely to occur over lengthy period which could be several days.

There is excellent district access to the subject land from multiple directions on district distributor roads.

4.2 Site Issues

At the local level within the subject land the major bushfire management issue is the interface with the existing and proposed bushland areas. The most significant of these is the proposed 50m wide revegetation buffer adjacent to Mundijong Road conservation category wetland, Bush Forever Site.

Ensuring that the development is able to have multiple access connections to the surrounding roads is also critical. This also includes crossings of the existing drains especially in the south western and south eastern corners of the site.

The most efficient and cost effective fire management measure is to separate development from hazard areas. The greater the separation distance the lower the hazard or BAL rating for the development. This principle is reflected in the SPP 3.7 and the Guidelines by seeking:

- To locate development in areas with either a low or moderate hazard level rating; and/or

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- To ensure that a maximum BAL-29 rating is applied to any development.

The anticipated bushfire hazard levels for the completed development are shown in Figure 9.

The areas within the site with an extreme hazard level rating are Plot 5 (Woodland) and the potential revegetated drainage lines. These have a combined area of approximately 35 hectares which is 4% of the total site.

The largest area within the site with an extreme hazard rating is Plot 5 located between Gangemi and Kargotich Roads. This has an area of approximately 9 hectares which is 1% of the total site. This contains scattered Sheoaks in paddocks to 15m height with less than 30% foliage coverage over grassland. While a 'woodland' is still classified as having an extreme hazard rating, it is easier to manage and incorporate into development than a forest with dense understorey vegetation. As Plot 5 has been actively grazed the vegetation already has had its lower limbs removed (under pruned) as shown in Photos 22, and 37, the hazard has been further reduced in a similar manner to that promoted in the specifications for an asset protection zone.

The extent to which development can occur within or adjacent to the woodland area (Plot 5) would depend upon the detailed subdivision and development design.

This illustrates that the majority of the subject is expected to have a Low Hazard rating with a Moderate Hazard rating.

4.3 High Risk Land Uses

High risk land uses are those uses which may lead to the potential ignition, prolonged duration and/or increased intensity of a bushfire. Such uses may also expose the community, fire fighters and the surrounding environment to dangerous, uncontrolled substances during a bushfire event. Examples of high risk land uses include service stations, landfill sites, bulk storage of hazardous materials, fuel depots.

Depending upon the specific land use provisions, it may be possible that high risk land uses are permissible within the service commercial area.

SPP 3.7 requires that a development application for any high risk land use is to be accompanied by a Bushfire Management Plan jointly endorsed by the local government and the Department of Fire and Emergency Services. This may include a risk management plan that addresses bushfire risk management measures for any flammable on-site hazards.

These provisions only apply when the development site is designated as being bushfire prone and has a rating of between BAL-12.5 and BAL-29.

4.4 Vulnerable Land Uses

Vulnerable land uses are uses where it is considered that occupants have a lesser capacity to respond in the event of a bushfire, and which may present evacuation challenges. These are generally associated with hospitals, nursing homes and retirement villages. However, they also include any form of tourist accommodation, places of assembly, family day care centres, schools etc.

It is expected that the residential components of the development may include various vulnerable land uses.

SPP 3.7 requires that a development application for a vulnerable land use is to be accompanied by a Bushfire Management Plan jointly endorsed by the local government and the Department of Fire and Emergency Services. This is also to have a Bushfire Emergency Evacuation Plan prepared for the proposal.

These provisions only apply when the development site is designated as being bushfire prone and has a rating of between BAL-12.5 and BAL-29.

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5.0 Assessment Against the Bushfire Protection Criteria

5.1 Compliance Table

A summary of the compliance with the Bushfire Protection Criteria as contained in Version 1.4 (Dec 2021) of the Guidelines for Planning in Bushfire Prone Areas is documented in Table 4. This demonstrates how the Criteria are expected to be complied with at the various planning stages being:

- The amendment to the Local Planning Scheme;
- A subdivision application; and
- A development application.

Version 1.4 of the Guidelines applies the Acceptable Solutions based upon the following planning stages:

- SP** – Strategic planning proposal and structure plan where the lot layout is not known
- Sb** – Structure plan where the lot layout is known and subdivision application
- Dd** – Development application for a single dwelling, ancillary dwelling or minor development
- Do** – Development application for any other development

Table 4 demonstrates how the Criteria are expected to be complied with at the various planning stages being:

- The South Metropolitan Peel Sub-Regional Planning Framework (SMPPRF);
- The amendment to the Metropolitan Region Scheme;
- The amendment to the Local Planning Scheme;
- The preparation of the District Structure Plan;
- A subdivision application; and
- A development application.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

Table 4 BPC Compliance

Development Stage Requirement	Metropolitan Region Scheme Amendment	Local Planning Scheme Amendment	Structure Plan	Subdivision Application	Development Application
Element 1 Location					
A1.1 Development Location	The majority of the land (95%) is expected to have a moderate or low hazard level when developed. Development can easily achieve a BAL-29 rating.	Can include additional setback requirements to restrict buildings from being located in areas with a BAL-40 or BAL-FZ rating.	Can require the subdivision design to be based upon BAL-12.5 setbacks for new development. A bushfire management plan would be prepared to support the structure plan.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim measures.	Approval of any development application is to have regard to SPP 3.7 and the Guidelines and can control the siting of development.
Element 2 Siting and Design					
A2.1 Asset Protection zone	Can be provided in accordance with a BAL-29 setback. The APZ can potentially be increased to accord with design objective for a lower BAL rating.	Can stipulate as a condition of development that it be setback in accordance with a BAL-29 rating.	Can consider the inclusion of the APZ within each lot or incorporation of other land such as a road reserve.	Would be in accordance with the structure plan and bushfire management plan.	Approval of any development application is to have regard to SPP 3.7 and the Guidelines and can control the siting of development in accordance with an approved bushfire management plan.
Element 3 Vehicular Access					
A3.1 Public Road	Is not applicable.	Is not applicable.	The road design is expected to comply with design requirements.	The road design is to comply with design requirements. Interim access for staging to be provided by public road connections.	Is not applicable.
A3.2a Multiple access routes (SP Sb Do)	The site has multiple access routes at both the district and local level.	The site has multiple access routes at both the district and local level.	At both the district and local level the area has multiple external access routes. Internal access routes to be provided connecting to the external road network.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim access measures.	Approval of any development application is to have regard to access under an approved bushfire management plan
A3.2b Emergency access way (SP Sb Do)	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan.	Is not applicable.

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Development Stage Design Requirement	Metropolitan Region Scheme Amendment	Local Planning Scheme Amendment	Structure Plan	Subdivision Application	Development Application
				Any staging would require interim access measures.	
A3.3 Through-roads (SP Sb)	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.
A3.4a Perimeter roads (SP Sb)	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan.	Is not applicable.
A3.4b Fire service access route (SP Sb)	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim access measures.	Is not applicable.
A3.5 Battle-axe access legs (Sb)	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.
A3.6 Private driveways (Dd Do)	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.	It may apply to low density lots in the eastern portion of the site.
A3.7 Fire Service Access Route	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim access measures.	Is not applicable.
Element 4 Water					
A4.1 Identification of future water supply (SP)	A reticulated water supply will be required.	A reticulated water supply will be required.	Can consider if any additional hydrants are required.	A reticulated water supply will be required.	Building permit application will assess water supply for structural fire fighting.
A4.2 Provision of water for firefighting purposes Sb Dd Do	A reticulated water supply will be required.	A reticulated water supply will be required.	Can consider if any additional hydrants are required.	A reticulated water supply will be required.	Building permit application will assess water supply for structural fire fighting.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

Development Stage Design Requirement	Metropolitan Region Scheme Amendment	Local Planning Scheme Amendment	Structure Plan	Subdivision Application	Development Application
High Risk Land Uses					
Proposed high risk land uses need special consideration.	The subject land is potentially suitable for minor high risk uses normally associated with urban development, such as service stations. Major uses are likely to be located in the West Mundijong Industrial Area.	Can be controlled through zoning and development provisions.	Can be controlled through the provisions of any structure plan.	Is not applicable.	Can require a BMP and risk evaluation plan.
Vulnerable Land Uses					
Proposed vulnerable land uses need special consideration.	The subject land is potentially suitable for vulnerable land uses.	Can be controlled through zoning and development provisions.	Can be controlled through the provisions of any structure plan.	Is not applicable.	Can require a BMP and risk evacuation plan.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

6.0 Conclusion

This report demonstrates and/or identifies:

- a) The existing hazard level is generally moderate due to the existing grassland;
- b) The hazard level on the subject land will be reduced and permanently altered by the site being developed.
- c) The developed site is expected to generally have a low hazard level.
- d) Areas most suitable for land use intensification where the bushfire hazard is low or moderate upon completion.
- e) Conservation areas including threatened ecological communities (TECs), Bush Forever, nature reserves, and wetlands that may constrain the clearing of vegetation to manage or reduce the BAL rating.
- f) The Bushfire Protection Criteria in the Guidelines can be achieved now or in subsequent planning stages.

The proposal complies with the objectives of State Planning Policy 3.7 as:

1. It avoids any increase in the threat of bushfire to people, property and infrastructure.

The proposed development is likely to reduce the existing bushfire hazard within the site as the majority of the land will have a low hazard level and may no longer be classified as being bushfire prone land.

2. It reduces vulnerability to bushfire through the identification and consideration of bushfire risks in the design of the development and the decision-making process.

The bushfire hazard and risks have been identified and assessed in this report.

3. The design of the subdivision and the development takes into account bushfire protection requirements and includes specific bushfire protection measures.

The proposed development will be able to comply with the Bushfire Protection Criteria.

4. Achieves an appropriate balance between bushfire risk management measures and biodiversity, conservation values, and environmental protection.

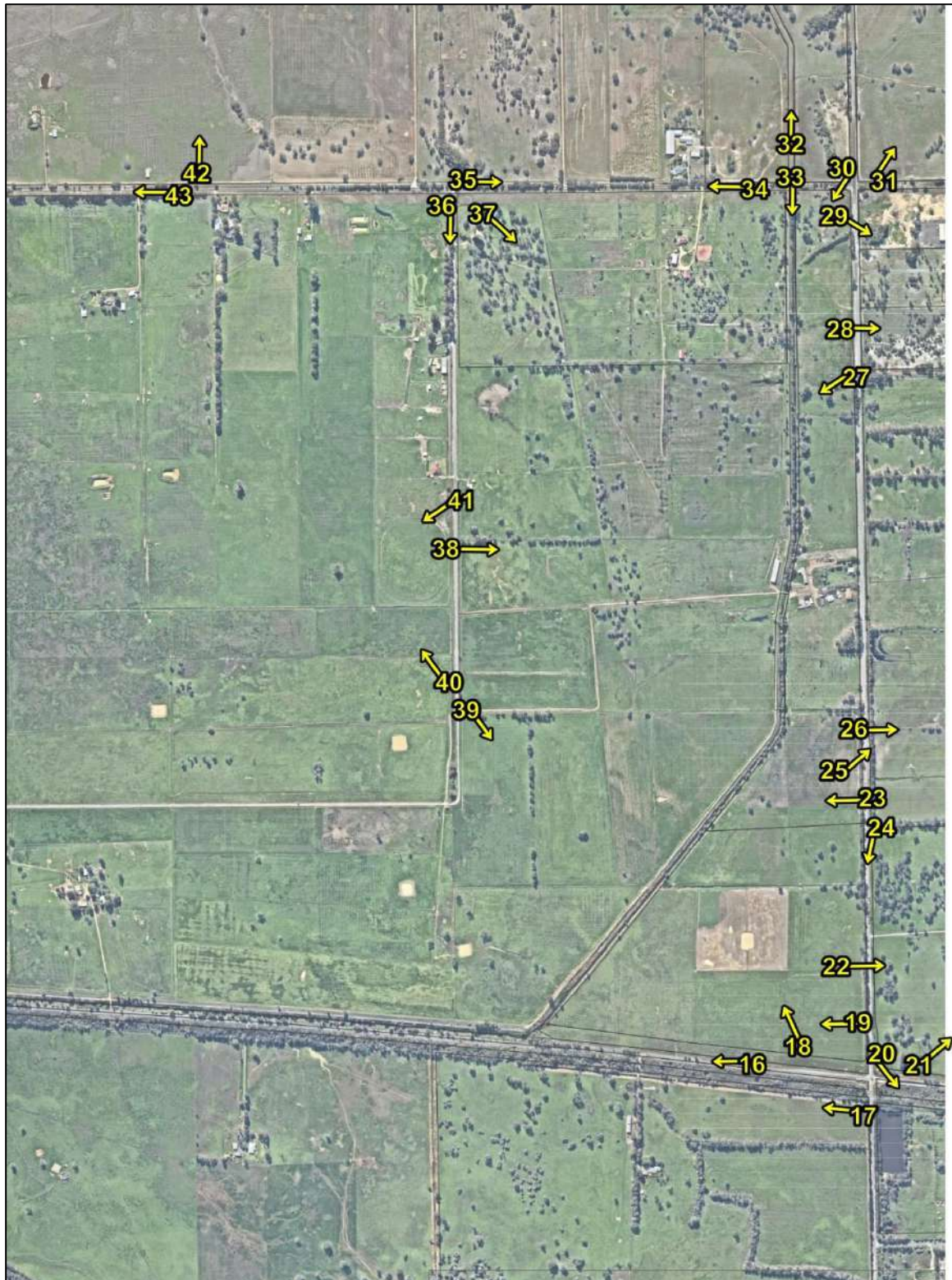
The scattered vegetation on the site which is to be cleared for any development does not have any significant conservation value. The proposed conservation buffers to the wetlands will be incorporated into any subsequent bushfire assessment and management plan.

Appendix 1 - Vegetation Photographs



Photograph Locations Sheet 1

Appendix 1 - Vegetation Photographs



Photograph Locations Sheet 2

Appendix 1 - Vegetation Photographs

Photo 1 Plot 2

Vegetation Classification

Class G Grassland – Tussock
grassland G-22

Description

Grassland along Water
Corporation drain



Photo 2 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing pasture areas within the
subject land.



Photo 3 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing pasture areas within the
subject land.



Appendix 1 - Vegetation Photographs

Photo 4 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 5 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Discontinuous linear forest along main drain. Variable height to 18m, Eucalypts and Sheoaks with shrub or grassland understorey.



Photo 6 Plot 5

Vegetation Classification

Class B Woodland - Woodland B-05

Description

Discontinuous linear vegetation along main drain. Variable height to 10m, with grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 7 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main King Road. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The road reserve is 20m wide and so the trees on either side are considered to be contiguous.



Photo 8 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Photo 9 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Appendix 1 - Vegetation Photographs

Photo 10 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Photo 11 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Photo 12 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Appendix 1 - Vegetation Photographs

Photo 13 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Photo 14 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Lightbody Road. Eucalypts to 18m, with Sheoaks more than 30% foliage coverage and shrub or grassland understorey. The road reserve is 20m wide and so the trees on either side are considered to be contiguous.



Photo 15 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land. Photo shows water main pipeline and transmission line.



Appendix 1 - Vegetation Photographs

Photo 16 Plot 4

Vegetation Classification

Class D Scrub - Closed scrub D-13

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. This section contains scrub being a mixture of Wattles and Sheoaks with dense understorey vegetation.



Photo 17 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land. Plot 4 vegetation on the right hand side.



Photo 18 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 19 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Photo 20 Plot 4

Vegetation Classification

Class D Scrub - Closed scrub D-13

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. This section contains scrub being a mixture of Wattles and Sheoaks with dense understorey vegetation.



Photo 21 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Appendix 1 - Vegetation Photographs

Photo 22 Plot 5

Vegetation Classification

Class B Woodland - Woodland B-05

Description

Scattered Sheoaks in paddocks to 15m with less than 30% foliage coverage over grassland.



Photo 23 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Photo 24 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Kargotich Road but not always on both sides of the road. Eucalypts and Sheoaks to 18m, with more than 30% foliage coverage and shrub or grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 24 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Kargotich Road but not always on both sides of the road. Eucalypts and Sheoaks to 18m, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 26 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 27 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 28

Plot 2

Vegetation Classification

Class G Grassland – Tussock grassland G-22

Description

Unmanaged grassland area to 0.5m height.



Photo 29

Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Eucalypts to 22m, with more than 30% foliage coverage and Melaleuca scrub on the eastern side of Kargotich Road.



Photo 30

Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 31 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 32 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 33 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Discontinuous linear forest along drain. Variable height to 15m, Eucalypts and Sheoaks with shrub or grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 34 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, Sheoaks or Melaleucas, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 35 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, Sheoaks or Melaleucas, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 36 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Gangemi Road but not always on both sides of the road. Eucalypts and Sheoaks to 18m, with more than 30% foliage coverage and shrub or grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 37 Plot 5

Vegetation Classification

Class B Woodland - Woodland B-05

Description

Scattered Sheoaks in paddocks to 15m with less than 30% foliage coverage over grassland.



Photo 38 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land. Windbreak on the left is classified as it is not a single line of trees.



Photo 39 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 40 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing pasture areas within the
subject land.



Photo 41 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing pasture areas within the
subject land.



Photo 42 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing areas on surrounding
land.



Appendix 1 - Vegetation Photographs

Photo 43 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, Sheoaks or Melaleucas, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 44 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land. Transmission line and drain also shown.



Photo 45 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Appendix 1 - Vegetation Photographs

Photo 46 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, and Sheoaks with more than 30% foliage coverage and shrub or grassland understorey.



Photo 47 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, and Sheoaks with more than 30% foliage coverage and shrub or grassland understorey.



Photo 48 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 3.1

Dynamic Planning and Developments Submission – Draft Local Planning Strategy and Local Planning Scheme No. 3 (6 December 2019)



Formal Submission to Advertising for

The Shire of Serpentine Jarrahdale

❖ *Local Planning Strategy, and*

❖ *Local Planning Scheme No. 3*

Proposed Increase to the Mundijong Urban Land Allocation



Prepared for
 WPG Landholdings Pty Ltd
 WPG Landholdings No 3 Pty Ltd
 C/O Watson Project Management Group Pty Ltd
 PO Box 934
 Balcatta WA 6914

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EXECUTIVE SUMMARY

This document represents a formal submission to the advertising of the Shire of Serpentine Jarrahdale proposed *Local Planning Strategy* and *Local Planning Scheme No 3*.

SJ2050 and the Shire's *Local Planning Strategy* identify that the *Mundijong District Structure Plan* urban area will need to accommodate a population of approximately 50,000 people, requiring in excess of 17,000 dwellings by 2050 to meet the Shire's long term growth targets.

A detailed review of the proposed *Local Planning Strategy* and the interrelated draft *Mundijong District Structure Plan* has identified that the land area allocated for urban purposes in the Mundijong townsite is not adequate to cater for the forecast population growth. The primary reasons identified for the shortfall are:

1. The draft *Mundijong District Structure Plan* utilises a zoning of R25 with an average lot size of 350m² to calculate the potential lot yields across the Mundijong townsite area. An average 350m² lot size is not appropriate nor adequate for a semi-rural outer metropolitan area such as Mundijong and will not be accepted by the market which ultimately is the primary driver of the product;
2. Excluding approved Local Structure Plans, the *Mundijong District Structure Plan* identifies eight proposed/potential urban precincts. The identified precincts contain numerous constraints which will significantly impact the ultimate yields achievable. In addition, two of the eight urban precincts are designated only as *Development Investigation Areas* and the development potential for these is therefore unknown.

To ensure adequate urban zoned land is provided for the future growth of the Mundijong town site and its surrounds this submission proposes an additional urban land precinct is added to the Shire of Serpentine Jarrahdale *Local Planning Strategy* and the interconnected *Mundijong District Structure Plan*.

The following document explores the above issues and proposal in detail and discusses the town planning processes required to facilitate the additional urban precinct.

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Glossary of Abbreviations

Shire of Serpentine Jarrahdale:	SSJ
WPG Landholdings Pty Ltd & WPG Landholdings No 3 Pty Ltd:	WPG
Watson Project Management Group:	WPMG
Dynamic Planning & Developments:	DPD
Shire of Serpentine Jarrahdale Draft Local Planning Strategy July 2019:	LPST
Shire of Serpentine Jarrahdale Draft Local Planning Scheme No. 3 September 2019:	LPSC
Shire of Serpentine Jarrahdale Draft Mundijong District Structure Plan:	MDSP
Metropolitan Region Scheme:	MRS
South Metropolitan Peel Sub-regional Planning Framework:	PPF
Development Investigation Area:	DIA
Approximately	~

1.0 INTRODUCTION

Dynamic Planning and Developments Pty Ltd (DPD) acts on behalf of WPG Landholdings Pty Ltd and WPG Landholdings No 3 Pty Ltd (WPG) being the registered proprietors of Lots 272, 273 and 274 Mundijong Road, Oldbury.

Lots 272, 273 and 274 and the surrounding landholdings bound by Mundijong, King, Leipold and Kargotich Roads (Figure 1 – The Subject Site) are currently designated Rural under the *South Metropolitan Sub-regional Planning Framework (PPF)* and the *Metropolitan Region Scheme (MRS)*, and at a local level under the *Shire of Serpentine Jarrahdale Draft Local Planning Strategy July 2019 (LPST)*, *Draft Local Planning Scheme No. 3 September 2019 (LPSC)*, and the *Draft Mundijong District Structure Plan December 2018 (MDSP)*.

This submission proposes that the Subject Site be included in the *Shire of Serpentine Jarrahdale LPST* and by extension the interrelated *MDSP* as Urban to facilitate future urban development.

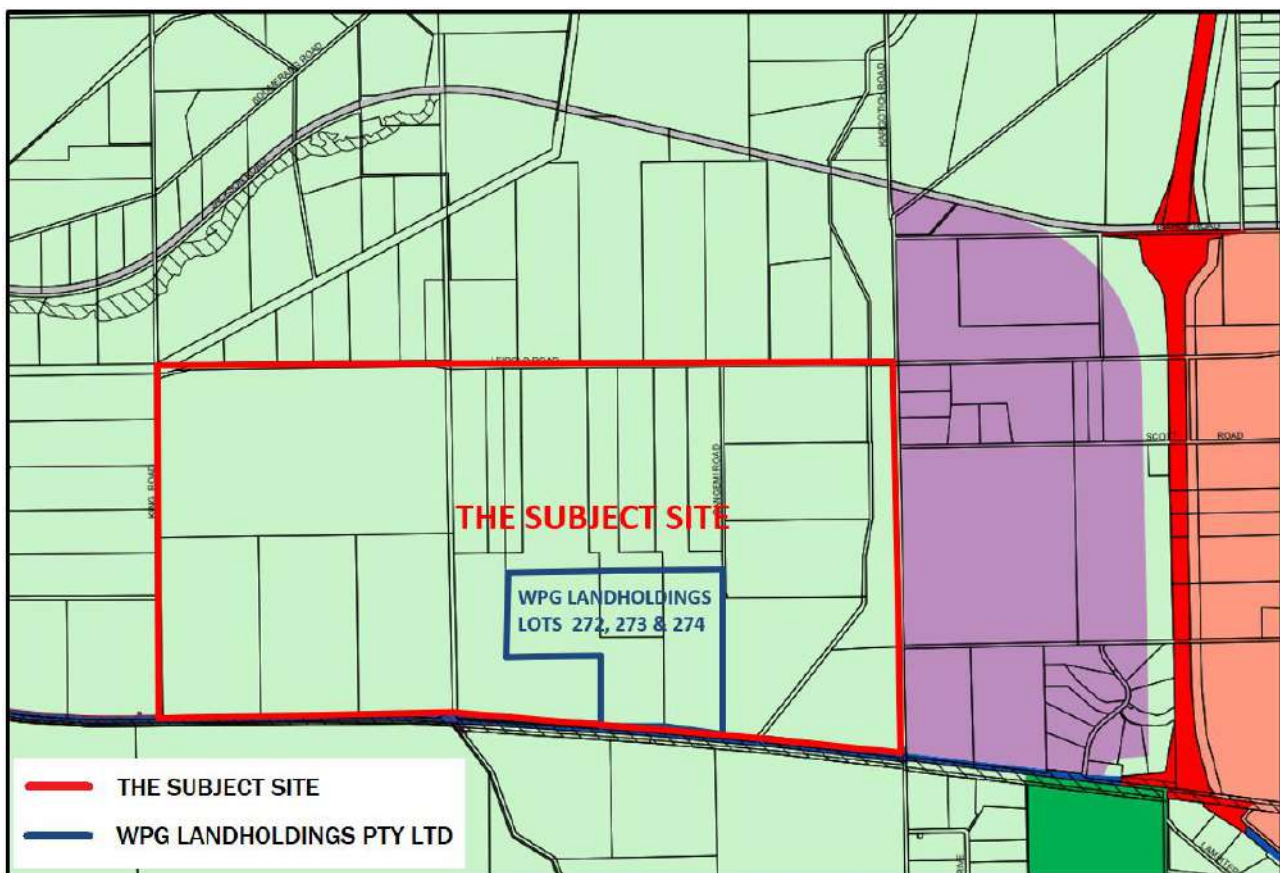


Figure 1 – The Subject Site

Notwithstanding that this document represents a formal submission to the advertising for the *LPST* and *LPSC* both of which deal with the Shire as a whole, the focus of this proposal is on the Mundijong townsite. It is therefore necessary to discuss the interconnected *MDSP* throughout.

A detailed review of the urban land allocations in the *LPST*, *LPSC* and *MDSP* documents has identified a significant disparity between the estimated dwelling yields for Mundijong and what is considered to be realistically achievable. The shortfall in readily available residential land will significantly limit Mundijong's ability to accommodate its forecast future population growth in an efficient, appropriate and timely manner.

This submission details the findings of the review and presents a case for the Subject Site to be included in the *LPST* as Urban and in the *MDSP* as Urban Precinct M, thereby enabling future amendments to the *MRS* and *LPSC* to ensure adequate urban land is readily available for Mundijong's future growth requirements.

2.0 OVERVIEW OF THE SHIRE OF SERPENTINE JARRAHDALE LOCAL PLANNING STRATEGY, LOCAL PLANNING SCHEME No. 3. AND THE MUNDIJONG DISTRICT STRUCTURE PLAN

The Shire of Serpentine Jarrahdale *LPST* and *LPSC* are the Shire's core planning documents and are closely related. The Shire's *LPST* will establish the strategic direction for development within the Shire whilst the *LPSC* establishes the statutory planning controls to implement the intent and direction of the *LPST*. In setting the strategic direction for development within the Shire, the *LPST* will be the guiding document in preparing various other strategic and statutory planning documents, including the *MDSP*.

As the *MDSP* focuses on the future planning and development of the Mundijong townsite and surrounds it is discussed in some detail throughout this submission.

The *MDSP* states a clear vision, established through a stakeholder and community engagement process:

'Mundijong will be a contemporary, connected place reflecting the community's rural character, 'green' values and vibrant village feel, building on the traditional town centre as the civic heart complemented by new sub-regional sports and recreational facilities to service the surrounding districts.'

To achieve the above vision the *MDSP* establishes seven (7) key objectives that were identified by the community as being important to the future growth of Mundijong:

1. A thriving community of choice;
2. Vibrant and connected district centres;
3. A distinct sense of place and identifiable character;
4. A safe pedestrian and interconnected transit hub;
5. A place that celebrates its environmental assets;
6. A water sensitive place; and
7. An innovation hub.

The above vision and key objectives are broadly consistent with the strategic intent of the *LPST* and were at the forefront in the preparation of the *MDSP* which details how the Shire intends to accommodate the forecast population growth and future development in the area.

3.0 POPULATION FORECASTS AND MDSP DWELLING YIELDS

The population within the Shire is expected to increase from ~32,000 in 2019 to ~110,000 by 2050 with the Byford and Mundijong town centres proposed to accommodate the bulk of this with 50,000 people each.

To accommodate the Mundijong population of 50,000 the *MDSP* yield calculations produce an estimated 17,702 dwellings across the proposed residential Precincts A through to G and a small Rural Residential component, and a further 2775 *potential* lots in Development Investigation Areas 2 and 3 which are subject to further investigations to confirm their suitability for development.

As a key objective of the *LPST*, *LPSC* and *MDSP* is to ensure the provision of sufficient developable land in the Mundijong area it is important that a realistic density zoning and average lot size are used to calculate the achievable lot yields from the outset.

The *MDSP* utilises a residential density coding of R25 and consequently an average lot size of 350m² across the residential precincts which is comparatively small even by today's standards of reduced lot sizes. This will not be widely accepted by the market (and nor likely the local community) in a semi-rural catchment such as Mundijong, and particularly so when there are larger lots on offer in other areas. Ultimately the average lot sizes within the *MDSP* area will need to be increased to at least an average of R20/450m² in order to achieve

realistic outcomes and provide adequate appropriately zoned land which is readily available for development.

The density disparity can be demonstrated by comparing the proposed MDSP densities to those of the two nearby large residential estates of *Whitby* and *The Glades*.

Figure 2 shows the MDSP residential density brackets (MDSP Page 81/Figure 17) in contrasting colours to highlight the proposed density coding within the Mundijong residential precincts, excluding the DIA's.

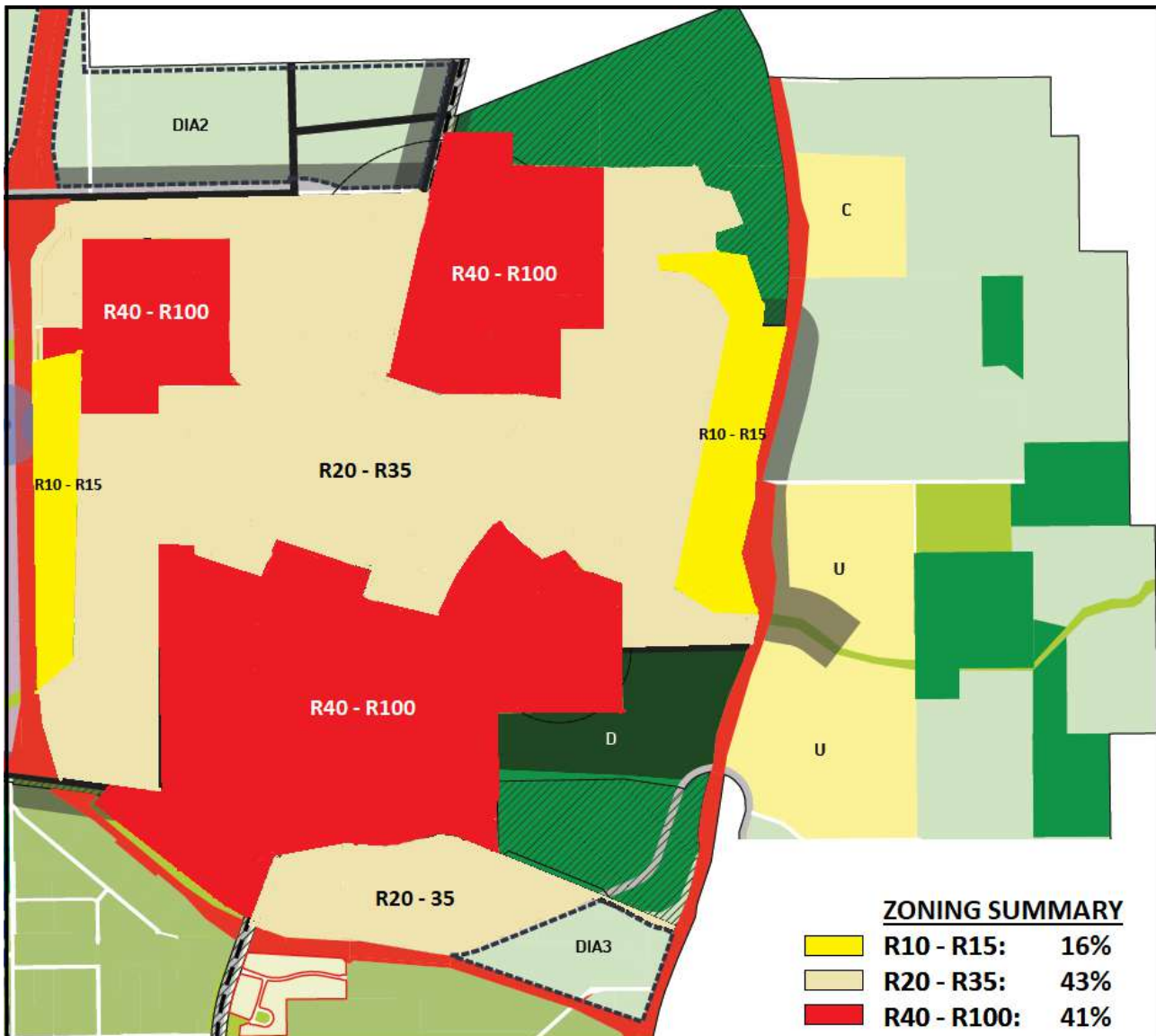


Figure 2 – MDSP Residential Density Brackets

It is important to note the proposed zoning brackets shown in *Figure 2* have not been used to calculate the MDSP dwelling yields, and as previously noted an average zoning/lot size of R25/350m² has been utilised for this purpose. It appears however that the proposed zonings shown in *Figure 2* may have been used as a justification to use the smaller than usual R25/350m² average as the MDSP 3.2.1 Table 8 Notes state that R25 is a 'conservative estimate', presumably implying that even higher densities will be available.

Notwithstanding the above, the high density bracket accounting for ~41% of the MDSP residential area has a zoning range of R40 up to R100. Under the R Codes, R40 equates to an average lot size of 220m² and R100 an average lot size of 120m², along with apartment options. High density zonings on this scale are clearly not appropriate for the Mundijong area.

By way of comparison the proposed MDSP zoning/density brackets in Figure 2 are shown below alongside those of the two nearby large residential estates *Whitby* and *The Glades* using their approved *Local Structure Plans*.

In summary the like for like density brackets are approximately as follows:

	MDSP	Whitby LSP	Glades LSP
Low Transitional	16%	10%	8%
Low Suburban	43%	88%	83%
Medium to High	41%	2%	8%
	100%	100%	100%

The above is based on the following zoning brackets:

Mundijong Proposed DSP

R10 - R15	16%	Low Transitional
R20 - R35	43%	Low Suburban
R40 - R100	41%	Medium to High
	<u>100%</u>	

Whitby Approved LSP

R5	10%	<u>10%</u>	Low Transitional
R20	62%		
R25	19%		
R30	7%	<u>88%</u>	Low Suburban
R50	2%	<u>2%</u>	Medium to High
	<u>100%</u>	100%	

The Glades Approved LSP

R10	3%		
R12.5	3%		
R15	3%	<u>9%</u>	Low Transitional
R20	52%		
R25	18%		
R30	13%	<u>83%</u>	Low Suburban
R40	6%		
R50	1%		
R60	1%	<u>8%</u>	Medium to High
	<u>100%</u>	100%	

As can be seen, the *Whitby* and *The Glades* density brackets are relatively similar to each other and represent a reasonable zoning spread for a modern residential land estate. Of note:

1. R20/450m² is by far the most significant individual density for both *Whitby* and *The Glades* accounting for ~62% and ~52% respectively whereas the MDSP allocates only ~43% for R20 to R35 combined; and
2. While the MDSP has an allocation of ~41% for the Medium to High density bracket, *Whitby* and *The Glades* only have ~2% and ~8% respectively.

As previously stated, Figure 2 shows the proposed zoning brackets of the MDSP residential precincts and has not been used to calculate the estimated dwelling yields for the MDSP, however the disproportionately high density zoning brackets have evidently been used to justify the comparatively high density average of

R25/350m² across the MDSP area and further, describe the resultant R25 dwelling yields as conservative. A blanket zoning of R25 and an average lot size of 350m² in a catchment such as Mundijong is not a realistic approach and will ultimately result in a significant shortfall in dwelling yields and consequently the Shire's *Developer Contribution Plan* which is predicated on lot yields.

In addition, almost without exception urban development necessitates the clear felling of the vast majority of trees in the proposed residential precincts. Precincts B, D and F will be particularly impacted in this regard and therefore a number of the Mundijong community's key objectives (*retention of established trees and maintaining a rural flavour for Mundijong*) will not be achieved.

3.1 MDSP Precinct Constraints Analysis

In addition to the identified zoning and density concerns, an analysis of the MDSP urban precinct areas has identified a significant number of constraints which will impact ultimate lot yields. The following matrix provides a precinct constraints snapshot and the subsequent pages provide the detail of each.

MDSP CONSTRAINTS MATRIX	PRECINCT B	PRECINCT C	PRECINCT D	PRECINCT F	PRECINCT G	DIA 2	DIA 3
FRAGMENTED LANDHOLDINGS	*		*	*			
TREE & CANOPY COVER	*		*	*			
RAIL LINE IMPACTS	*	*	*	*	*	*	
TONKIN HIGHWAY IMPACTS			*		*	*	*
SOUTH WEST HIGHWAY IMPACTS	*						*
MANDEJAL BROOK RESERVE	*				*		
SIGNIFICANT WATER COURSE	*	*	*		*	*	*
CONSERVATION CATEGORY WETLAND	*	*	*	*	*		
MULTIPLE USE CORRIDORS	*	*	*	*	*		
THREATENED/PRIORITY FLORA	*	*			*		
THREATENED/PRIORITY FAUNA	*	*	*		*		
BUSHFIRE THREAT	*	*	*	*	*	*	
WASTE WATER PUMP STATION BUFFER	*	*			*		
SIGNIFICANT RESERVES/DOS IMPACT		*		*	*		
ABORIGINAL HERITAGE					*		
SCHOOL SITE		*		*	*		

Matrix 1 - Precinct Constraints Summary

Precinct A – Whitby: Precinct A/Whitby has an approved Local Structure Plan and therefore is included here as a reference point only. Based on a gross 368 Ha of developable land an estimated yield of 3,750 dwellings is achieved, as noted in the Whitby LSP dated July 2012 and utilised in the draft Mundijong District Structure Plan. The available Whitby staging plans for Stages 1A, 1B, 2A and 2B combined indicates an average lot size of 494m². Taking into account higher densities in and around the future district centre a median of 450m² across the whole estate would appear to be a reasonable assumption.

Precinct E (E1 & E2) – Mundijong West: Precinct E1 & E2 both have approved Local Structure Plans and are included here as a reference point only. The two approved structure plans for Precincts E1 and E 2 dated January 2014 and April 2015 respectively, indicate a gross 151 Ha land area with an estimated yield of 1,835 dwellings.

Precinct B – Keirnan Street (Refer Figure 3 Constraints Mapping Overlay)

Precinct B has a net developable area of approximately 148 Ha across ~47 individual land holdings.

The draft MDSP identifies Precinct B as an *Infill* site and shows an estimated dwelling yield of 1,695 which it states was deducted via manual calculations of the development potential of each landholding based on an R25 density of 350m² per lot.

A simple recalculation of the R25/350m² average lot sizes to a more appropriate R20/450m² average results in a revised Precinct B yield of 1,318 dwellings, 377 less than shown in the structure plan.

The following constraints are also noted for Precinct B which will further impact ultimate dwelling yields:

1. **Fragmented Land Holdings:** Precinct B consists of ~47 land holdings, presumably most with separate owners. Fragmented ownership of this scale invariably results in uncoordinated, ad hoc and inefficient development due to the differing intentions of individual owners. This also creates funding issues for the required town planning and other required planning processes as while a percentage of owners may wish to progress structure planning across the precinct and therefore contribute to the costs, others will not wish to develop and/or contribute to the required town planning and other works. There are many examples of long stalled strategic development areas across the Perth metropolitan area for this very reason. The differing intentions of owners also often result in land use conflicts;
2. **Tree Cover:** Precinct B has a significant mature tree cover and canopy over much of the site which not only act as heat and carbon sinks combatting climate change, but also provide critical roosting, foraging and breeding habitat for endangered bird species such as the Baudin's and Carnaby's Black Cockatoo's, and other fauna species. Modern development practice requires the clear felling of trees for engineering purposes. *Ref Appendix 6 Environmental Features Survey - PGV Environmental Nov 2019;*
3. **Rail Line Setback Buffer:** The existing rail line is located inside and parallel to the entire ~1.5km western boundary of Precinct B which will therefore be impacted by residential rail buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
4. **Mandejal Brook Reserve/Multiple Use Corridor:** Mandejal Brook Reserve is nominated as a Multiple Use Corridor (MUC) and forms the entire northern boundary of Precinct B. The reserve contains significant areas of Conservation Category Wetland. Residential setback buffers will be required from the reserve given its environmental sensitivity. In addition, MUC's have very specific requirements as to minimum widths, landscaping and residential setbacks;
5. **Threatened and Priority Flora:** Threatened and Priority 1 Flora has been identified within Precinct B;
6. **Threatened and Priority Fauna:** Precinct B contains areas of Threatened/Critically Endangered and Priority Fauna;
7. **Bushfire Threat:** Precinct B is largely covered and surrounded by moderate to dense tree cover which will impact lot yield and incur additional house build costs resulting from increased Bushfire Attack Level (BAL) ratings;
8. **Waste Water Pump Station Buffer:** A 400 metre odour buffer is indicated for the sewer pump station located on the northern boundary of Precinct C which extends into Precinct B in its entirety.

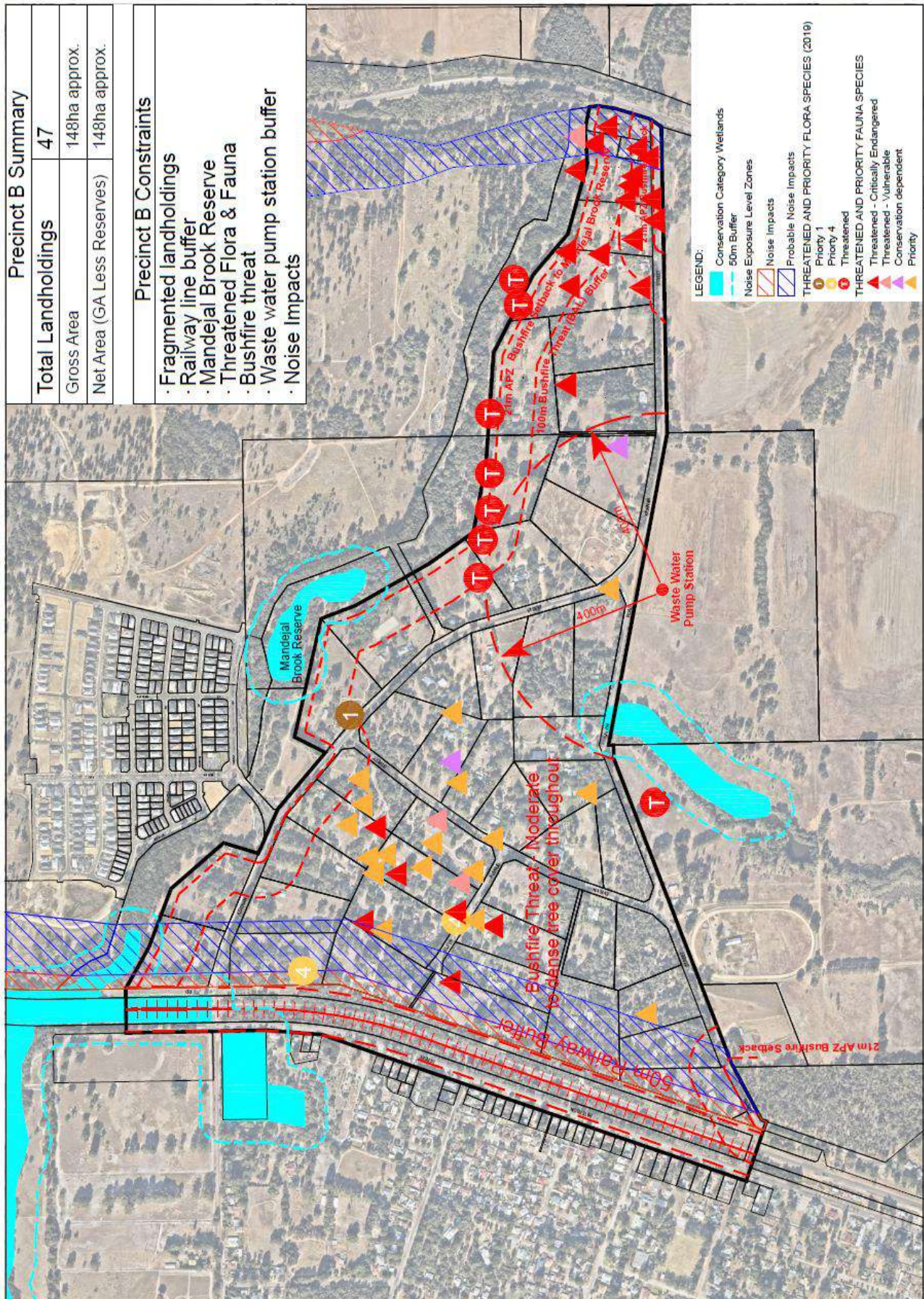


Figure 3 – Precinct B Constraints Mapping

Precinct C – Watkins Road North (Refer Figure 4 Constraints Mapping Overleaf)

Precinct C has an approximate gross area of approximately 253 Ha with a net developable area of ~132 Ha across ~14 landholdings when the existing reserves and future District Open Space are deducted.

The *MDSP* identifies Precinct C as broad hectare and shows an estimated dwelling yield of 3,172 which it states was calculated by identifying the total land area, deducting 40% for roads, public open space and drainage, and multiplying by R25, presumably based on an average of 350m² lots.

A simple recalculation of the 350m² average lots to a more appropriate 450m² average results in a revised Precinct C yield of 2,467 dwellings, 705 less than that shown in the *MDSP*.

The following additional constraints are noted for Precinct C which will further impact ultimate dwelling yields:

1. **Density Anomaly:** Precinct C has an apparent density anomaly at odds with the stated *MDSP* yield calculation methodology. The developable land area after reserves are deducted of ~132 hectares and the stated yield of 3,172 equates to 24 lots per gross developable hectare. An approximate guide would indicate this is based on an R40/220m² zoning, significantly higher density than the average R25/350m² stated in the *MDSP*.
2. **Rail Line Setback Buffer:** The existing rail line is located inside and parallel to the entire ~750 metre western boundary of Precinct C. With bush reserve accounting for close to one half of this length the remaining urban allocation will be impacted by residential rail buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
3. **Reserves and District Open Space:** The two existing reserves and the proposed District Open Space account for ~121 Ha or close to half of the total area of Precinct C. It is not clear what dispensation has been made in the yield calculations in this regard;
4. **Significant Water Course/Potential Multiple Use Corridor (MUC):** It is noted that a significant water course traverses Precinct C centrally north east to south west with the northern one third consisting of a Conservation Category Wetland. The entire water course will likely be retained in any future development (possibly as a MUC) and require appropriate residential development setbacks;
5. **Threatened and Priority Flora:** Threatened and Priority 1 Flora has been identified within Precinct C;
6. **Threatened and Priority Fauna:** Threatened/Critically Endangered and Priority Fauna has been identified within Precinct C;
7. **Bushfire Threat:** The wooded reserves within and adjacent to Precinct C represent a significant bushfire threat and will result in potential yield loss and/or additional house build costs from increased Bushfire Attack Level (BAL) ratings.
8. **Waste Water Pump Station Buffer:** It is noted that a 400 metre odour buffer is indicated for the sewer pump station located on the northern boundary of Precinct C;
9. **Primary Schools:** The *MDSP* indicates two primary schools within Precinct C with adjoining neighbourhood space, presumably playgrounds/ovals accounting for 8 hectares.

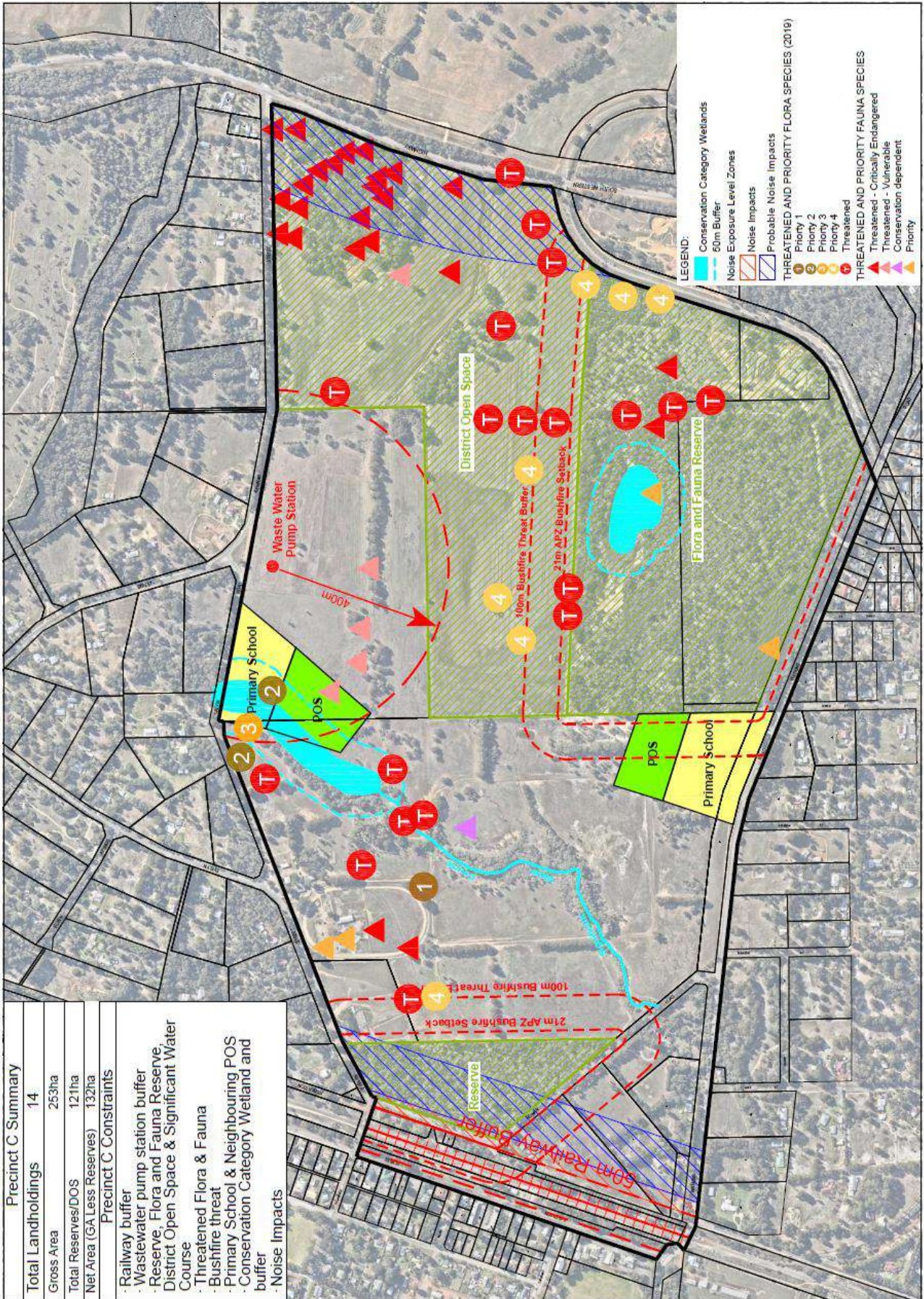


Figure 4 – Precinct C Constraints Mapping

Precinct D – Watkins Road South (Refer Figure 5 Constraints Mapping Overleaf)

Precinct D has an approximate developable area of approximately 95 Ha with a gross developable area of ~91 Ha across ~65 landholdings once the existing reserve is deducted.

The Mundijong District Structure Plan identifies Precinct D as an *Infill site* and shows an estimated dwelling yield of 1,134 deducted via manual calculations of the development potential of each landholding based on an R25 density of 350m².

A simple recalculation of the 350m² lots to a more appropriate average of 450m² results in a revised yield of 882 dwellings, 252 less than shown in the structure plan.

The following additional constraints are noted for Precinct D which will further impact dwelling yields:

1. **Fragmented Land Holdings:** Precinct D consists of ~65 land holdings, presumably most with separate owners. Fragmented ownership of this scale invariably results in uncoordinated, ad hoc and inefficient development due to the differing intentions of individual owners. This also creates funding issues for the required town planning and other required planning processes as while a percentage of owners may wish to progress structure planning across the precinct and therefore contribute to the costs, others will not wish to develop and/or contribute to the required town planning and other works. There are many examples of long stalled strategic development areas across the Perth metropolitan area for this very reason. The differing intentions of owners also often result in land use conflicts;
2. **Tree Cover:** Precinct D has a significant mature tree cover and canopy over much of the site which not only act as heat and carbon sinks combatting climate change, but also provide critical roosting, foraging and breeding habitat for endangered bird species such as the Baudin's and Carnaby's Black Cockatoo's, and other fauna species. Modern development practice requires the clear felling of trees for engineering purposes. *Ref Appendix 6 Environmental Features Survey - PGV Environmental Nov 2019;*
3. **Rail Line Setback Buffer:** The existing rail line is located adjacent and parallel to the entire ~620 metre western boundary of Precinct D which will therefore be impacted by residential rail buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
4. **Tonkin Highway Setback Buffer:** The Tonkin Highway reserve forms the ~1.1 kilometre southernmost boundary of Precinct D which will therefore be impacted by residential highway buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
5. **Significant Water Course/Potential Multiple Use Corridor (MUC):** A significant water course traverses Precinct D north east to south west with the western half consisting of a Conservation Category Wetland. The entire water course will likely be retained as an MUC in any future development.
6. **Threatened and Priority Fauna:** Threatened/Critically Endangered and Priority Fauna has been identified within Precinct D;
7. **Bushfire Threat:** The moderate to dense mature tree cover throughout and adjacent to Precinct D represents a significant bushfire threat and will result in potential yield loss and/or additional house build costs from increased Bushfire Attack Level (BAL) ratings.

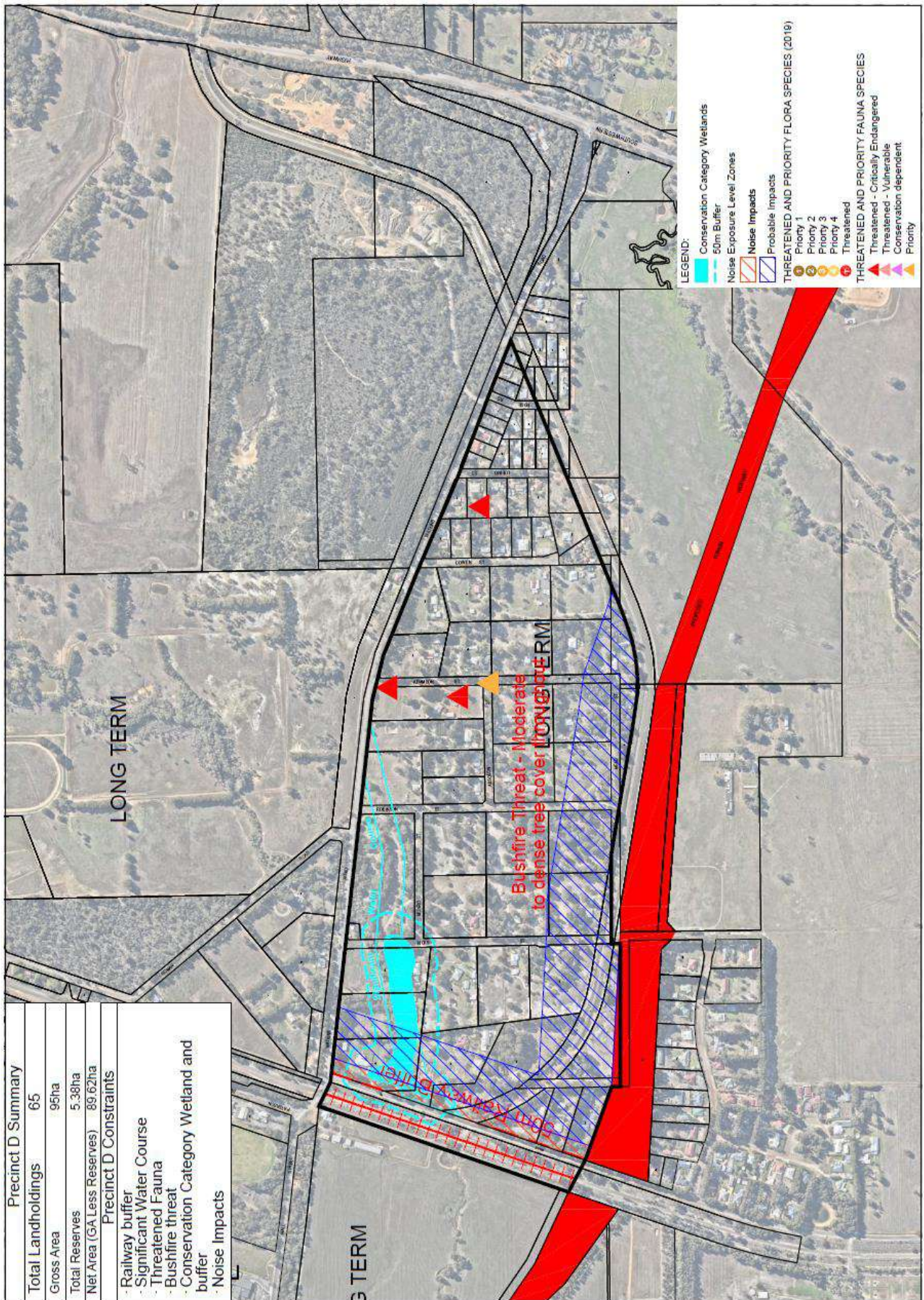


Figure 5 – Precinct D Constraints Mapping

Precinct F – Mundijong Town Centre (Refer Figure 6 Constraints Mapping Overleaf)

Precinct F has a gross area of approximately 177 Ha across ~389 landholdings incorporating primarily residential uses along with other existing town centre uses such as community and commercial.

The Mundijong District Structure Plan identifies Precinct F as an *infill site* and shows an estimated dwelling yield of 2,831 deducted via manual calculations of the development potential of each landholding based on an R25 density of 350m².

A simple recalculation of the 350m² lots to a more appropriate 450m² results in a revised yield of 2,202 dwellings, 629 less than shown in the structure plan.

The following additional constraints are noted for Precinct F which will further impact ultimate dwelling yields:

1. **Fragmented Land Holdings:** Precinct F consists of ~389 land holdings, presumably most with separate owners. Fragmented ownership of this scale invariably results in uncoordinated, ad hoc and inefficient development due to the differing intentions of individual owners. This also creates funding issues for the required town planning and other required planning processes as while a percentage of owners may wish to progress structure planning across the precinct and therefore contribute to the costs, others will not wish to develop and/or contribute to the required town planning and other works. There are many examples of long stalled strategic development areas across the Perth metropolitan area for this very reason. The differing intentions of owners also often result in land use conflicts;
2. **Tree Cover:** Precinct F has a significant mature tree cover and canopy over much of the site which not only act as heat and carbon sinks combatting climate change, but also provide critical roosting, foraging and breeding habitat for endangered bird species such as the Baudin's and Carnaby's Black Cockatoo's, and other fauna species. Modern development practice requires the clear felling of trees for engineering purposes. *Ref Appendix 6 Environmental Features Survey - PGV Environmental Nov 2019;*
3. **Rail Line Setback Buffer:** The existing rail line is located adjacent and parallel to the entire ~2 kilometre eastern boundary of Precinct F which will therefore be impacted by residential rail buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
4. **Conservation Category Wetland:** A CCW exists in the north eastern corner of Precinct F which will require appropriate setback buffers;
5. **Multiple Use Corridors:** Multiple Use Corridors (MUC's) transects the northern end of Precinct F. MUC's generally have very specific requirements as to minimum widths, landscaping and residential setbacks;
6. **Bushfire Threat:** The moderate to dense mature tree cover throughout Precinct F represents a significant bushfire threat and will result in potential yield loss and/or additional house build costs from increased Bushfire Attack Level (BAL) ratings.

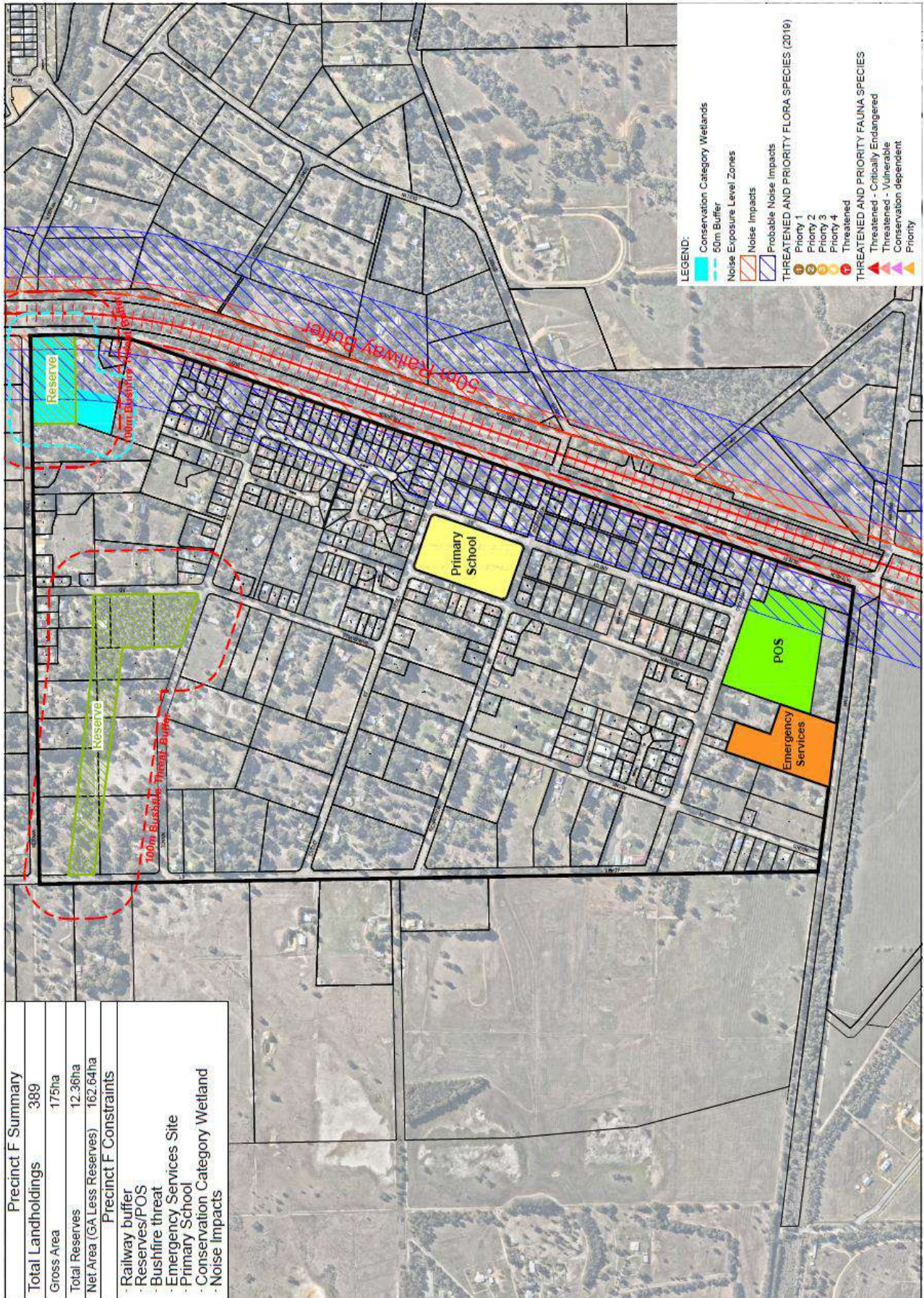


Figure 6 – Precinct F Constraints Mapping

Precinct G – Mundijong North (Refer Figure 7 Constraints Mapping Overleaf)

Precinct G has a gross land area of approximately 277 Ha across ~24 landholdings which it is understood are primarily owned by several different development entities.

The Mundijong District Structure Plan identifies Precinct G as broad hectare and shows an estimated dwelling yield of 3,175 which it states was calculated by identifying the total land area, deducting 40% for roads, public open space and drainage, and multiplying by R25, presumably based on an average of 350m² lots.

A simple recalculation of the 350m² lots to a more appropriate 450m² results in a revised yield of 2,469 dwellings, 706 less than shown in the MDSP.

The following additional constraints are noted for Precinct G which will further impact ultimate dwelling yields:

1. **Rail Line Setback Buffer (Eastern Boundary):** The existing rail line is located adjacent and parallel to the entire ~1.5km eastern boundary of Precinct G which will therefore be impacted by residential rail buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
2. **Rail Line Setback Buffer (Northern Boundary):** The existing Kwinana freight rail line is located adjacent and parallel to the northern boundary of Precinct G for a distance of approximately 1.3 kilometres and also transects the north eastern corner of the precinct. The considerations noted above therefore apply;
3. **Tonkin Highway Setback Buffer:** The Tonkin Highway reserve forms the ~1.7 kilometre westernmost boundary of Precinct G. In addition an interchange is planned at the intersection with Bishop Road further increasing the impact on Precinct G by residential highway buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
4. **Mandejal Brook Reserve/Multiple Use Corridor:** It is noted that the Mandejal Brook Reserve is nominated as a Multiple Use Corridor (MUC) and transects Precinct G approximately centrally east to west. The entire length of the reserve through the precinct is classed as Conservation Category Wetland which will result in yield impacts due to related setback buffers. MUC's also have very specific requirements as to minimum widths, landscaping and residential setbacks.
5. **Bushfire Threat:** The Mandejal Brook Reserve and the reserve in the north eastern corner of Precinct F represent a significant bushfire threat for Precinct G and will result in potential yield loss and/or additional house build costs from increased Bushfire Attack Level (BAL) ratings;
6. **Waste Water Pump Station Buffer:** A 400 metre odour buffer is indicated for the sewer pump station located in Precinct G.

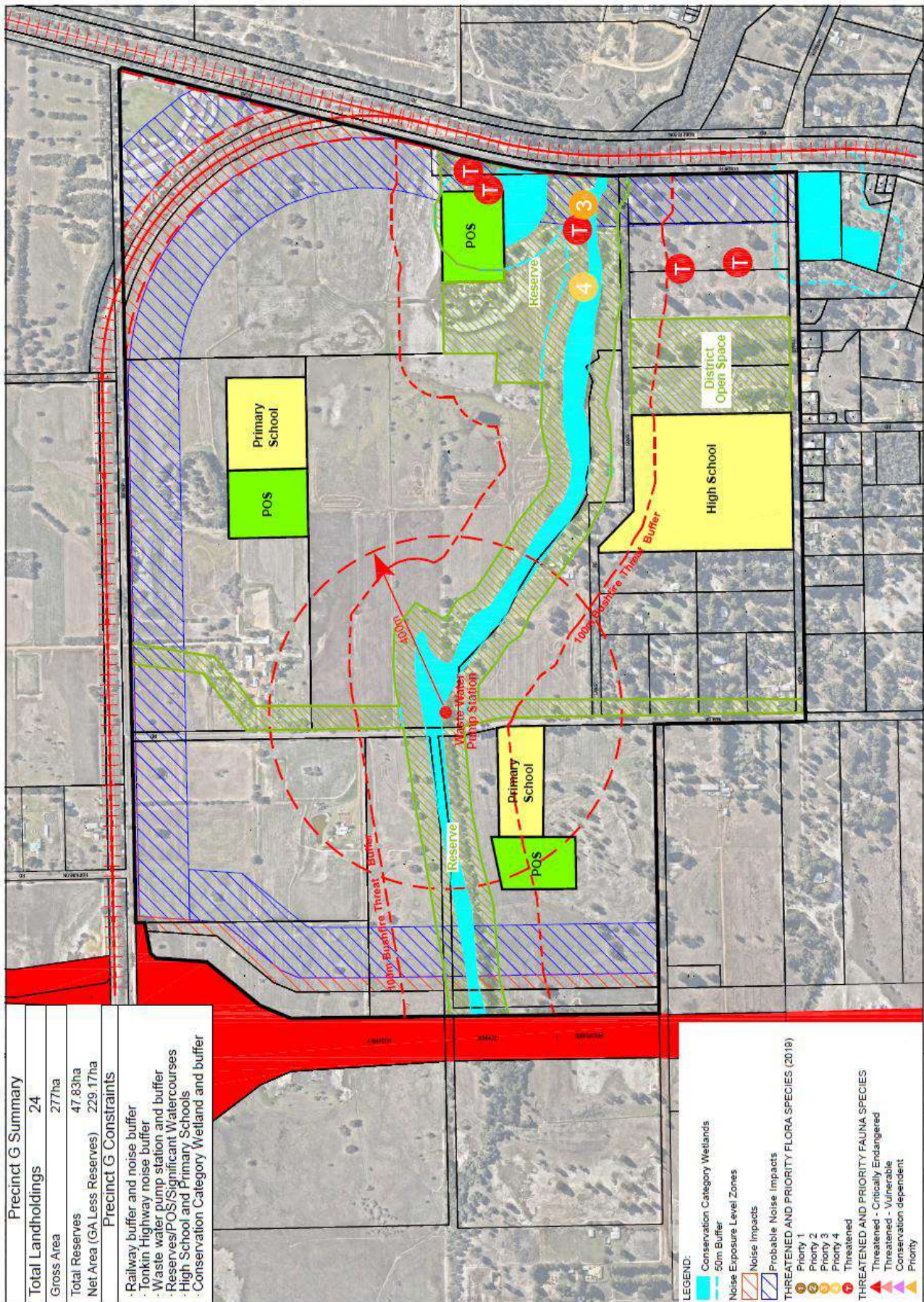


Figure 7 – Precinct G Constraints Mapping

Development Investigation Area 2/DIA2 (Refer Figure 8 Constraints Mapping Overleaf)

DIA 2 has an approximate gross land area of ~158 Ha over 9 landholdings.

The Mundijong District Structure Plan identifies DIA2 to *investigate opportunity for urban expansion to provide additional dwellings with a focus on innovation*, and estimates a dwelling yield of 2,220.

A simple recalculation of the 350m² lots to a more appropriate 450m² results in a revised yield of 1,727 dwellings, 493 less than shown in the structure plan.

The following additional constraints are noted for DIA2 which will further impact ultimate dwelling yields:

1. **Rail Line Setback Buffer (Eastern Boundary):** The existing rail line is located adjacent and parallel to the entire ~720 metre eastern boundary of DIA2 which will therefore be impacted by residential rail buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
2. **Rail Line Setback Buffer (Southern Boundary):** The existing Kwinana freight rail line is located inside DIA2 adjacent and parallel to the southern boundary for a distance of approximately 1.7 kilometres which will therefore be impacted by residential rail buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
3. **Tonkin Highway Setback Buffer:** The Tonkin Highway reserve forms the ~1.4 kilometre westernmost boundary of DIA2. In addition an interchange is planned at the intersection with Bishop Road further increasing the impact on DIA2 by residential highway buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
4. **Significant Water Course/Potential Multiple Use Corridor (MUC):** It is noted that a significant water course traverses DIA2 centrally east to west which will likely be retained in any future development (possibly as a MUC) and require appropriate residential development setbacks.
5. **Bushfire Threat:** The bush reserve adjacent to the north eastern boundary of DIA2 will likely represent a bushfire threat and will result in potential yield loss and/or additional house build costs from increased Bushfire Attack Level (BAL) ratings;

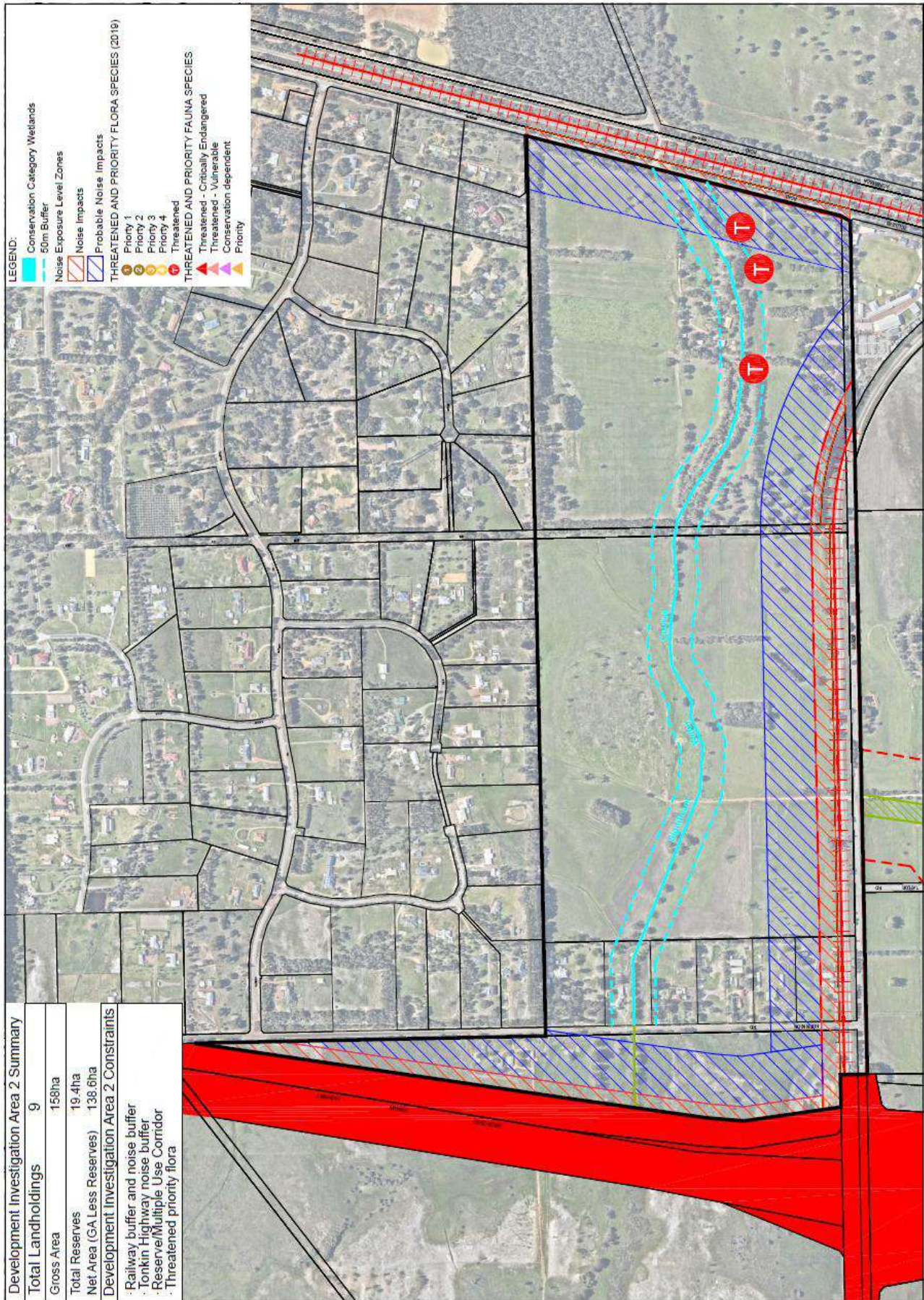


Figure 8 – DIA 2 Constraints Mapping

Development Investigation Area 3/DIA3 (Refer Figure 9 Constraints Mapping Overleaf)

DIA3 has an approximate gross land area of 43 Ha across ~16 land holdings.

The Mundijong District Structure Plan identifies DIA 3 to *explore the potential for a rural/urban interface area with consideration for innovative housing opportunities which respond to the landscape*, and estimates a dwelling yield of 555.

A simple recalculation of the 350m² average lot size to a more appropriate 450m² results in a revised yield of 432 dwellings, 123 less than shown in the structure plan.

Notwithstanding the above, the following constraints are noted for DIA3 which will further impact ultimate dwelling yields:

1. **South Western Highway Setback Buffer (Eastern Boundary):** The South Western Highway forms the ~720 metre south eastern boundary of DIA 3 which will impact DIA3 by residential highway buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
2. **Tonkin Highway Setback Buffer:** The Tonkin Highway road reserve forms the ~1.1 kilometre southern boundary of DIA3. In addition the future Tonkin Highway intersection with South Western Highway is located at the south eastern corner which will further increase the impacts on DIA3 by residential highway buffer and setback requirements, additional land development costs for the likes of earth bunds and/or noise walls which can impact the viability of a project, and additional house build costs for the required noise and vibration attenuation measures which can be significant. If earth bunds and/or noise walls are ultimately utilised the visual and connectivity impacts will be significant;
3. **Significant Water Course/Potential Multiple Use Corridor (MUC):** It is noted that a significant water course traverses DIA3 north east to south west which will likely need to be retained in any future development (possibly as a MUC) and require appropriate residential development setbacks.

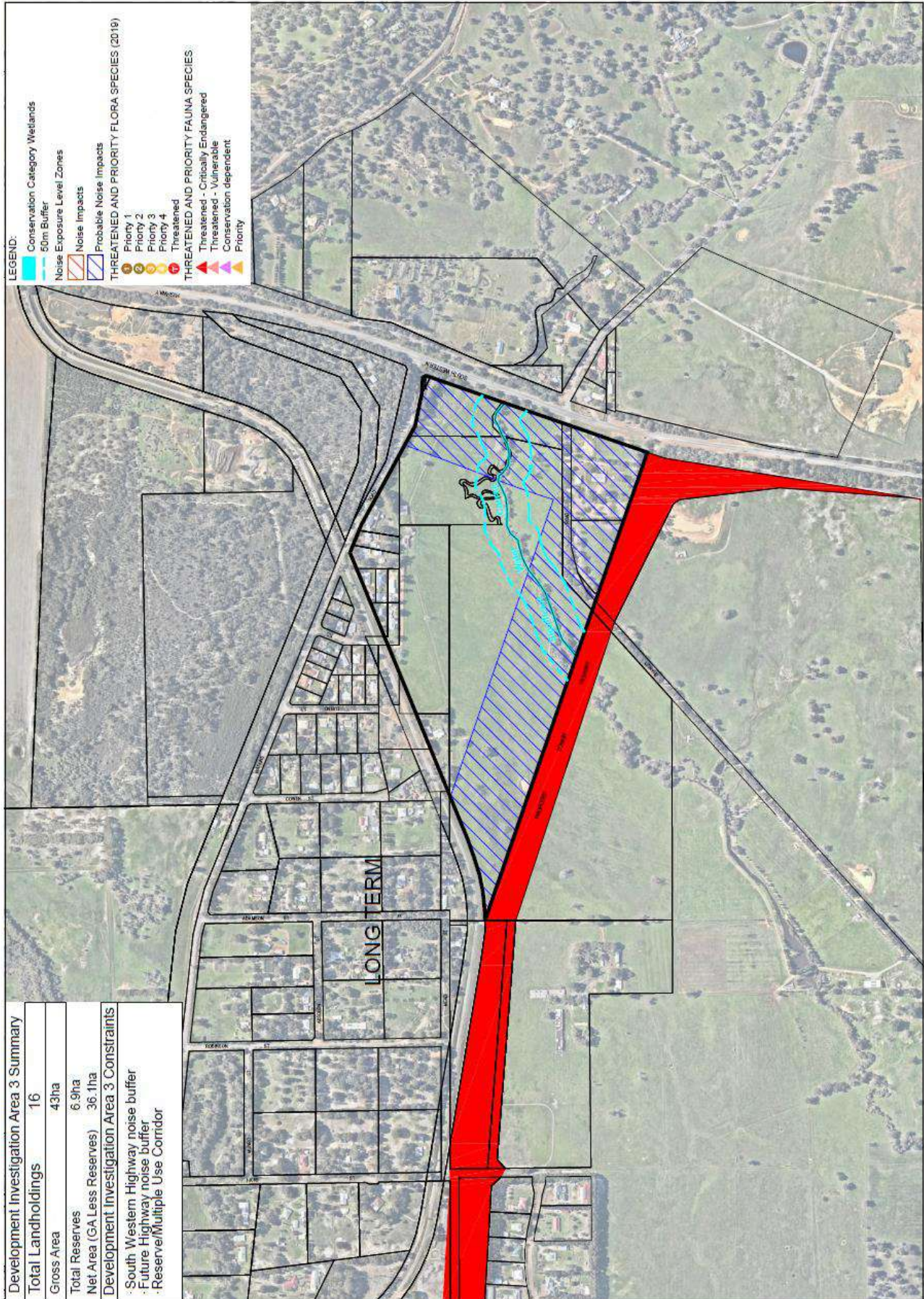


Figure 9 –DIA3 Constraints

3.2 Revised MDSP Precinct Dwelling Yields

Revising the average lot sizes from R25/350m² to a more appropriate R20/450m² results in a significant reduction to the ultimate dwelling yields as noted under each precinct above.

While it is difficult to accurately forecast the additional yield loss attributable to the other identified constraints, a figure of 20% across all precincts has been used for the purposes of this submission, and which is considered very conservative.

The following tables are based on the *MDSP Table 8* and show the impact of the above factors. *Precincts A and E* remain unchanged as they have approved LSP's, as does *Rural Residential* due to its small yield.

- ❖ Table 1: Current dwelling and population estimates as calculated in the *Draft MDSP*;
- ❖ Table 2: Dwelling and population projections transposed from average 350m² to 450m²;
- ❖ Table 3: Proposed av. 450m² yields per *Table 2* less estimated 20% for other identified constraints;
- ❖ Table 4: Overall Yield Impact Summary (*Tables 1* Totals less *Table 3* Totals);
- ❖ Table 5: Revised dwelling and population estimates by utilising proposed *Precinct M*.

STRUCTURE PLAN PRECINCT	ESTIMATED DWELLINGS	ESTIMATED POPULATION
A – Whitby – Approved LSP	3,750	10,837
B - Keirnan Street	1,695	4,898
C - Watkins Road North	3,172	9,167
D - Watkins Road South	1,134	3,277
E - Mundijong West – Approved LSP	1,835	5,303
F - Mundijong Town Centre	2,831	8,181
G - Mundijong North	3,175	9,175
Rural Residential	110	318
SUB TOTAL	17,702	51,156
DIA 2	2,220	6,416
DIA 3	555	1,604
DIA TOTAL	2,775	8,019
TOTAL	20,477	59,176

Table 1 – Draft MDSP Dwelling Yield and Population Estimates Utilising 350m² Average Lot Size

STRUCTURE PLAN PRECINCT	ESTIMATED DWELLINGS	ESTIMATED POPULATION
A - Whitby - Unchanged	3,750	10,837
B - Keirnan Street	1,318	3,810
C - Watkins Road North	2,467	7,130
D - Watkins Road South	882	2,549
E - Mundijong West - Unchanged	1,835	5,303
F - Mundijong Town Centre	2,202	6,363
G - Mundijong North	2,469	7,136
Rural Residential - Unchanged	110	318
SUB TOTAL	15,034	43,446
DIA 2	1,727	4,990
DIA 3	432	1,247
DIA TOTAL	2,158	6,237
TOTAL	17,192	49,683

Table 2 – Proposed Dwelling Yield and Population Estimates Utilising 450m² Average Lot Size

STRUCTURE PLAN PRECINCT	ESTIMATED DWELLINGS	ESTIMATED POPULATION
A - Whitby - Unchanged	3,750	10,837
B - Keirnan Street	1,055	3,048
C - Watkins Road North	1,974	5,704
D - Watkins Road South	706	2,039
E - Mundijong West - Unchanged	1,835	5,303
F - Mundijong Town Centre	1,762	5,091
G - Mundijong North	1,976	5,709
Rural Residential - Unchanged	110	318
SUB TOTAL	13,166	38,048
DIA 2	1,381	3,992
DIA 3	345	998
DIA TOTAL	1,727	4,990
TOTAL	14,893	43,038

Table 3 – 450m² Lots/Table 2 Less 20% Constraints Loss

STRUCTURE PLAN PRECINCT	ESTIMATED DWELLINGS	ESTIMATED POPULATION
Table 1 – MDSP Yields	20,477	59,176
Table 2 – 350m ² to 450m ²	17,192	49,683
Table 3 – T2 less 20% Constraints	14,893	43,038
TOTAL YIELD SHORTFALL (T1 – T3)	5,584	16,138

Table 4 – MDSP Total Dwelling Yield Loss Summary (Table 1 minus Table 3)

The above exercise results in a shortfall in the MDSP yields of 5,584 lots equating to a population shortfall of ~16,000 persons. It should be noted that the above estimates include more than 1,700 lots from both Development Investigation Areas 2 and 3, the development potential of which is yet unknown, and also uses what appears to be a very high density for Precinct C.

The proposed *Precinct M* will have an estimated minimum yield of 6,500 dwellings which not only resolves the above yield shortfall but achieves a reasonable contingency should any other impacts eventuate.

STRUCTURE PLAN PRECINCT	ESTIMATED DWELLINGS	ESTIMATED POPULATION
A - Whitby	3,750	10,837
B - Keirnan Street	1,055	3,048
C - Watkins Road North	1,974	5,704
D - Watkins Road South	706	2,039
E - Mundijong West	1,835	5,303
F - Mundijong Town Centre	1,762	5,091
G - Mundijong North	1,976	5,709
M - Kargotich to King	6,500	18,784
Rural Residential	110	318
SUB TOTAL	19,666	56,832
DIA 2	1,381	3,992
DIA 3	345	998
DIA TOTAL	1,727	4,990
TOTAL	21,393	61,822
SURPLUS (Table 2 - Table 6)	916	2,646

Table 5 – Dwelling Yields Including Proposed Precinct M

4.0 THE SUBJECT SITE

Table 6 and Figure 10 show the Subject Site land holdings, the landowners and their support status for this proposal. The *letters of support* are available for review in *Appendix 8*.

No	ID	PROPERTY ADDRESS	PROPERTY OWNER	LOT AREA HA	SUPPORT
1	A	LOT 272 MUNDIJONG ROAD OLDBURY	WPG	31.33	YES
2	B	LOT 273 MUNDIJONG ROAD OLDBURY		13.37	
3	C	LOT 274 MUNDIJONG ROAD OLDBURY		44.11	
4	D	LOT 275 MUNDIJONG ROAD OLDBURY	VERNON COCKELL	46.72	YES
5	E	LOT 725 MUNDIJONG ROAD OLDBURY	GRAHAM FORWARD AND FORREST FAMILY INVESTMENTS	56.33	YES
6	F	LOT 726 MUNDIJONG ROAD OLDBURY		58.99	
7	G	LOT 727 MUNDIJONG ROAD OLDBURY		58.96	
8	H	729 KING ROAD OLDBURY	BDJ 234 PTY LTD	158.42	YES
9	I	467 LEIPOLD ROAD OLDBURY	GP TREVCO NOMINEES PTY LTD	21.17	YES
10	J	457 LEIPOLD ROAD OLDBURY	WOUTER GERRYTS	10.6	YES
11	K	447 LEIPOLD ROAD OLDBURY	ERIC & DIANNE BROADWIDTH	10.6	YES
12	L	409 LEIPOLD ROAD OLDBURY	FERDINANDO CICOLARI	46.9	NO RESPONSE
13	M	LOT 265 LEIPOLD ROAD OLDBURY		22.58	
14	N	389 LEIPOLD ROAD OLDBURY	MICHAEL & PATRICIA CABASSI	22.2	YES
15	O	365 LEIPOLD ROAD OLDBURY	JOAN WILLIS & PATRICIA CABASSI	24.34	YES
16	P	331 LEIPOLD ROAD OLDBURY	RENE & PATRICIA DE BOUVRIE	20.33	NEUTRAL
17	Q	LOT 50 LEIPOLD ROAD OLDBURY	HELEN & DAVID RANSOM	36.43	NEUTRAL
18	R	LOT 52 GANGEMI ROAD OLDBURY		36.68	
19	S	LOT 51 KARGOTICH ROAD OLDBURY	NINO GANGEMI	28.56	YES
20	T	LOT 53 GANGEMI ROAD OLDBURY		35.32	
21	U	LOT 54 GANGEMI ROAD OLDBURY		40.66	
22	V	LOT 56 KARGOTICH ROAD OLDBURY		33.99	
TOTAL:				858.59	

Table 6 – Subject Site Land Owners Support Table

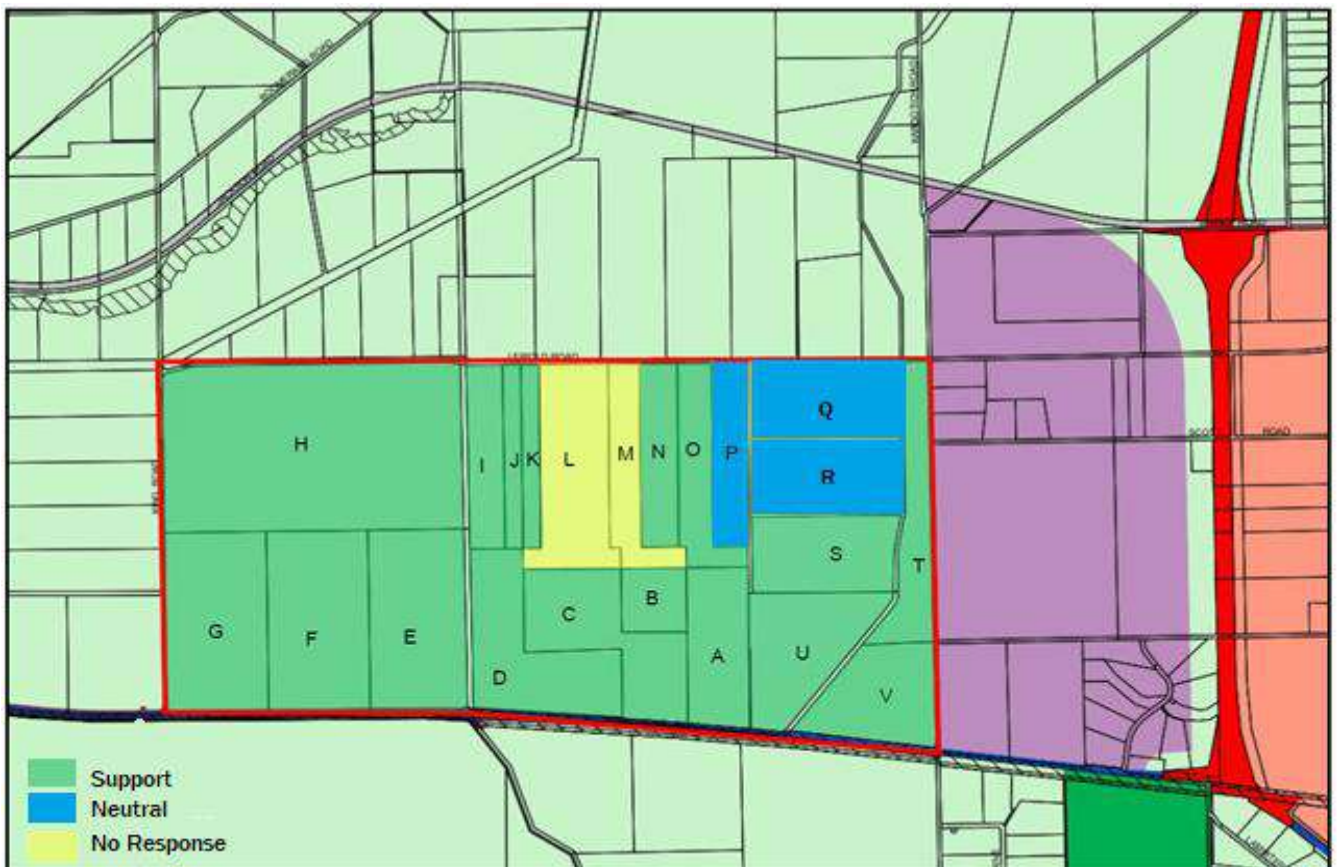


Figure 10 – Subject Site Land Owners Support Plan

The Subject Site is the entire land parcel bound by Mundijong, King, Leipold and Kargotich Roads and consists of a total land area of 859 hectares. Of this, it is envisaged 212 hectares of the easternmost land holdings between Gangemi Road and Kargotich Road (Lots 50 – 54 & 56 and notated as Q, R, S, T U & V on *Figure 10 Owners Support Plan*) would be utilised for service commercial/low density residential and/or other uses suitable to provide an effective 1km buffer between the West Mundijong industrial area and the proposed medium density residential development area west of Gangemi Road.

It is also envisaged the proposed medium density residential development area west of Gangemi Road comprising of 647 hectares would entail an R20 zoning with an average lot size of 450m² across the development area, along with associated open space, recreational areas and facilities, and neighbourhood amenities.

Importantly, the Subject Site consists of only 22 land holdings and 13 individual landowners. Of these, ten support this proposal, two have advised their neutrality and one has not been able to be contacted.

The Subject Site is almost entirely cleared of trees and other flora of any environmental or ecological value.

Empirical evidence and feedback from several of the landowners suggests the Subject Site is not productive agricultural land and nor is it likely to become so at any point in the future. Other rural uses are also limited.

The Subject Site has been deemed suitable for urban development by the preliminary environmental assessment (Aurora Environmental March 2019) and civil engineering investigations (Porters Consulting Engineers March 2019) commissioned by WPMG and summarised in Sections 5.4.1 and 5.4.2 of this submission. The full reports are available for review in Appendices 4 and 5.

Critically the proponent WPG has undertaken to fund the required investigations and town planning works up to and inclusive of an amendment to the Metropolitan Region Scheme (MRS) over the entire Subject Site thereby eliminating the usual funding barriers for such works.

5.0 JUSTIFICATION OF PROPOSAL

The inclusion of the Subject Site for urban uses in the *SSJ Local Planning Strategy* and the *Mundijong District Structure Plan* is considered an appropriate modification to supplement the proposed urban allocation for Mundijong. The proposal is consistent with strategic planning principles and will enable the Shire of Serpentine Jarrahdale to effectively and efficiently accommodate Mundijong's very significant forecast population growth, as well as providing opportunities for additional accommodation options such as potential retirement and aged care facilities.

The preliminary environmental and civil engineering investigations undertaken to support this proposal demonstrate the suitability of the Subject Site for urban development.

The proponents wish to stress that this proposal is aimed at complementing the existing allocated urban areas of the related draft planning documents rather than competing with them. Given the outcomes of the investigations contained in this submission it is clear the existing urban allocation will not be adequate to accommodate the forecast population growth for Mundijong nor achieve many of the visioning objectives.

In addition, the inclusion of the Subject Site in the existing urban allocation will provide many additional opportunities for Mundijong and the surrounding areas residents via significant additional public open space, recreation facilities and other amenities over what would otherwise remain non-accessible private land holdings.

5.1 Strategic Planning Considerations

The proposal is considered to be consistent with a number of broad strategic planning principles that are echoed throughout numerous strategic planning documents. These principles include:

1. **Creating places where people can live close to where they work:** In addition to the increase in employment opportunities in the Mundijong area by virtue of organic population growth, the recent MRS Amendment 1298/41 to rezone 448 Ha of Rural zoned land to Industrial for the West Mundijong Industrial Area will result in significant additional growth in local employment opportunities. The easternmost boundary of the Subject Site is located immediately adjacent to the proposed industrial area and the proposed residential component commences 1km away.
2. **Prioritising growth around key transport routes:** The subject site is located in close proximity to the proposed Tonkin Highway extension which has recently secured the remaining funding required to progress works from Thomas Road through to South West Highway. In addition the Subject Site is less than 7km from the Kwinana Freeway via Mundijong Road which forms the entire southern boundary of the site. Mundijong Road is designated an existing 'Other Regional Road' reserve under the MRS but is identified as a future 'Primary Regional Road' under the Perth and Peel @ 3.5 Million South Metropolitan Subregional Planning Framework, as illustrated below in Figure 11.

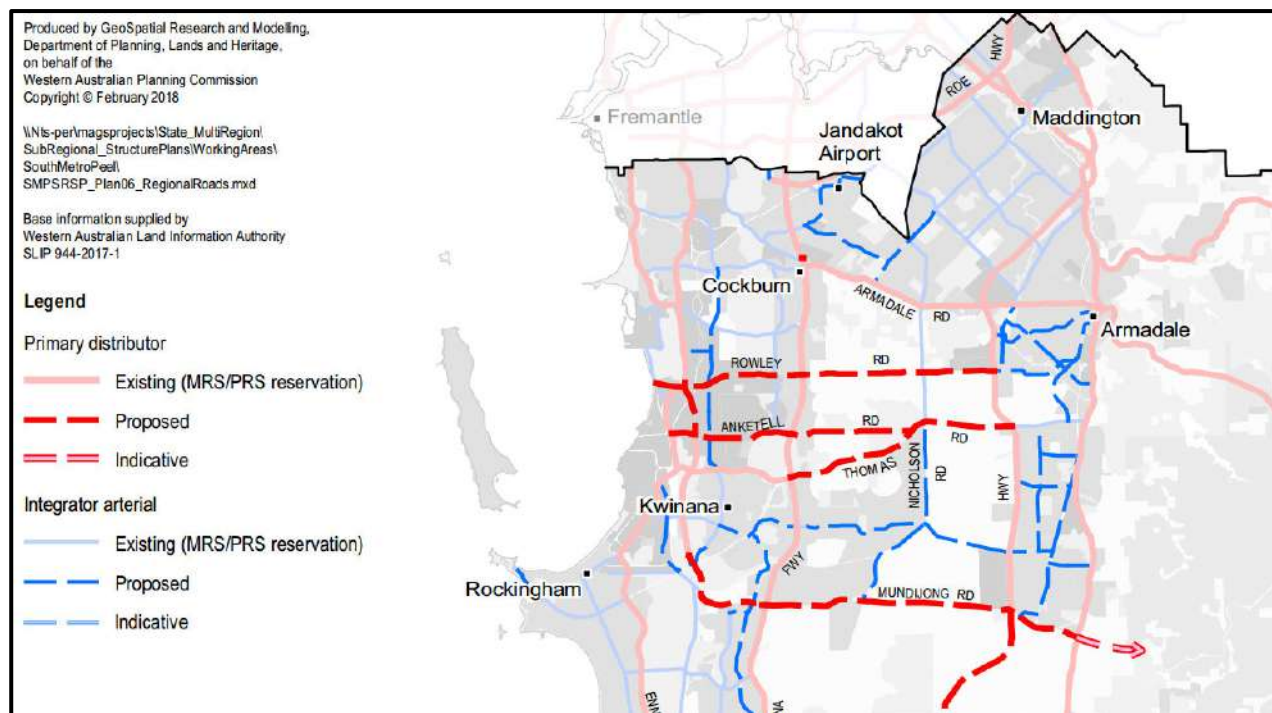


Figure 11 – Perth and Peel Regional Roads Plan

The Subject Site is also located in close proximity to the Mundijong train station which it is envisaged will be connected to the Perth Metronet network at some point in the future. In the interim the nearby Byford townsite is part of the planned Metronet network.

5.2 Local Planning Considerations

The aims of the Shire and Mundijong townsite planning documents are largely based on visions formulated from the community consultation process and are similar in each of the documents.

Section 9 of the draft *Local Planning Scheme No 3* lists the *Aims of the Scheme* which are broadly repeated throughout all of the SSJ planning documents including the *Local Planning Strategy* and the *Mundijong District Structure Plan*. These are noted below with the proponents comments to address each.

Aim a) Protect and enhance the landscape, natural environment, ecological values and environmental quality:

- Comment: Without exception, medium to high density urban development necessitates the clear felling of trees/tree canopy and other flora within the development area for fill placement, drainage, geotechnical and numerous other civil engineering purposes. The Subject Site is already largely cleared of tree cover and other natural flora and fauna of significance. Further, the urbanisation of the Subject Site would significantly enhance the landscape, ecological and environmental qualities of the area by virtue of substantial additional landscaped/planted public open spaces and street trees implemented as part of the development, over what is currently unimproved private landholdings.

Aim b) Preserve heritage values, amenity and areas of cultural significance and integrate new built environments with the existing local character:

- Comment: The Preliminary Environmental Assessment (*Aurora Environmental March 2019 – Included as Appendix 4* of this document) indicates the Subject Site does not contain any areas of significant heritage value, amenity or cultural significance. The inclusion of the Subject Site as urban would however significantly increase the overall amenity of the Mundijong area via the creation of additional public open space and recreational opportunities over what is currently private land.

Aim c) Support the growth of the local economy to attract business, investment and tourism and generate local employment opportunities:

- Comment: Population is a known primary driver behind economic growth. The urbanisation of the Subject Site will therefore supplement the ability of existing Mundijong precincts to effectively cater for the significant forecast growth of the townsite.

Aim d) Deliver a diversity of housing types and lot sizes to accommodate all sectors of the population, respond to changing needs, facilitate aging in place and provide a range of housing choices:

- Comment: The proposed average lot sizes of 350m² across the MDSP area will restrict diversity of housing types and options. Pertaining to aging in place, many families would like the opportunity to care for their elderly by living under the same roof and options such as a larger family home with separate facilities and/or dual key residences, both of which require larger lot sizes, would facilitate this. In addition, the urbanisation of the Subject Site will provide significantly greater options and opportunities for the likes of dedicated retirement and/or high dependency aged care facilities not only for the local community but the wider community.

Aim e) Support community wellbeing by promoting active, connected, safe and secure pursuits for all:

- Comment: The urbanisation of the Subject Site can only result in the provision of additional community pursuits by significantly increasing the overall amenity of the Mundijong area via the creation of additional public open space and recreational opportunities over what is currently private land.

Aim f) Protect rural land for agricultural production and minimise land use conflicts:

- Comment: The Subject Site and much of the immediately surrounding area is not productive agricultural land and is unlikely to be transformed into such moving forward. Any potential land use conflicts can be managed with the implementation of appropriate buffers during the structure planning process.

Aim g) Create distinctive and well-defined urban centres and townsites which foster a strong sense of place and local identity:

- Comment: The Subject Site is less than 3 kilometres from the existing Mundijong town centre and remains directly connected by virtue of Precincts E, G, and H – L. There is no reason the Subject Site if urbanised would be considered anything other than an extension of the Mundijong townsite.

Aim h) Ensure the orderly and proper provision of services and infrastructure:

- Comment: As noted in the Infrastructure and Servicing Constraints Assessment of the Subject Site (*Porter Consulting Engineers March 2019* – Included as *Appendix 5* of this document) there are no major constraints or fatal flaws to prevent servicing of the Subject Site. In addition and as is often the case, the servicing of the Subject Site will likely assist in the development of other precincts in the *MDSP* area via the provision of infrastructure and/or the sharing of costs for the same.

Aim i) Support regional development and improve connections with the broader region:

- Comment: By its very nature this proposal promotes and supports regional development by augmenting the existing/proposed Mundijong townsite development precincts and providing significantly increased opportunities for public open space, passive and active recreational facilities, and additional scope for the likes of retirement and aged care facilities over what is currently private land.

With respect to the above, clearly the Aims and Visions of the *LPST*, *LPSC* and *MDSP* will be significantly enhanced by the inclusion of the Subject Site into the urban allocation for Mundijong.

5.3 Population Growth

SJ2050 and the Shire's *Local Planning Strategy* identify that the *Mundijong District Structure Plan* area will need to accommodate a population of approximately 50,000 people by 2050 to meet the Shire's long term growth targets.

An estimated 17,300 dwellings will be required to achieve these targets equating to the delivery of nearly 600 dwellings year on year until 2050. This will necessitate a ready supply of appropriately zoned land which can be delivered in a timely fashion.

5.4 Suitability of Subject Site for Development

Preliminary investigations over the Subject Site consisting of an Environmental Assessment (*Aurora Environmental March 2019*) and an Infrastructure and Engineering Constraints Assessment (*Porters Consulting Engineers March 2019*) conclude the Subject Site is suitable for urban development. These investigations are summarised below and the full reports are available as *Appendices 4 and 5*.

5.4.1 Environmental Assessment

The investigations and report concluded that the Subject Site is considered suitable for urban development from an environmental perspective and that any identified issues are capable of being dealt with through the planning process. The full report is available as *Appendix 4*.

Key findings:

- There are very few environmental constraints over the Subject Site and the land is suitable to support urban development;

- From an ecological perspective, due to previous clearing and many years of low intensity rural use the degraded nature of the site means that sensitive environments are unlikely to be adversely impacted.
- The majority of the Subject Site is considered to have a moderate to low risk of Acid Sulphate Soils (ASS) within 3m of the natural ground level;
- The majority of the Subject Site is designated as a Multiple Use Wetland. As Multiple Use Wetlands are quite flexible in their uses this designation is not considered to be a significant barrier to development. There is a very thin slither of Conservation category Wetland (CCW) overlapping the southern boundary of the site however this is degraded and could be subject to a successful redesignation application to Multiple Use, or can be managed during structure planning if remaining CCW;
- Groundwater levels are manageable;
- The site is largely free of contamination apart from a minor portion of the old clay pits on Lot 275 which is nearing completion of rehabilitation;
- Surrounding land uses and applicable buffers are unlikely to impact development as long as due consideration is given through appropriate land use planning;
- There are no intact areas of native vegetation present on the Subject Site;
- Due to the degraded condition of the available fauna habitat, the Subject Site contains very few values for native fauna;
- The land is not considered productive as agricultural land.

5.4.2 Infrastructure and Engineering Constraints Assessment

The report concluded that the Subject Site is considered suitable for urban development from an infrastructure and civil engineering perspective. The full report is available as *Appendix 5*.

Key Findings:

- Detailed groundwater investigations will be required during the planning phase to determine the groundwater profile and establish the drainage arrangements and ultimately finished lot levels;
- Site works required for the proposed urban development are likely to involve the topsoil being stripped prior to the placement of fill to achieve the required finished surface levels with the topsoil being reused across the site;
- There is currently no existing wastewater infrastructure that services the subject site, however the Water Corporation has confirmed its ultimate planning for the region details a large Type 1000 relay pumping station on Scott Street. This is likely to service a significant area including Byford to the north down to Serpentine to the south including the subject area. The land for this pumping station has already been obtained;
- Water Corporation has confirmed two potential options for a mains water supply to service the Subject Site;
- Drainage and road infrastructure can be addressed through subsequent planning stages;
- Western Power advises that reinforcing works are likely to occur in the area which will increase the available power to the subject area and the wider Serpentine Jarrahdale district;
- Communication networks exist in the surrounding road reserves;
- Gas networks exist in the area, however, should a point of supply be required for the Subject Site, the existing network would need to be extended from Bishop Road.

6.0 THE PROPOSED TOWN PLANNING PROCESS

It is acknowledged that in order for the Subject Site to accommodate urban development various town planning processes will need to be undertaken, commencing with the inclusion of the Subject Site in the SSJ *Local Planning Strategy* as Urban Settlement. This will facilitate the required amendments to the other State and Local planning documents including the South Metropolitan Peel Sub-regional Planning Framework

(scheduled review in 2021), The Metropolitan Region Scheme, the SSJ Local Planning Scheme No 3 and the Mundijong District Structure Plan.

The following flowchart shows the primary town planning tasks required to facilitate development of the Subject Site in conjunction with the existing urban precincts to assist with Mundijongs forecast population growth.

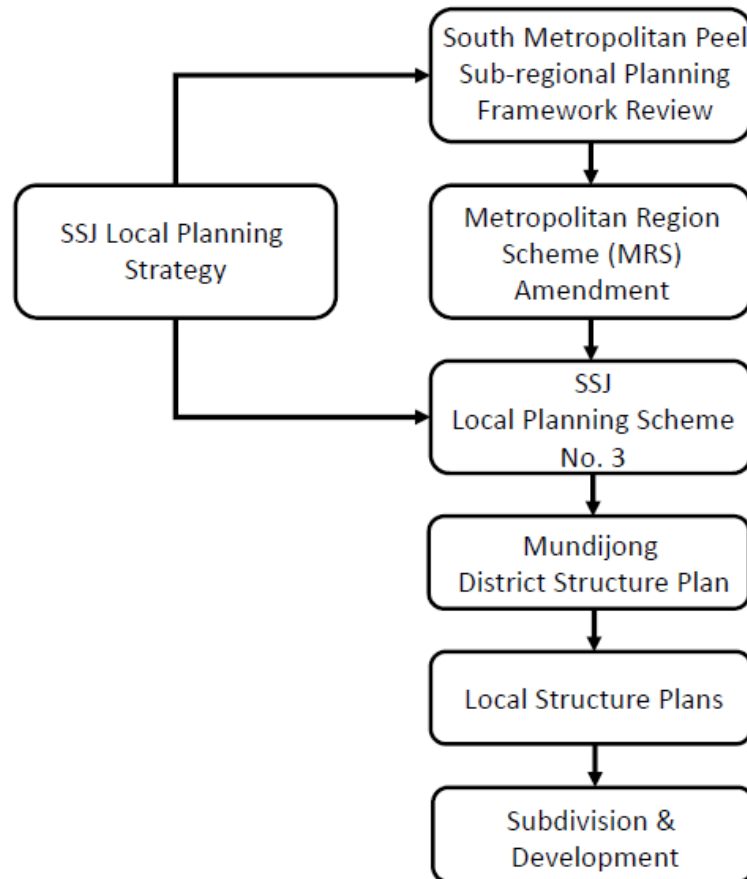


Figure 12 – Proposed Town Planning Flow Chart

The town planning processes and respective time frames are expected to be as follows:

- | | |
|--|-----------|
| 1. SSJ Local Planning Strategy Endorsement: | 12 months |
| 2. Sub-regional Planning Framework review (commencing 2021): | 24 months |
| 3. MRS Amendment to rezone the land from Rural to Urban: | 24 months |
| 4. SSJ Local Planning Scheme No. 3 to rezone the land from Rural to Urban: | 12 months |
| 5. Local Structure Planning: | 24 months |
| 6. WAPC subdivision approval: | 12 months |

Several of the above processes can and often do overlap, and it is also anticipated that the Mundijong District Structure Plan would be finalised and implemented concurrently with the earlier of the above processes.

With respect to the above, a reasonable time frame for the required town planning and related investigative works would therefore be expected to be between 5 to 7 years.

7.0 CONCLUSION

This submission provides the reasoning and justification for implementing an additional urban precinct in the Mundijong area to augment and complement the proposed Mundijong urban precincts.

In summary:

1. The proposed *LPST/LPSC/MDSP* urban precincts will not be able to accommodate the areas forecast population growth;
2. The Subject Site is a large land parcel consisting of only 22 lots and 13 landowners, most of whom support this proposal;
3. The Subject Site is not productive from an agricultural perspective and is constrained for grazing and equine purposes;
4. The Subject Site has been demonstrated to be suitable for urban development from both environmental and infrastructure perspectives;
5. The proponent WPG has undertaken to fund all required town planning and other consultancy works up to and inclusive of an amendment to the *Metropolitan Region Scheme* over the entire Subject Site, thereby eliminating the usual funding barriers for such works;
6. The inclusion of the Subject Site for urban development will provide far greater opportunities for public open space, recreational facilities, amenities and accommodation options than if it remains as privately owned unproductive rural holdings.

The proponents respectfully request Council's support for the Subject Site to be included in the Shire of Serpentine Jarrahdale's *Local Planning Strategy* as Urban, and the forthcoming *Mundijong District Structure Plan* as 'Precinct M' for urban purposes, utilising the town planning methodology set out previously.

APPENDIX 1

Draft Local Planning Strategy & Mundijong District Structure Plan Mapping

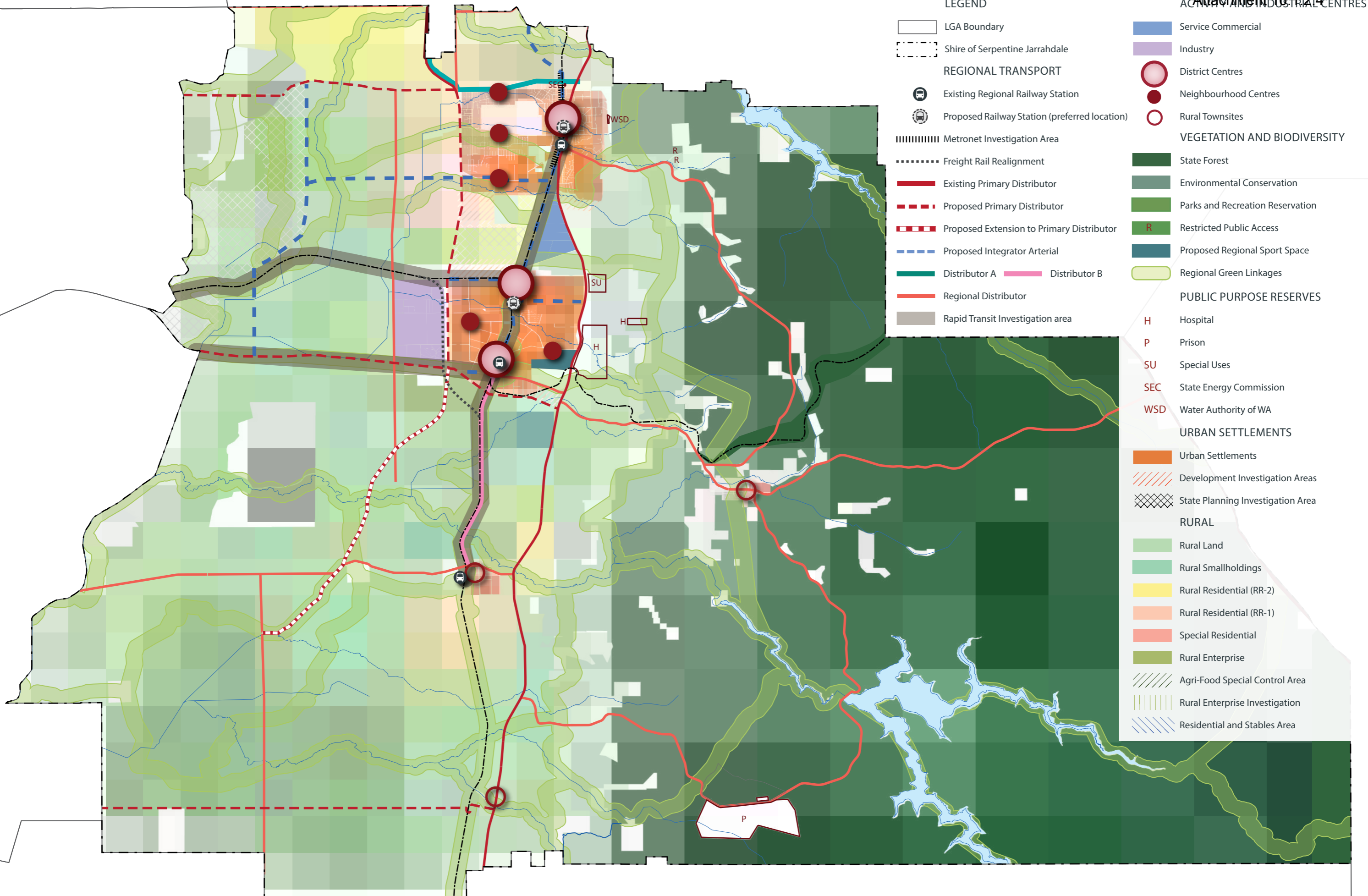
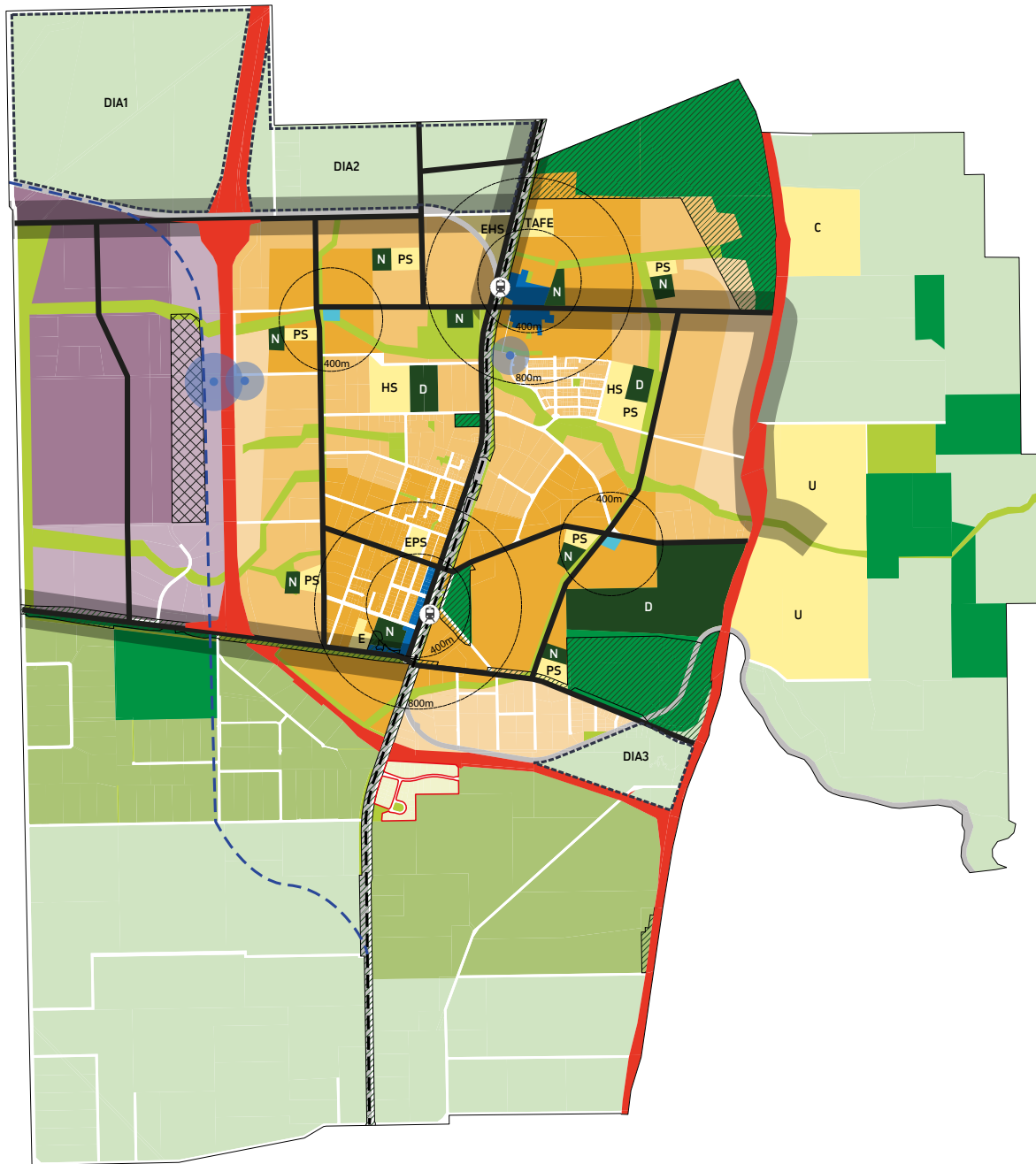


FIGURE 20: LOCAL PLANNING STRATEGY MAP



Figure 1: Mundijong District Structure Plan



Mundijong District Structure Plan

Status: Preliminary (not to be used for feasibility purposes)
Path: P163814 Development Strategies for Serpentine-Jarrahdale

Scale: 1:5,000 (P.A.T.)
0 100 200 300 400



Project Number: 43874
Drawing Number: A101
Revision: A
Date: 24/10/18

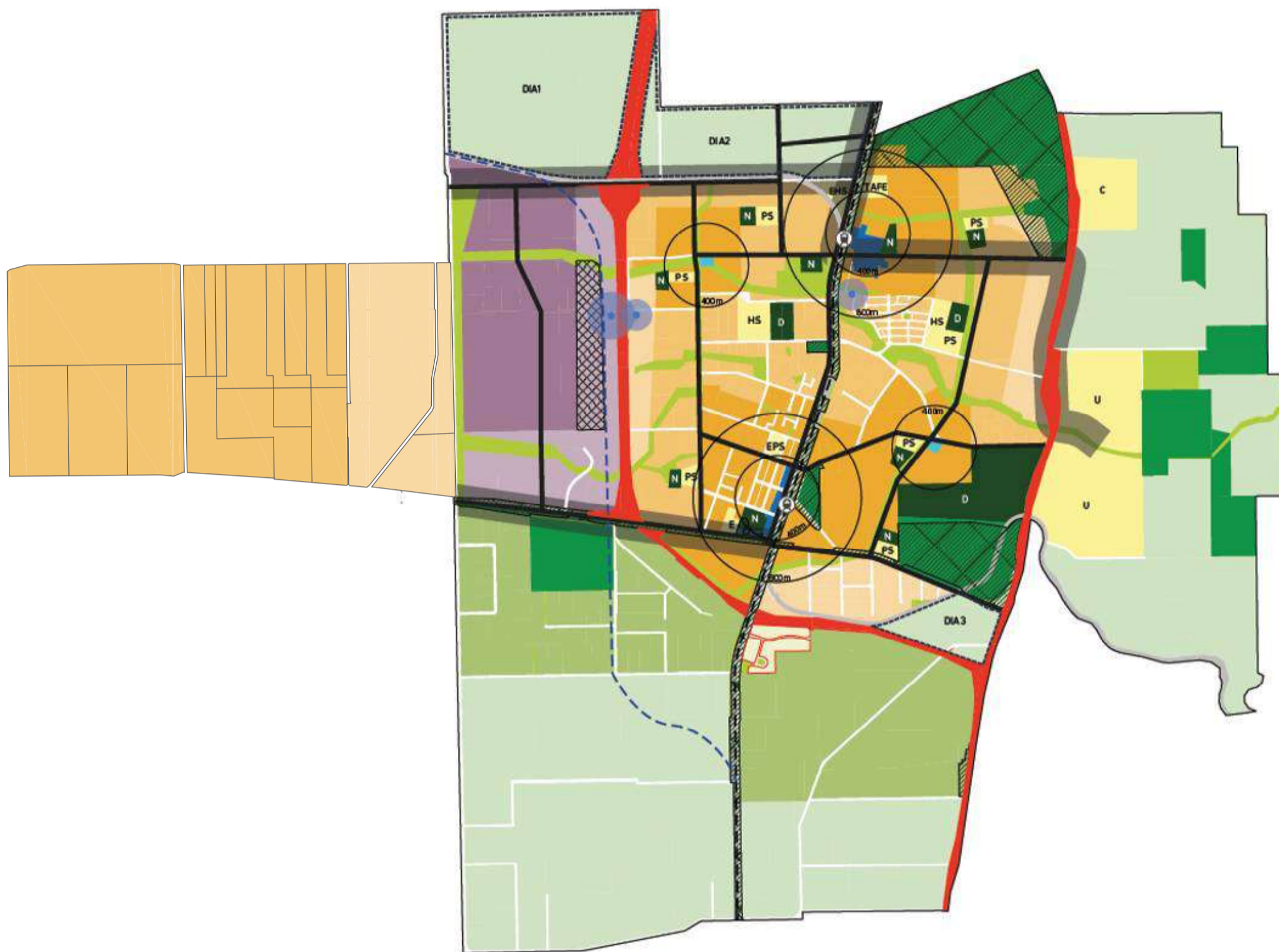


LEGEND

- | | | |
|--|------------------------------|---------------------------------------|
| — MUNDIJONG DSP BOUNDARY | ■ MEDIUM - HIGH: R40-100 | ● WASTE WATER PUMP STATION AND BUFFER |
| ■ DISTRICT CENTRE | ■ LOW (SUBURBAN): R20-35 | - - - DIA BOUNDARY |
| ■ NEIGHBOURHOOD CENTRE | ■ LOW (TRANSITIONAL): R10-15 | ○ DEVELOPMENT INVESTIGATION AREA |
| ■ COMMUNITY AND PUBLIC PURPOSE | ■ SPECIAL USE | ○ EHS EXISTING HIGH SCHOOL |
| ■ LIGHT INDUSTRIAL | ■ RURAL SMALL HOLDINGS | ○ EPS EXISTING PRIMARY SCHOOL |
| ■ INDUSTRIAL | ■ RURAL | ○ HS HIGH SCHOOL |
| ■ BUSH FOREVER | ■ PRIMARY DISTRIBUTOR | ○ PS PRIMARY SCHOOL |
| ■ DISTRICT/ NEIGHBOURHOOD OPEN SPACE | ■ DISTRICT DISTRIBUTOR | ○ D DISTRICT OPEN SPACE |
| ■ RESERVE | ■ RAILWAY RESERVE | ○ N NEIGHBOURHOOD OPEN SPACE |
| ■ MULTIPLE USE CORRIDOR/LOCAL OPEN SPACE | ■ FREIGHT RAIL REALIGNMENT | ○ U UNIVERSITY/ INNOVATION HUB |
| ■ INTER-MODAL FACILITY | ■ RAIL LINE | ○ C CEMETERY |
| ■ HIGH FREQUENCY TRANSIT CORRIDOR | ○ TRANSIT NODE | ○ E EMERGENCY SERVICES |

APPENDIX 2

Proposed Mundijong District Structure Plan Mapping



Mundijong District Structure Plan

<p>LEGEND</p> <ul style="list-style-type: none"> — MUNDIJONG DSP BOUNDARY ■ DISTRICT CENTRE ■ NEIGHBOURHOOD CENTRE ■ COMMUNITY AND PUBLIC PURPOSE ■ LIGHT INDUSTRIAL ■ INDUSTRIAL ■ BUSH FOREVER ■ DISTRICT/ NEIGHBOURHOOD OPEN SPACE ■ RESERVE ■ MULTIPLE USE CORRIDOR/LOCAL OPEN SPACE ■ INTER-MODAL FACILITY ■ HIGH FREQUENCY TRANSIT CORRIDOR 	<ul style="list-style-type: none"> ■ MEDIUM - HIGH R40-100 ■ LOW (SUBURBAN): R20-35 ■ LOW (TRANSITIONAL): R10-15 ■ SPECIAL USE ■ RURAL SMALL HOLDINGS ■ RURAL ■ PRIMARY DISTRIBUTOR ■ DISTRICT DISTRIBUTOR ■ RAILWAY RESERVE ■ FREIGHT RAIL REALIGNMENT ■ RAIL LINE ⊙ TRANSIT NODE 	<ul style="list-style-type: none"> ⊙ WASTE WATER PUMP STATION AND BUFFER --- DIA BOUNDARY ■ DIA DEVELOPMENT INVESTIGATION AREA ■ EHS EXISTING HIGH SCHOOL ■ EPS EXISTING PRIMARY SCHOOL ■ HS HIGH SCHOOL ■ PS PRIMARY SCHOOL ■ D DISTRICT OPEN SPACE ■ N NEIGHBOURHOOD OPEN SPACE ■ U UNIVERSITY/INNOVATION HUB ■ C CEMETERY ■ E EMERGENCY SERVICES
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Ordinary Council Meeting 17 December 2018

APPENDIX 3

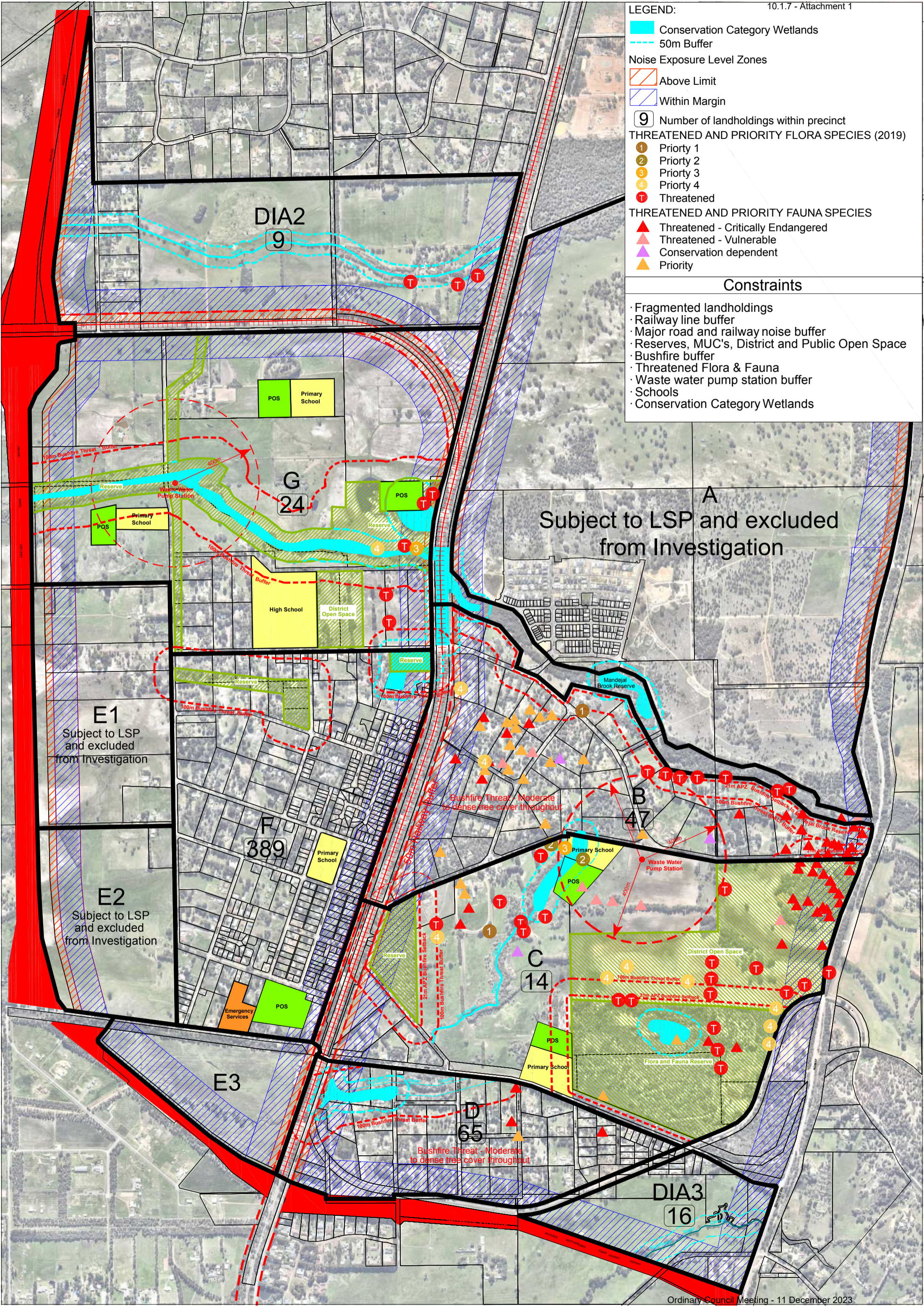
Precinct Constraints Mapping A3

LEGEND:

- Conservation Category Wetlands
- 50m Buffer
- Noise Exposure Level Zones**
- Above Limit
- Within Margin
- 9 Number of landholdings within precinct
- THREATENED AND PRIORITY FLORA SPECIES (2019)**
- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened
- THREATENED AND PRIORITY FAUNA SPECIES**
- Threatened - Critically Endangered
- Threatened - Vulnerable
- Conservation dependent
- Priority

Constraints

- Fragmented landholdings
- Railway line buffer
- Major road and railway noise buffer
- Reserves, MUC's, District and Public Open Space
- Bushfire buffer
- Threatened Flora & Fauna
- Waste water pump station buffer
- Schools
- Conservation Category Wetlands

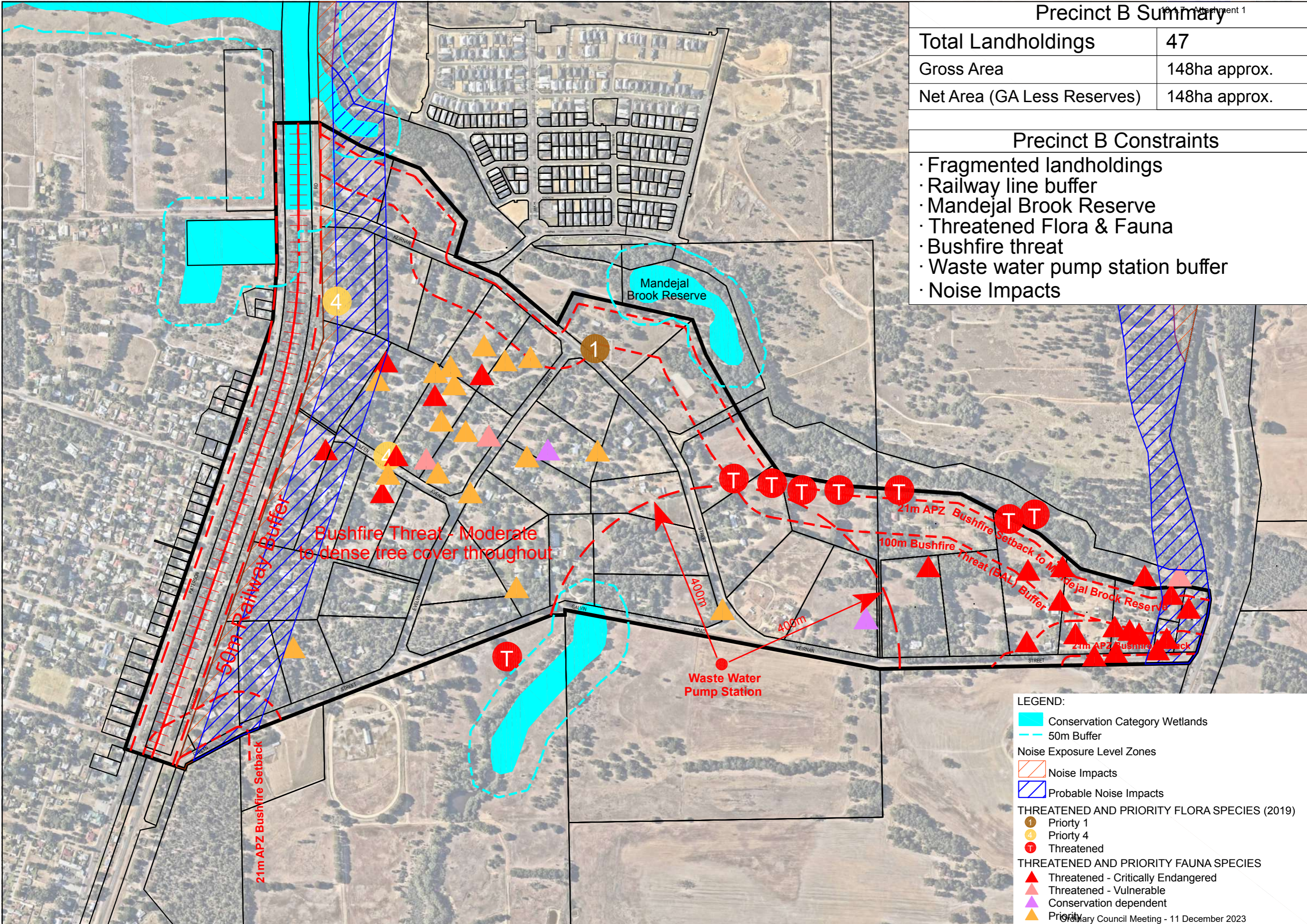


Precinct B Summary

Total Landholdings	47
Gross Area	148ha approx.
Net Area (GA Less Reserves)	148ha approx.

Precinct B Constraints

- Fragmented landholdings
- Railway line buffer
- Mandejal Brook Reserve
- Threatened Flora & Fauna
- Bushfire threat
- Waste water pump station buffer
- Noise Impacts



Bushfire Threat - Moderate to dense tree cover throughout

LEGEND:

- Conservation Category Wetlands
- 50m Buffer
- Noise Exposure Level Zones
- Noise Impacts
- Probable Noise Impacts

THREATENED AND PRIORITY FLORA SPECIES (2019)

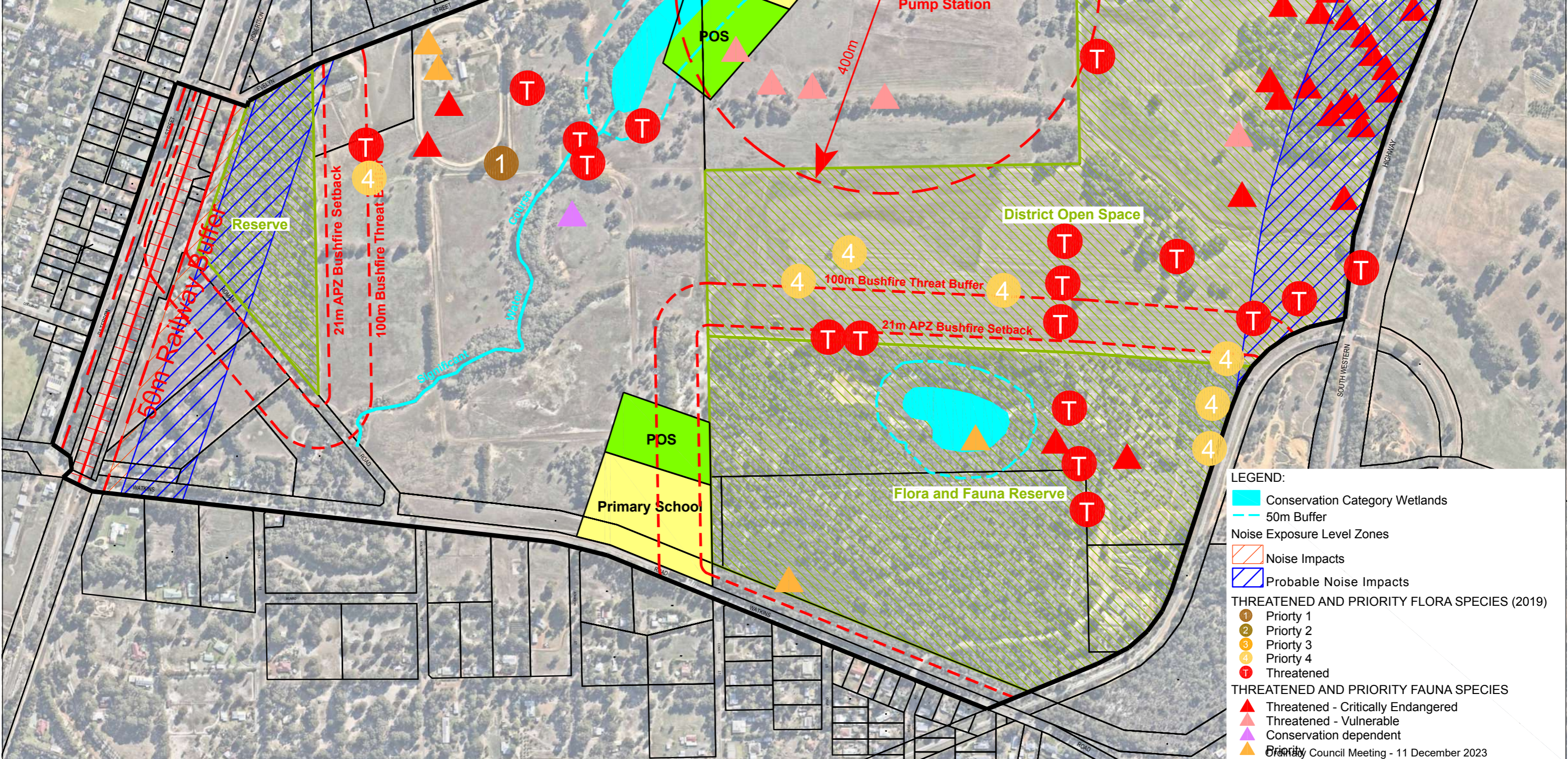
- Priority 1
- Priority 4
- Threatened

THREATENED AND PRIORITY FAUNA SPECIES

- Threatened - Critically Endangered
- Threatened - Vulnerable
- Conservation dependent
- Priority

Ordinary Council Meeting - 11 December 2023

Precinct C Summary	
Total Landholdings	14
Gross Area	253ha
Total Reserves/DOS	121ha
Net Area (GA Less Reserves)	132ha
Precinct C Constraints	
<ul style="list-style-type: none"> · Railway buffer · Wastewater pump station buffer · Reserve, Flora and Fauna Reserve, District Open Space & Significant Water Course · Threatened Flora & Fauna · Bushfire threat · Primary School & Neighbouring POS · Conservation Category Wetland and buffer · Noise Impacts 	



LEGEND:

- Conservation Category Wetlands
- 50m Buffer
- Noise Exposure Level Zones
- ▭ Noise Impacts
- ▭ Probable Noise Impacts

THREATENED AND PRIORITY FLORA SPECIES (2019)

- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened

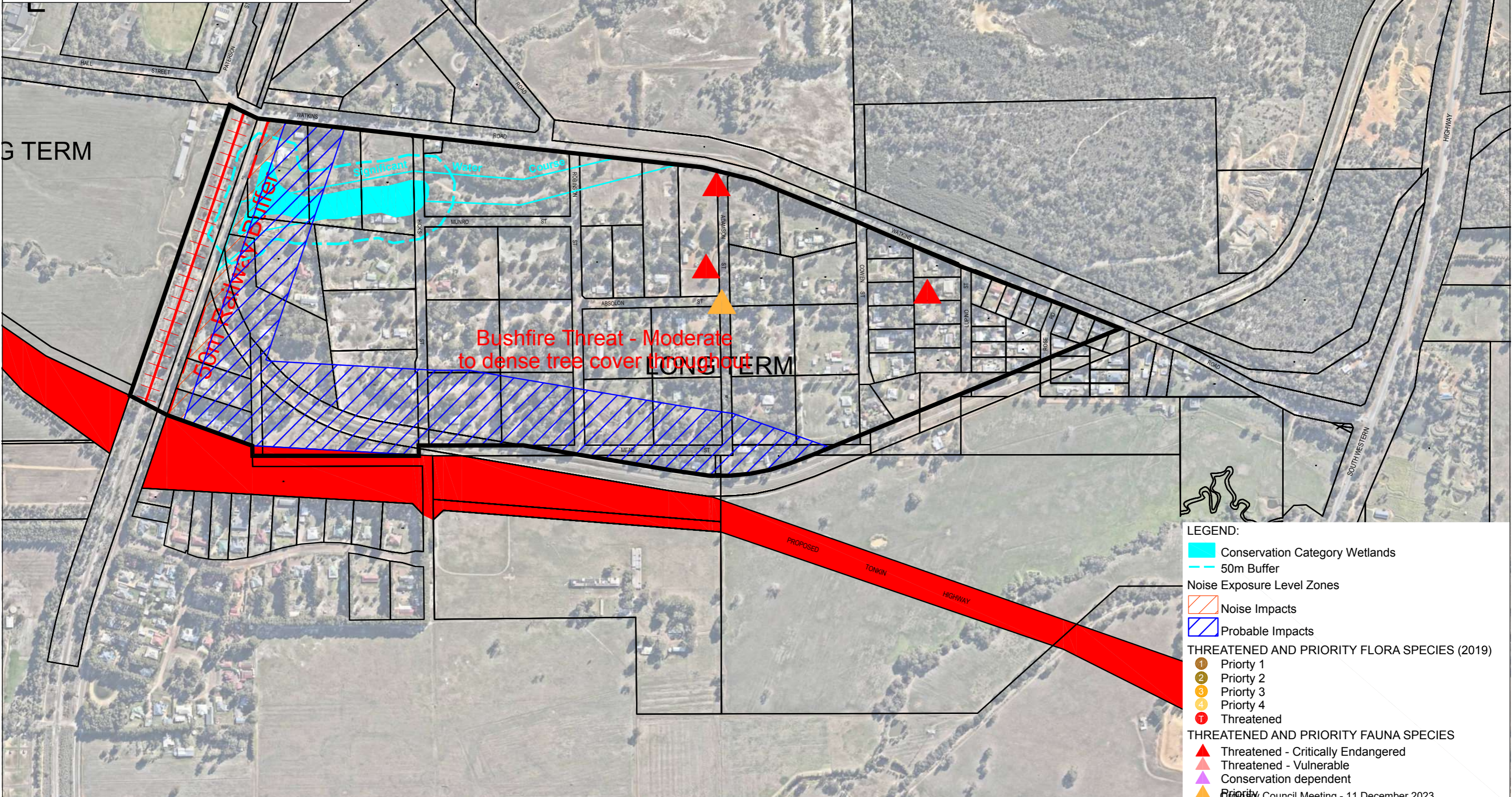
THREATENED AND PRIORITY FAUNA SPECIES

- ▲ Threatened - Critically Endangered
- ▲ Threatened - Vulnerable
- ▲ Conservation dependent
- ▲ Priority

City Council Meeting - 11 December 2023

Precinct D Summary	
Total Landholdings	65
Gross Area	95ha
Total Reserves	5.38ha
Net Area (GA Less Reserves)	89.62ha
Precinct D Constraints	
<ul style="list-style-type: none"> · Railway buffer · Significant Water Course · Threatened Fauna · Bushfire threat · Conservation Category Wetland and buffer · Noise Impacts 	

LONG TERM



LONG TERM

50m Railway Buffer

significant Water Course

Bushfire Threat - Moderate to dense tree cover throughout

LONG TERM

LEGEND:

- Conservation Category Wetlands
- 50m Buffer
- Noise Exposure Level Zones
- Noise Impacts
- Probable Impacts

THREATENED AND PRIORITY FLORA SPECIES (2019)

- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened

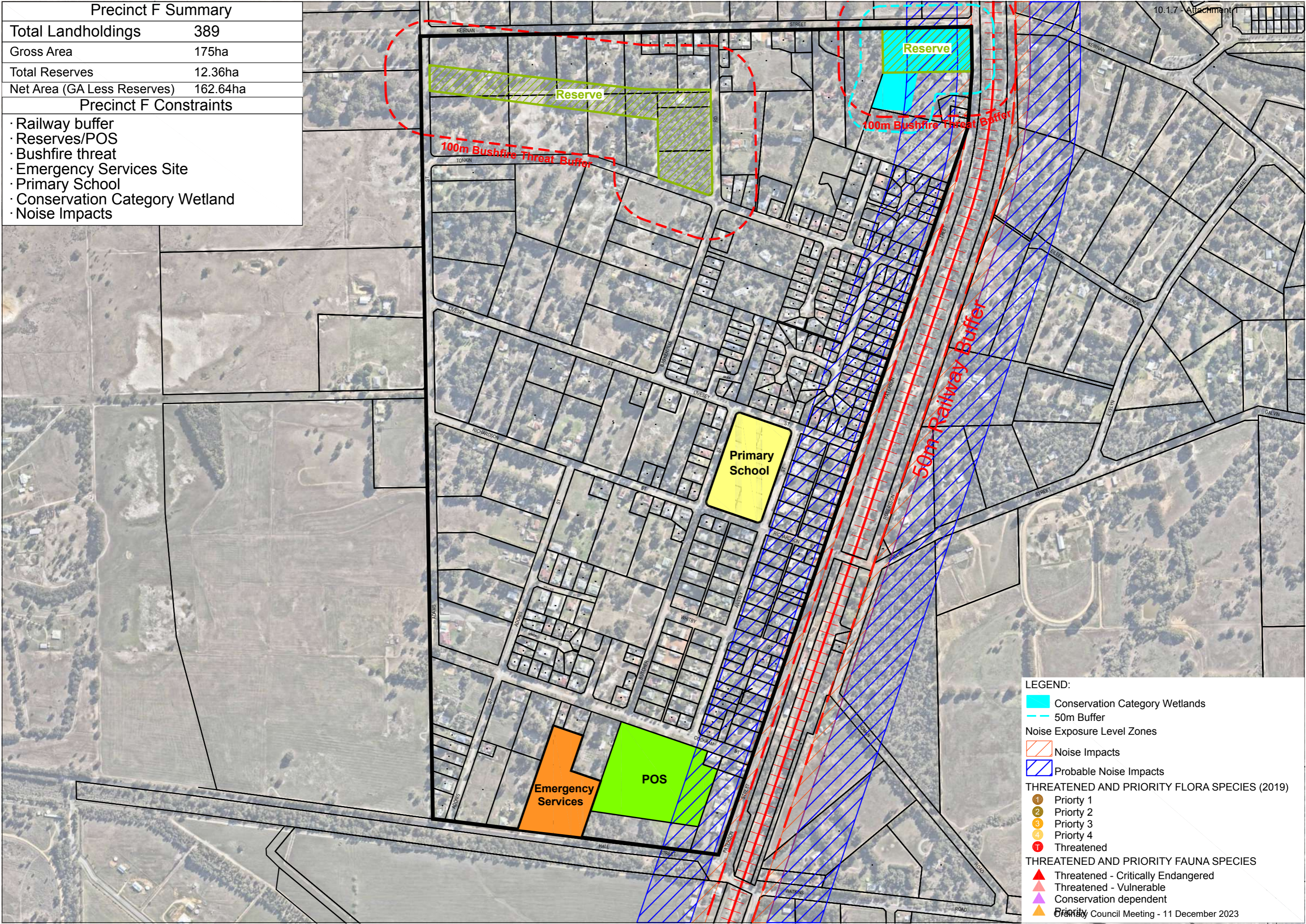
THREATENED AND PRIORITY FAUNA SPECIES

- Threatened - Critically Endangered
- Threatened - Vulnerable
- Conservation dependent
- Priority

City Council Meeting - 11 December 2023

Precinct F Summary	
Total Landholdings	389
Gross Area	175ha
Total Reserves	12.36ha
Net Area (GA Less Reserves)	162.64ha
Precinct F Constraints	

- Railway buffer
- Reserves/POS
- Bushfire threat
- Emergency Services Site
- Primary School
- Conservation Category Wetland
- Noise Impacts



LEGEND:

- Conservation Category Wetlands
- 50m Buffer

Noise Exposure Level Zones

- Noise Impacts
- Probable Noise Impacts

THREATENED AND PRIORITY FLORA SPECIES (2019)

- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened

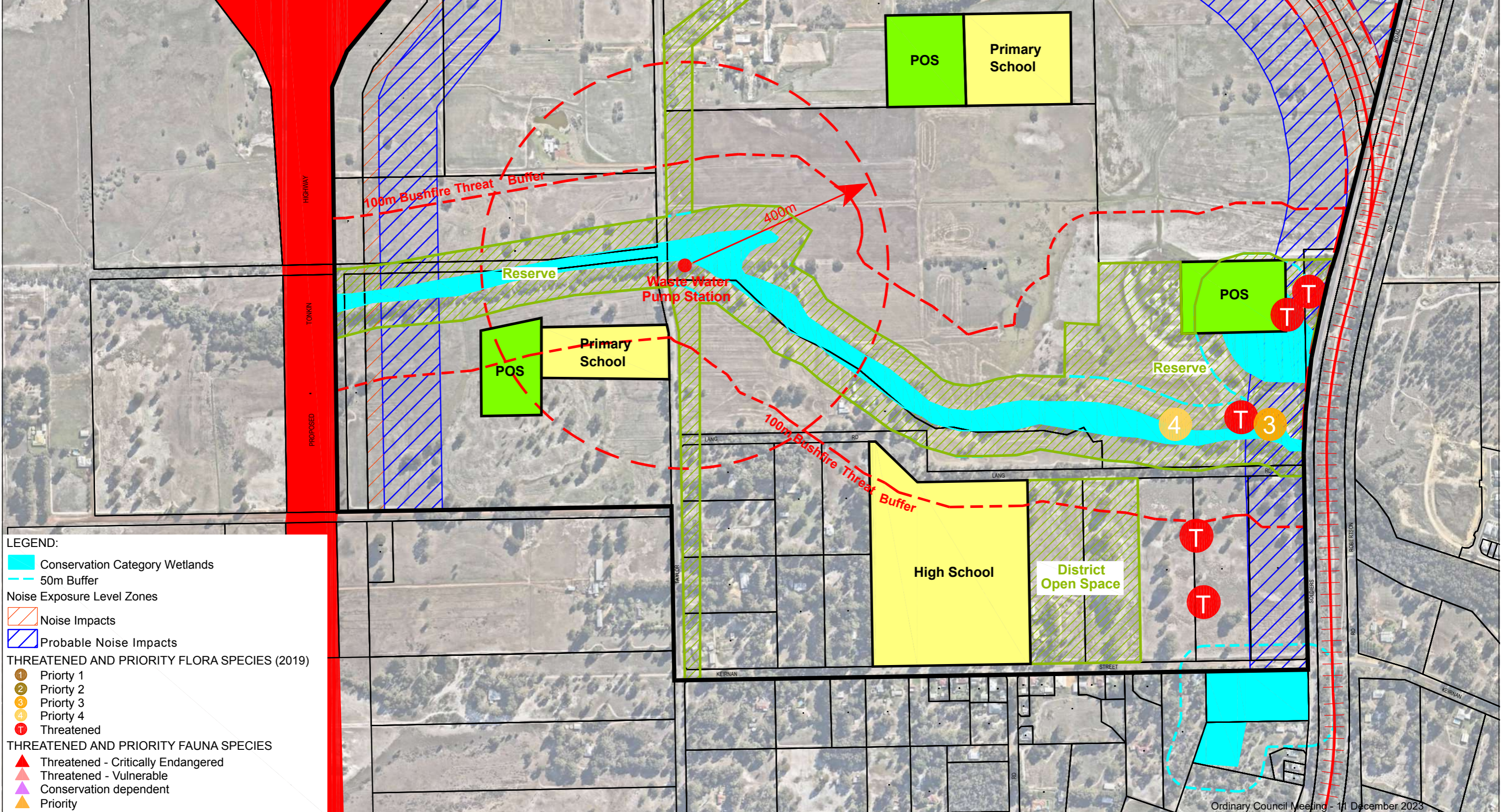
THREATENED AND PRIORITY FAUNA SPECIES

- Threatened - Critically Endangered
- Threatened - Vulnerable
- Conservation dependent
- Priority

City Council Meeting - 11 December 2023

Precinct G Summary	
Total Landholdings	24
Gross Area	277ha
Total Reserves	47.83ha
Net Area (GA Less Reserves)	229.17ha
Precinct G Constraints	

- Railway buffer and noise buffer
- Tonkin Highway noise buffer
- Waste water pump station and buffer
- Reserves/POS/Significant Watercourses
- High School and Primary Schools
- Conservation Category Wetland and buffer



LEGEND:

- Conservation Category Wetlands
- 50m Buffer
- Noise Exposure Level Zones**
- Noise Impacts
- Probable Noise Impacts
- THREATENED AND PRIORITY FLORA SPECIES (2019)**
- 1 Priority 1
- 2 Priority 2
- 3 Priority 3
- 4 Priority 4
- T Threatened
- THREATENED AND PRIORITY FAUNA SPECIES**
- ▲ Threatened - Critically Endangered
- ▲ Threatened - Vulnerable
- ▲ Conservation dependent
- ▲ Priority

Development Investigation Area 2 Summary

Total Landholdings	9
Gross Area	158ha
Total Reserves	19.4ha
Net Area (GA Less Reserves)	138.6ha

- Development Investigation Area 2 Constraints
- Railway buffer and noise buffer
 - Tonkin Highway noise buffer
 - Reserve/Multiple Use Corridor
 - Threatened priority flora

LEGEND:

- Conservation Category Wetlands
- 50m Buffer

Noise Exposure Level Zones

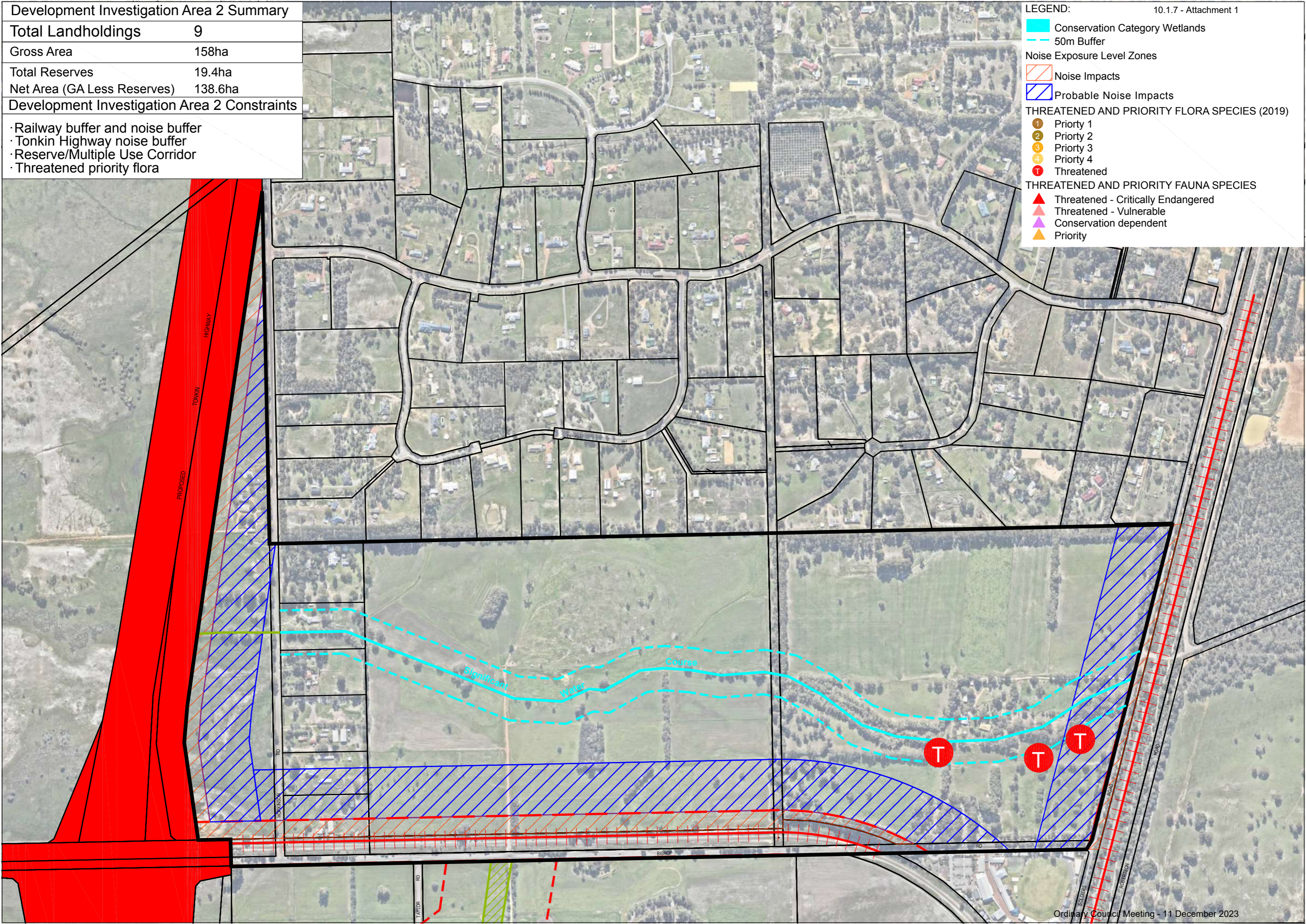
- Noise Impacts
- Probable Noise Impacts

THREATENED AND PRIORITY FLORA SPECIES (2019)

- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Threatened

THREATENED AND PRIORITY FAUNA SPECIES

- Threatened - Critically Endangered
- Threatened - Vulnerable
- Conservation dependent
- Priority



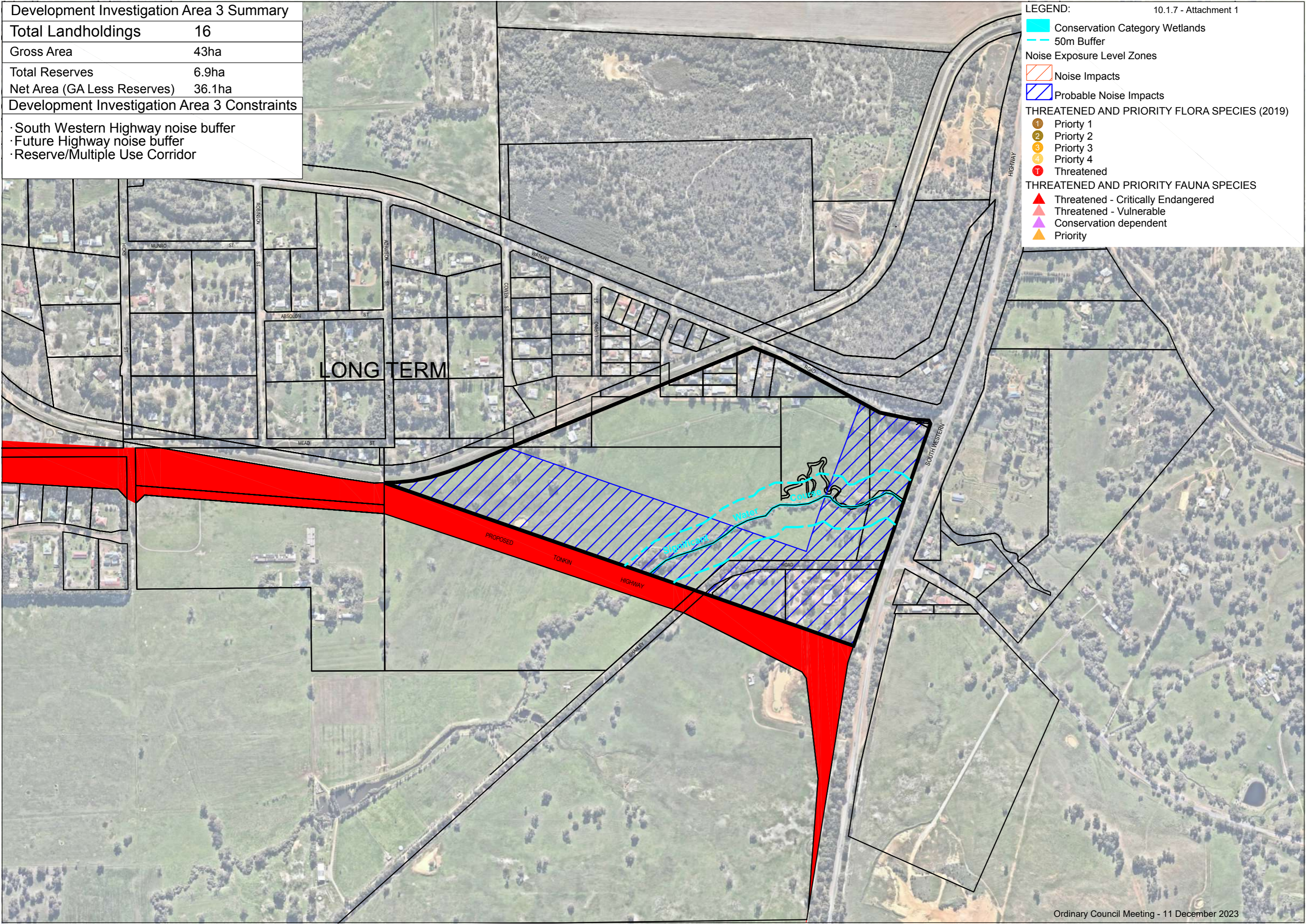
Development Investigation Area 3 Summary

Total Landholdings	16
Gross Area	43ha
Total Reserves	6.9ha
Net Area (GA Less Reserves)	36.1ha
Development Investigation Area 3 Constraints	

- South Western Highway noise buffer
- Future Highway noise buffer
- Reserve/Multiple Use Corridor

LEGEND: 10.1.7 - Attachment 1

- Conservation Category Wetlands
- 50m Buffer
- Noise Exposure Level Zones
- Noise Impacts
- Probable Noise Impacts
- THREATENED AND PRIORITY FLORA SPECIES (2019)
 - Priority 1
 - Priority 2
 - Priority 3
 - Priority 4
 - Threatened
- THREATENED AND PRIORITY FAUNA SPECIES
 - Threatened - Critically Endangered
 - Threatened - Vulnerable
 - Conservation dependent
 - Priority



APPENDIX 4

Subject Site Environmental Assessment (Aurora Environmental March 2019)



2 Bulwer Street
PERTH WA 6000
T: (+61) 8 9227 2600
F (+61) 8 9227 2699
www.auroraenvironmental.com.au

Desktop Environmental Assessment – Various Lots Bounded by Mundijong Road, Kargotich Road, Leipold Road and King Road, Oldbury



Prepared For: Watson Property Group
6/110 Erindale Road
BALCATTWA WA 6021
Report Number: AP2019/069
Report Version: 2
Report Date: 13 March 2019

EXECUTIVE SUMMARY

Aurora Environmental was commissioned by Watson Property Group to conduct a high level desktop environmental assessment of an 858 hectare (ha) parcel of land (the study area) in Oldbury. The study area is bounded by Mundijong, Kargotich, Leipold and King Roads.

The study area is zoned 'Rural' under the Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 and 'Rural' under the Metropolitan Region Scheme. The aim of this assessment is to determine the suitability of the study area for future urban development.

The environmental assessment found the site itself contains few environmental constraints and would be suitable to support future development. From an ecological perspective, the degraded nature of the site due to previous clearing and many years of low intensity agricultural use mean that sensitive environments are unlikely to be adversely impacted.

Aurora Environmental recommends the following matters should be considered in planning and developing the study area:

- Soil permeability is anticipated to be low and potentially not suitable for infiltration of stormwater. Testing should be conducted to inform stormwater management options. This can be undertaken at the structure plan stage, or potentially at the local structure plan stage.
- Consider undertaking a targeted ASS investigation and the preparation and implementation of Management Plans (if required) once disturbance (dewatering or excavation) details are known. This is best undertaken at the subdivision stage when more detailed engineering design has been completed.
- Implement a pre-development groundwater and surface water monitoring program to capture water quality data and groundwater levels. It is likely that fill material and sub-soil drainage will be needed to provide adequate separation from shallow groundwater levels and 100-year flood levels. The pre-development monitoring should be undertaken at the structure plan stage.
- Implement the Better Urban Water Management framework, commencing with the preparation of a district water management strategy (DWMS). Ensure that a water sensitive urban design approach is adopted to planning for the study area. The DWMS should be prepared in support of the scheme amendment or potentially at the structure planning stage. A local water management strategy (LWMS) may be prepared at the local structure plan stage and an urban water management plan (UWMP) can be prepared as condition of subdivision.
- The risk of widespread contamination in the study area was regarded as low due to the long history of low intensity agricultural uses. However, it should be noted that any areas of contamination (if identified at a later stage) are to be managed in accordance with the requirements of the *Contaminated Sites Act 2003*.
- A buffer of 50m to the mapped conservation category wetland (CCW) along Mundijong Road, which is also a Bush Forever Site, is provided and a management plan prepared for the treatment of the buffer/interface with the proposed development in the study area. The buffer should be reflected in the structure plans and the management plan could be prepared

Desktop Environmental Assessment – Various Lots Bounded by Mundijong Road, Kargotich Road, Leipold Road and King Road, Oldbury

at local structure plan stage or as a condition of subdivision. However, if the landowners wish to apply to have the CCW management category downgraded to reduce the buffer, this will involve a site assessment of the vegetation types and condition, presence of any threatened flora or ecological communities and collection of site photos. This information will need to be submitted to the Department of Biodiversity, Conservation and Attractions (DBCA) for review and assessment as a formal request to modify the Geomorphic Wetlands of the Swan Coastal Plain dataset.

- Complete a bushfire risk assessment and if necessary prepare a bushfire management plan. This is best conducted at the structure planning stage. Appropriate setbacks and building design considerations may be required to ensure that bushfire risks are taken into account during the development of the site.

Desktop Environmental Assessment – Various Lots Bounded by Mundijong Road, Kargotich Road, Leipold Road and King Road, Oldbury

DISCLAIMER

This document has been produced in accordance with and subject to an agreement between Aurora Environmental (“**Aurora**”) and the client for whom it has been prepared (“**Client**”). It is restricted to those issues that have been raised by the Client in its engagement of Aurora and prepared using the standard of skill and care ordinarily exercised by Environmental / Occupational Health and Safety consultants in the preparation of such documents.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by Aurora and the Client without first obtaining the prior written consent of Aurora, does so entirely at their own risk and should not alter their position or refrain from doing so in reliance of this document. Aurora denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed by Aurora

QUALITY ASSURANCE

Aurora Environmental has implemented a comprehensive range of quality control measures on all aspects of the company’s operation.

An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed and signed off by senior members of the consultancy team prior to issue to the client.

Document No: WPL2019-001-ENVA-001_at_V2

Report No: AP2019/069

Author: Angela Taylor
Senior Environmental
Scientist



13 March 2019

Signature

Date

Reviewed by: Paul Zuvela
Manager – Environmental
Impact Assessment &
Approvals



13 March 2019

Signature

Date

Desktop Environmental Assessment – Various Lots Bounded by Mundijong Road, Kargotich Road, Leipold Road and King Road, Oldbury

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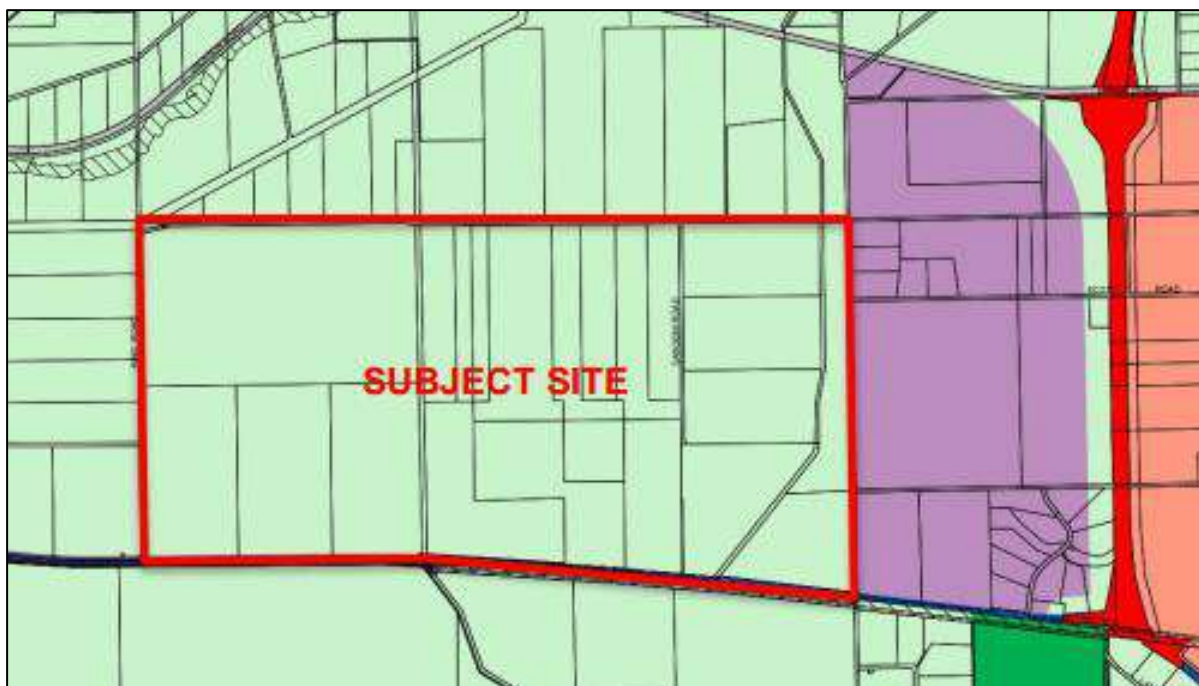
1 INTRODUCTION

1.1 BACKGROUND

Aurora Environmental has been commissioned by Watson Property Group to conduct a high level desktop environmental assessment of an 858 hectare (ha) parcel of land (the study area) in Oldbury (Plate 1). The 858 ha study area is bound by Mundijong, Kargotich, Leipold and King Roads. It is approximately 50km south-southeast of the Perth Central Business District and approximately 3km west of the Mundijong township. It is located on the eastern side of the Swan Coastal Plain.

The study area is zoned 'Rural' under the Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 and 'Rural' under the Metropolitan Region Scheme (Plate 1).

PLATE 1: STUDY AREA



Historical aerial photography from Landgate (2019a) shows that in November 1953 the entire study area had been cleared with few trees scattered throughout paddocks. No houses or other built structures are evident. A few houses can be seen by September 1974 and the first evidence of clay extraction on Lot 275 was noted. The most recent aerial photography (August 2018) and site inspection (13 February 2019) confirmed the majority of the site is cleared of native vegetation with scattered trees, mainly in the north east corner. The study area appears to be primarily used for low intensity agriculture or horse keeping.

1.2 PURPOSE

The aim of this assessment is to determine the suitability of the study area for future urban development. Also provided are recommendations for future environmental investigations as well as advice in relation to the management of potential environmental impacts associated with the future development of the study area as well as guidance about the environmental approvals that may be required in order to facilitate development of the land.

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1.3 SCOPE

The scope of this high level desktop assessment included a review of the following:

- Geology, soils and acid sulfate soils risk;
- Desktop information about conservation significant flora, vegetation and fauna using the Department of Biodiversity, Conservation and Attractions' (DBCA) NatureMap (DBCA, 2019a) and the Department of the Environment and Energy's (DoEE) Protected Matters Search Tool (DoEE, 2019);
- Desktop information about wetlands and other surface water features;
- Available groundwater information;
- The Department of Water and Environmental Regulation's (DWER) Contaminated Sites online database;
- Historical aerial photographs (Landgate, 2019a) to see if there were any historical activities in the study area that may have the potential to cause contamination;
- Surrounding land uses and the potential for land use conflicts between the proposed use for the study area and adjacent land uses;
- Aboriginal heritage issues based on desktop information available from the Department of Planning, Lands and Heritage's (DPLH) Aboriginal Heritage Inquiry System; and
- Previous advice from the Environmental Protection Authority (EPA) relating to the study area or nearby sites.

A brief site inspection was conducted by an Associate Environmental Scientist from Aurora Environmental on 13 February 2019. Lots 272 to 275 were accessible during the site visit. All other lots were viewed from adjacent boundaries or from public roads.

2 EXISTING ENVIRONMENT

2.1 TOPOGRAPHY

The study area is relatively flat and is approximately 15 m Australian Height Datum (AHD) in height (DWER, 2019a) over the majority of the site, rising up to 20 m AHD in the north-east and south-east corners, and down to 10m AHD near the centre of the study area.

2.2 GEOLOGY AND SOILS

The study area is located on the eastern side of the Swan Coastal Plain. Jordan (1986) indicates that the majority of the study area is located within the Pleistocene aged Guildford Formation geological unit. The soils on the site are mapped as unit C_s which is described as Sandy Clay: white-grey to brown, fine to coarse, sub-angular to rounded, clay of moderate plasticity, with gravel and silt layers near the scarp, and is of alluvial origin. C_s soils have low permeability and corrosion potential, low to medium slope stability and low bearing capacity. They are suitable for excavation, however will likely require investigation to confirm geotechnical suitability for construction. Jordan (1986) also identifies two other soil units on the study area. A small area in the north-east corner of the site is mapped as unit S₁₀ which is Bassendean Sand over the Guildford Formation. The S₁₀ sand is highly permeable, white to pale grey at surface, yellow at depth; fine to medium grained, moderately sorted, sub-angular to sub-rounded, contains minor heavy minerals and is of eolian origin.

An area in the south-west corner of the study area is mapped as unit M_{sc1} which is Clayey Sandy Silt; pale brown sand, angular to rounded, low cohesion, and is of alluvial origin. This soil type is associated with a high water table and has low permeability (Jordan, 1986).

Soil landscape mapping by the Department of Agriculture and Food, available via Western Australian Local Government Association's (WALGA) Environmental Planning Tool, shows that the study area is predominantly located within the Pinjarra Soil Landscape Zone (Plate 2) which comprises alluvial deposits between the Bassendean Dunes Zone and the Darling Scarp as well as colluvial and shelf deposits adjacent to the Darling Scarp. The soils are broadly described as clayey to sandy alluvial soils with wet areas. A small portion in the north-east of the study area (Plate 2) is mapped as belonging to the Bassendean Soil Landscape Zone which comprises fixed dunes inland from the coastal dune zone. The soils are non-calcareous sands, podsolised soils with low-lying wet areas.

The Soil Landscape Unit mapping has been further refined into a series of sub-units. The mapping (Plate 3) shows that there are nine sub-units present in the study area. Seven of the sub-units belong to the Pinjarra Landscape Zone and two are associated with the Bassendean Landscape Zone (Plate 3).

Pinjarra Landscape Zone

- 213Pj_P1d – Flat to very gently undulating plain with deep acidic mottled (or effectively duplex) soils. Shallow pale sand to sandy loam over clay, imperfect to poorly drained and moderately susceptible to salinity.
- 213Pj_P2 – Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan layer at 1-2m.

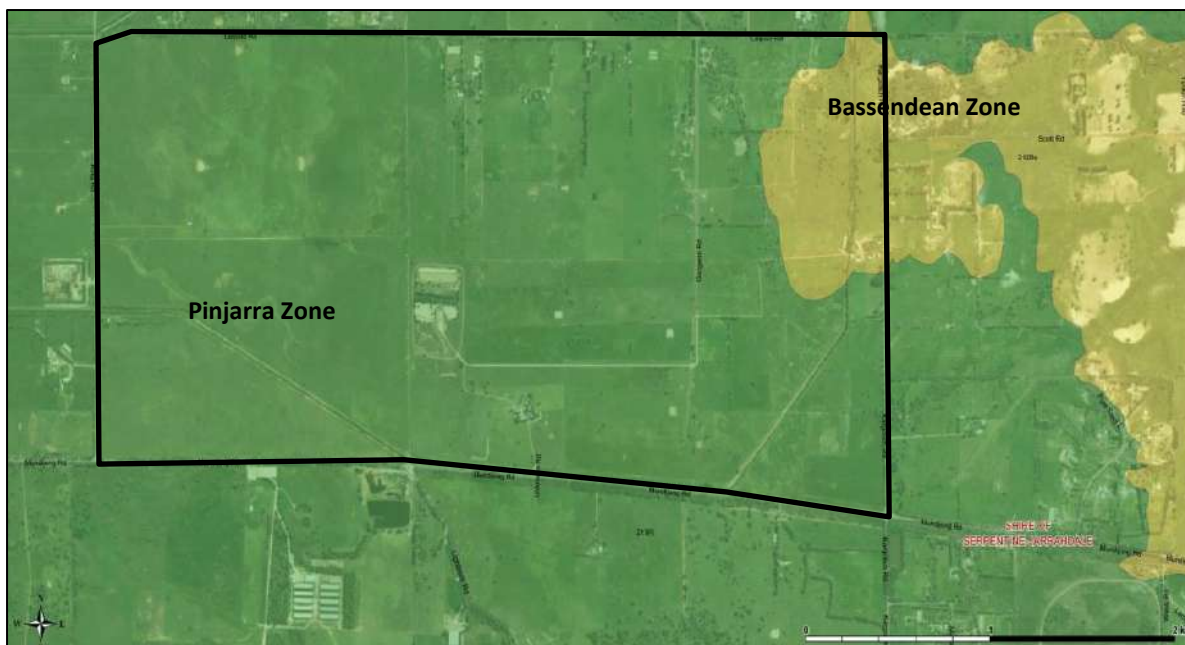
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- 213Pj_P3 – Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.
- 213Pj_P4 – Poorly drained flats, sometimes with gilgai micro-relief and with moderately deep to deep black, olive grey and some yellowish brown cracking clays and less commonly non-cracking friable clays with generally acidic sub-soils.
- 213Pj_P5 – Poorly drained flats, commonly with gilgai micro-relief and with deep black-grey to olive-brown cracking clays with subsoils becoming alkaline.
- 213Pj_SWP6b – Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well-drained soils associated with prior stream deposits. Soils are uniform brownish sands.
- 213Pj_P7 – Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and gley sandy duplex and effective duplex soils.

Bassendean Landscape Zone

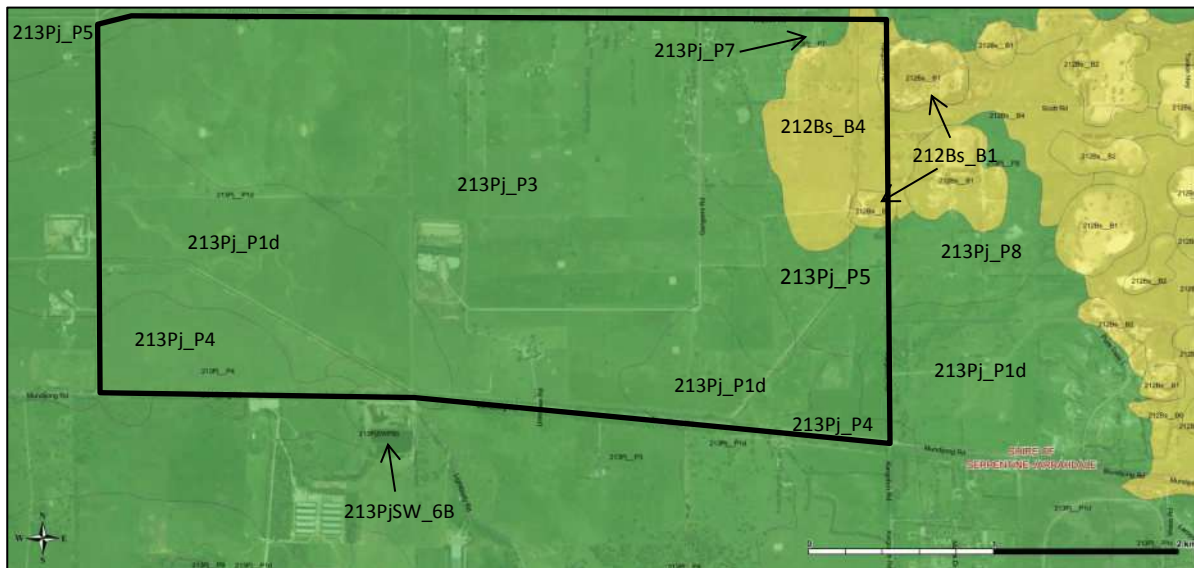
- 212Bs_B1 – Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands, sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2m, Banksia dominant.
- 212Bs_B4 – Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain greater at depths generally greater than 1.5m by clay or less frequently a strong iron-organic hardpan.

PLATE 2: SOIL LANDSCAPE ZONES



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PLATE 3: SOIL LANDSCAPE SUB-UNITS



2.3 ACID SULPHATE SOILS

Acid sulphate soils (ASS) are naturally occurring soils and sediment containing iron sulphides. Soils containing iron sulphides are generally found in a layer of waterlogged soil or sediment, and are benign in their natural state. However, when disturbed and exposed to air, they oxidise and produce sulphuric acid, iron precipitates and concentrations of dissolved heavy metals such as aluminium, iron and arsenic. The site is mapped as Class 2 - moderate to low risk of ASS within 3m of the natural soil surface, but high to moderate risk of ASS beyond 3m of natural soil surface (DWER, 2019b).

2.4 WETLANDS AND WATERWAYS

2.4.1 Wetlands

Plate 4 shows the geomorphic wetland mapping for the study area. The entire study area is mapped as a Multiple Use wetland (UFI 16021) with an area of Conservation Category Wetland (UFI 14817) along Mundijong Road, from just west of King Road to east of Kargotich Road (Australian Government, 2019).

The DBCA describes multiple use wetlands as '*wetlands with few important ecological attributes and functions remaining*' (DBCA, 2019b). Their use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning. However, generally multiple use wetlands do not represent a constraint to development. The DBCA describes conservation category wetlands (CCWs) as '*wetlands which support a high level of attributes and functions.*' These wetlands are the most valuable wetlands and any activity that may lead to further loss or degradation (including development or clearing) is considered inappropriate (DBCA, 2019b). However the area mapped as CCW in Plate 4 (the northern portion of the Mundijong Road reserve and abutting the southern boundary of the study area) was noted during the site inspection as comprising extensive infestation of *Watsonia (Watsonia bulbifera)* and being poorly vegetated. Therefore, its values are somewhat compromised and potentially the current values are not commensurate with the CCW classification. A reclassification of the wetland

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(or portion thereof) will require a detailed wetland assessment to be conducted and a request to the DBCA to modify the Geomorphic Wetlands of the Swan Coastal Plain dataset.

The study area is within the catchment of the Peel-Yalgorup System, which is recognised as a Wetland of International Significance and is afforded protection under the EPBC Act.

2.4.2 Waterways

The study area is within the Serpentine sub-catchment of the Peel-Harvey Estuary system. The Peel-Harvey Estuary system has a long history of water quality problems, largely related to the release of nutrients from agricultural activities within its catchment. The *Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992* (Government of Western Australia 1992) set out environmental quality objectives for the protection of the Peel-Harvey Estuary. The median annual load of total phosphorus (TP) flowing into the Estuary from the Serpentine River was set at less than 21 tonnes per annum. Water quality monitoring of the Serpentine River (water column and sediments) has shown there are high levels of phosphorus which is contributing to adverse impacts on the River system and the downstream Peel-Harvey Estuary (EPA, 2008). The *Water Quality Improvement Plan (WQIP) for the Rivers and Estuary of the Peel-Harvey System – Phosphorus Management* (EPA, 2008) notes that significant reductions of phosphorus are required in the Serpentine, i.e. the median annual load of phosphorus from the Serpentine Catchment is 69 tonnes per annum and the desired target is 21 tonnes per annum. Majority of this phosphorus export to the estuary system is attributable to grazing including intensive animal agriculture, feedlots and grazing areas (EPA, 2008).

Manjedal Brook / Oakland main drain, a non-perennial minor water course runs along the southern boundary of the site (DWER, 2018). During the site visit, two major drains were noted in the study area (Plate 5), along with a series of shallow spoon drains (Plate 6) that have been constructed to drain the paddocks and alleviate waterlogging and inundation during wet periods. It was noted during the site visit that the study area is low-lying with soils that have a low permeability and are likely to be waterlogged or inundated during wet months which would contribute to reduced productivity from agricultural activities such as cropping.

PLATE 4: GEOMORPHIC WETLANDS MAPPING



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PLATE 5: MAIN SURFACE DRAINAGE CHANNELS

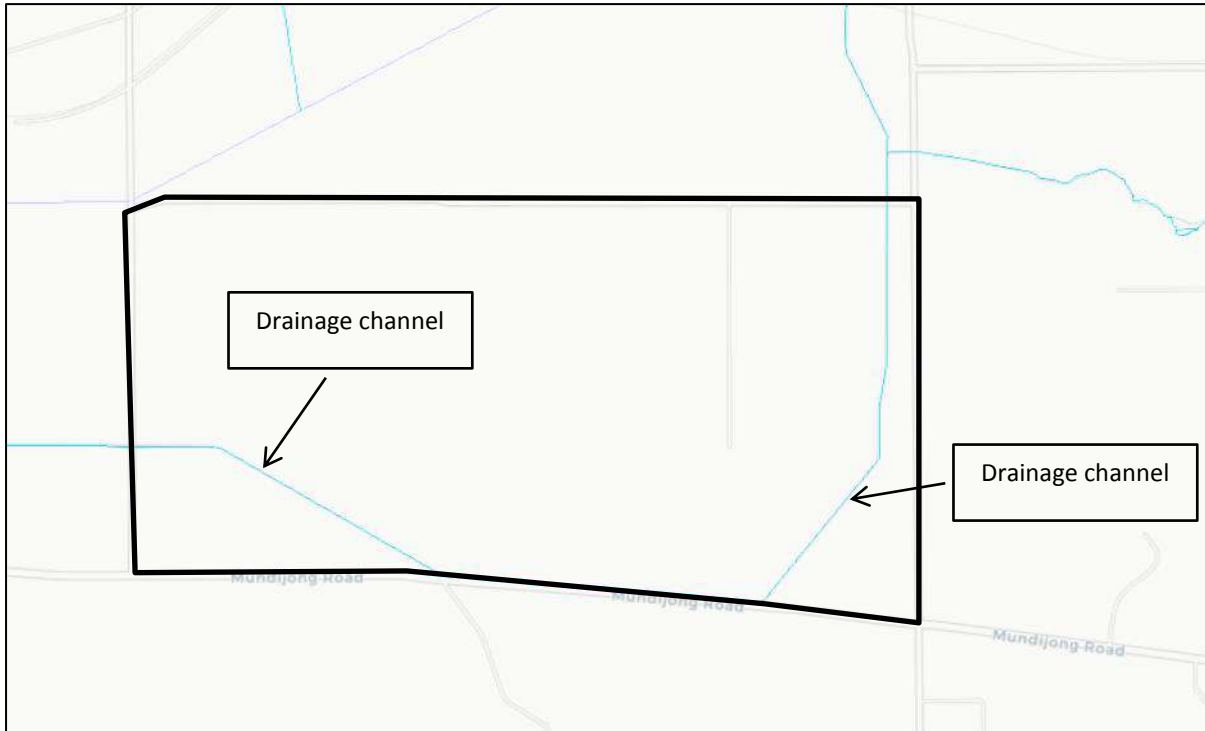


PLATE 6: EXAMPLE OF SHALLOW SURFACE DRAIN



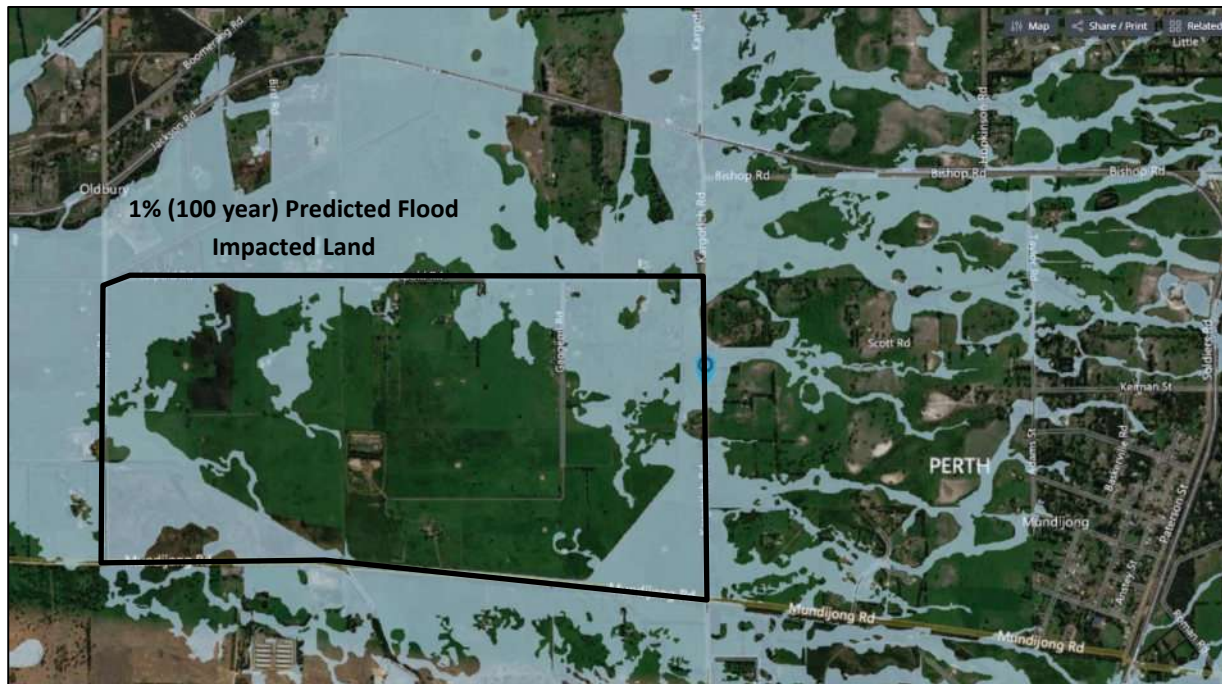
2.4.3 Flood Risk

The DWER’s floodplain mapping provides guidance about land potentially impacted by major flooding events. The floodplain risk mapping (Plate 7) shows that the central portion of the study area is not at risk of flooding. However, the outer portions, notably in the north-east, south-east,

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south-west and north-west corners of the study area, may be prone to flooding during the 100 year ARI event at existing ground levels.

PLATE 7: 100-YEAR FLOOD RISK MAPPING



Source: DoW Report No. WST 71 (Hall, 2015)

2.5 GROUNDWATER

The study area is located within the Serpentine Groundwater Area as proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act) (DWER, 2018). The Perth Groundwater Map (DWER, 2019a) provides some groundwater level information; depicting minimum groundwater levels, but no details in relation to maximum groundwater levels. The groundwater contours in the Perth Groundwater Map (Plate 8) show that a deep drain north of Leipold Road appears to be influencing local groundwater levels (Plate 8). In general, groundwater levels appear to be at their deepest in the western half of the study area and shallower in the eastern portion.

The groundwater levels in the Perth Groundwater Map need to be interpreted with some caution with respect to accuracy of the data and ground elevation information. Further investigations are recommended to refine maximum groundwater levels for the study area, to inform the civil engineering design for future development ensuring that risks posed by shallow groundwater levels are adequately taken into account.

Plate 9 shows the location of DWER groundwater bores.

Whilst there are a number of bores in the study area, only some of these have information on groundwater levels. The four bores in or near the study area that have groundwater information are:

- 61410148 – located on the southern border of the study area, near the south east corner;
- 61410130 – located west of the south west corner of the study area;

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- 61410131 – located north of the northwest corner of the study area; and
- 61410151 – located north of the northeast corner of the study area.

PLATE 8 – GROUNDWATER LEVELS (in m AHD)

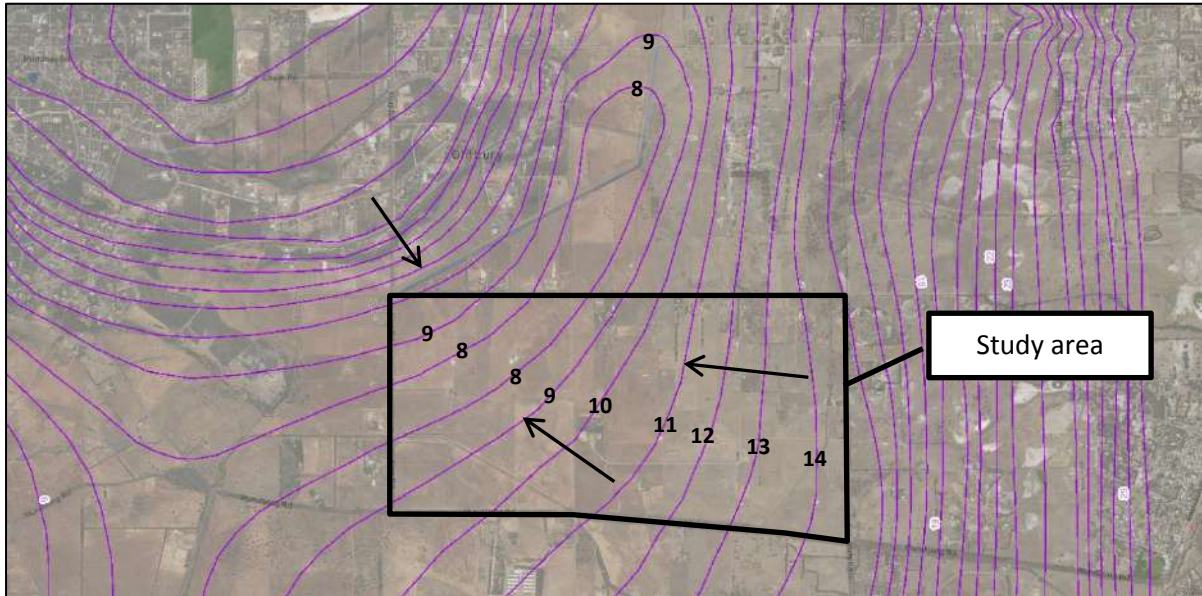


PLATE 9 – LOCATION OF DWER GROUNDWATER BORES



Plates 10 to 13 show the groundwater levels recorded at these four bores. The general trend across all bores is a decline in water level, this being most apparent for bore 61410148 located on the southern border of the site. This trend is consistent with observations from other localities in the Perth region where groundwater levels have been declining since the mid-1970's due to a reduction in average annual rainfall over this period.

Based on the available records, the maximum groundwater level recorded since 1975 for Bore 61410148 is approximately 14 m AHD. With the ground elevation at this location being 16.02 m AHD, this represents a depth to groundwater for the Superficial Aquifer of approximately

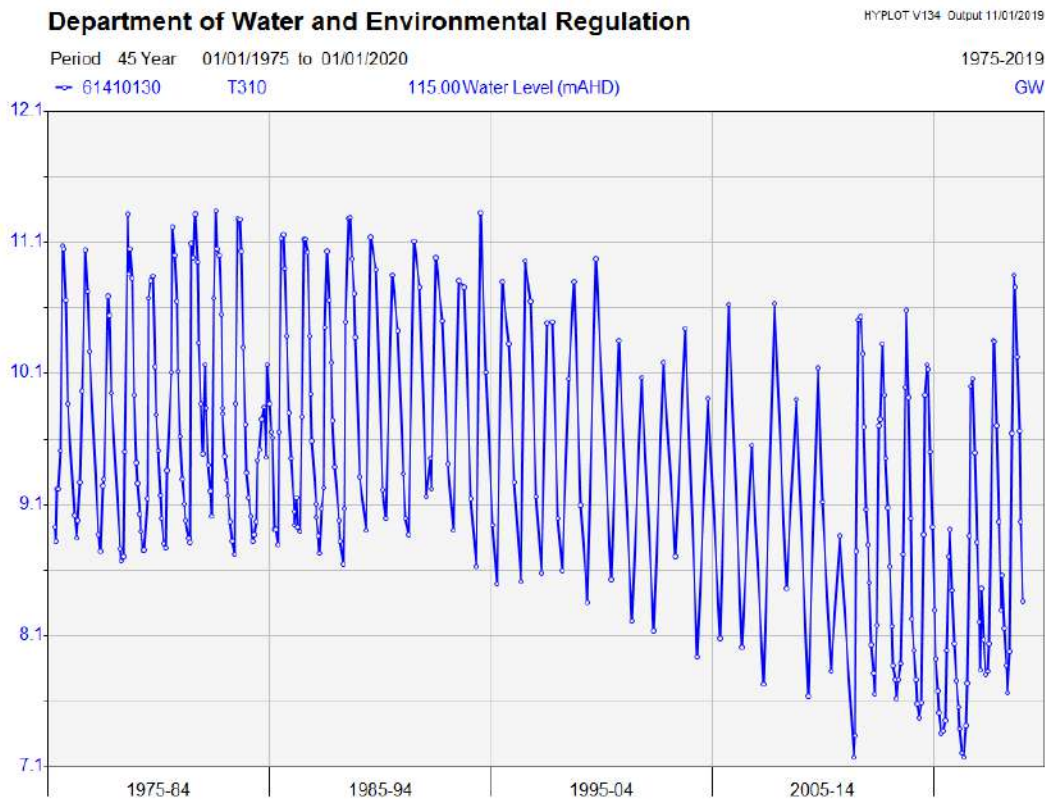
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2 m below ground level. For Bore 61410130, the maximum groundwater level recorded since 1975 was approximately 11.3 m AHD and the ground elevation at this location is 11.694 m AHD, representing a depth to groundwater of 0.394 m below ground level.

The data suggests that groundwater levels may be shallow in the study area. However, further monitoring to inform the preparation of a Local Water Management Strategy (LWMS) is recommended with a greater number of bores to be installed and monitored across two winters. The monitoring program should also capture groundwater level data from the DWER bores near the site (particularly Bore 61410148) to provide a reference point for the newly installed bores and potentially enable a correction factor to be applied to determine an appropriate maximum groundwater level across the study area.

The majority of groundwater beneath the study area is brackish (1,000-3,000mg/L) with a small area in the south east corner mapped as saline (3,000-7,000mg/L) (DWER, 2019a).

PLATE 10 – HYDROGRAPH BORE 61410130



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PLATE 11 – HYDROGRAPH BORE 61410148

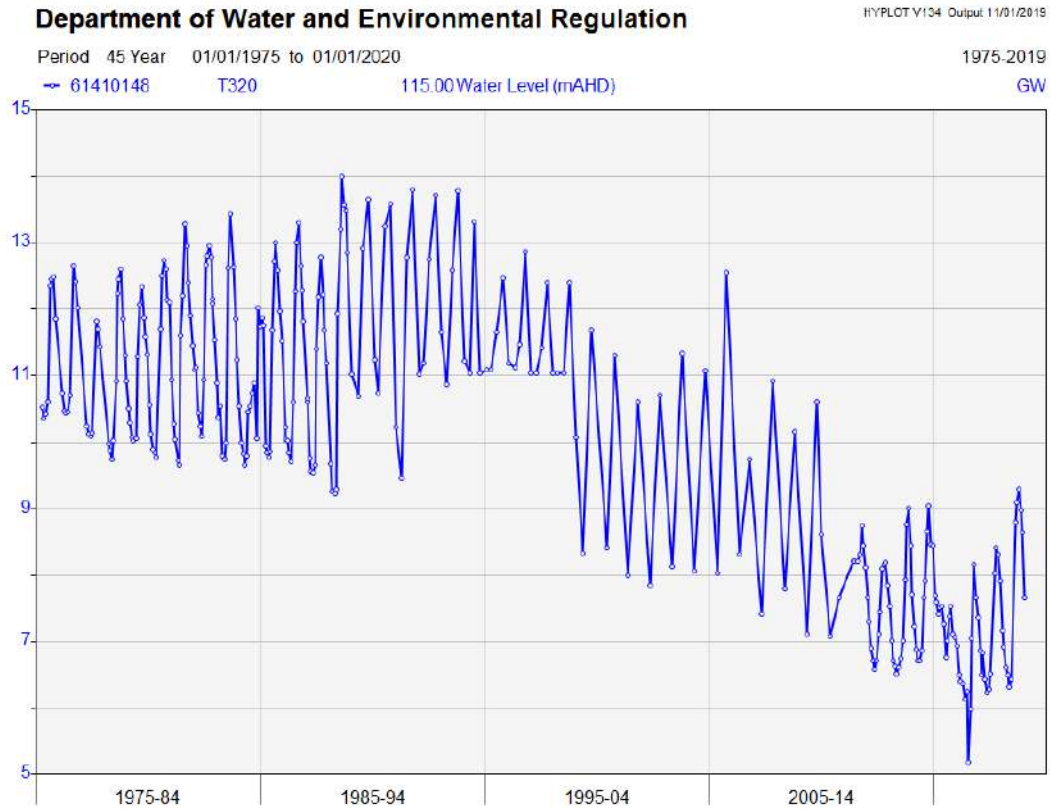
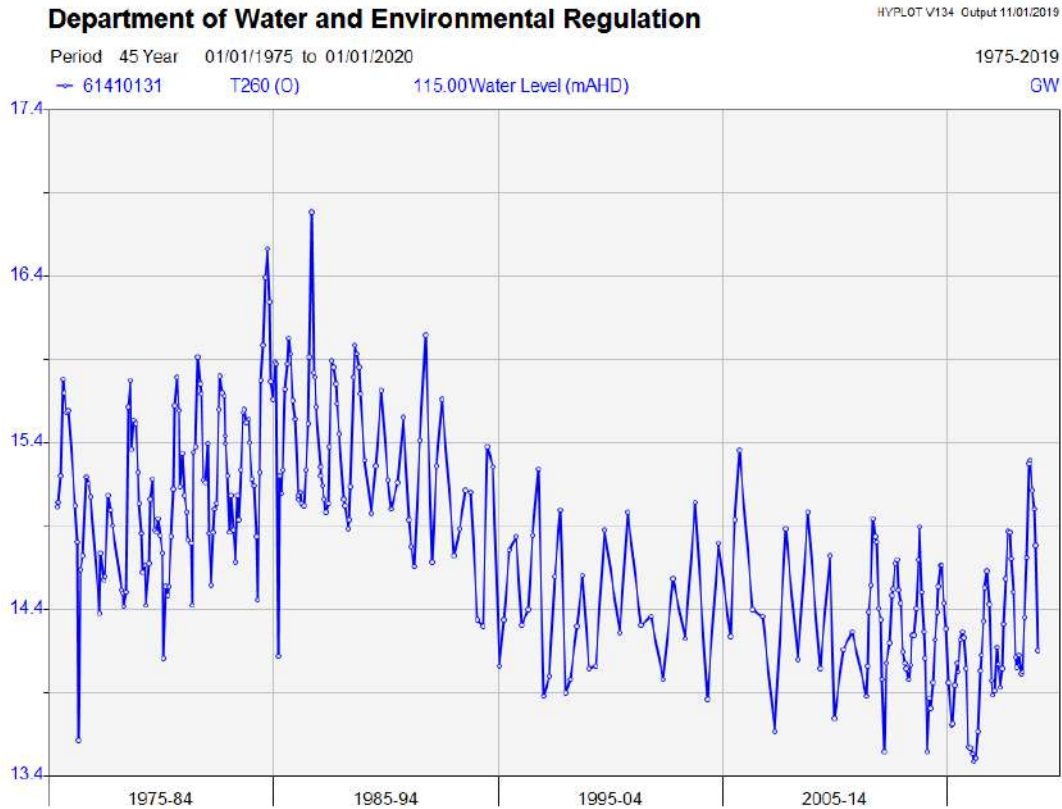
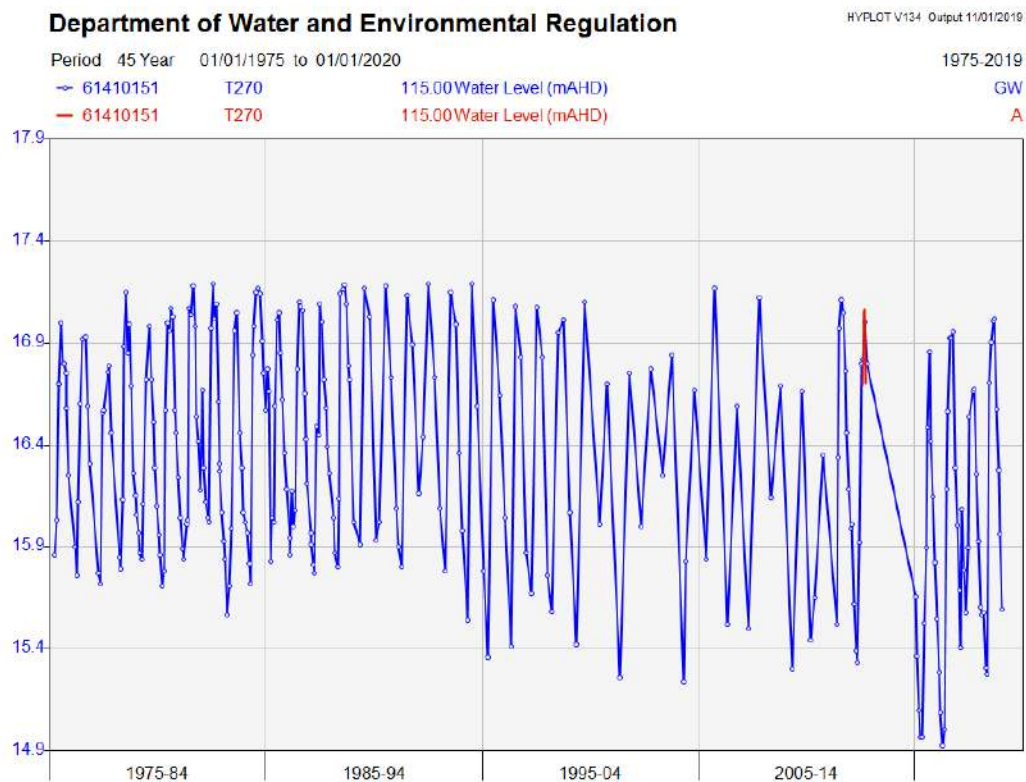


PLATE 12 – HYDROGRAPH BORE 61410131



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PLATE 13 – HYDROGRAPH BORE 61410151



2.6 LAND USE AND CONTAMINATION RISK

2.6.1 Land Use

The study area is currently used for low intensity agriculture including cattle grazing and the keeping of horses. It largely comprises open paddocks with occasional scattered trees, with some dwellings and stables/sheds.

Historical aerial photography from Landgate (2019a) dating back to 1953 was reviewed to identify activities conducted in the study area that may cause contamination. The 1953 image shows that the entire study area had already been cleared of vegetation and was being used for low intensity agriculture. There have been no significant changes in land use in the study area over the last six decades with the only exception being the extraction of clay on Lot 275 Mundijong Road, which commenced in approximately 1974. Plates 14, 15 and 16 show the development of clay mining on Lot 275 in 1974, 1981 and 2018 respectively.

A Development Approval (DA) from the Shire of Serpentine-Jarrahdale was granted on 23 October 2014 to conduct rehabilitation works on Lot 275 (inclusive of filling the former clay pits with imported fill material). In 2014, Australian Civil Haulage (ACH) was commissioned to assist with the rehabilitation works by filling the clay pits and levelling out the remainder of the site. The clay pits have been progressively filled with imported fill material. However, during the placement of the fill material minor fragments of plastic, PVC piping, scrap metal, brick and green waste such as wood chips were identified by DWER officers (SERS, 2017). A Works Approval application was submitted to the DWER on 14 February 2018 to construct and operate a Category 62 Solid Waste depot on Lot 275 to excavate, screen and stockpile material that had been backfilled in the clay pits. The Works

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Approval was approved in December 2018. The operation involves excavating the backfilled material (approximately 12,000m³), screening the material on site to separate the non-conforming material for off-site disposal from the reusable material. The screened material is to be stockpiled on-site for a maximum period of one year.

It should be noted that the area affected by the clay pits (approximately 6.3 ha) represents only 0.73% of the overall study area.

PLATE 14: FIRST EVIDENCE OF DISTURBANCE ON LOT 275 (SEPTEMBER 1974)

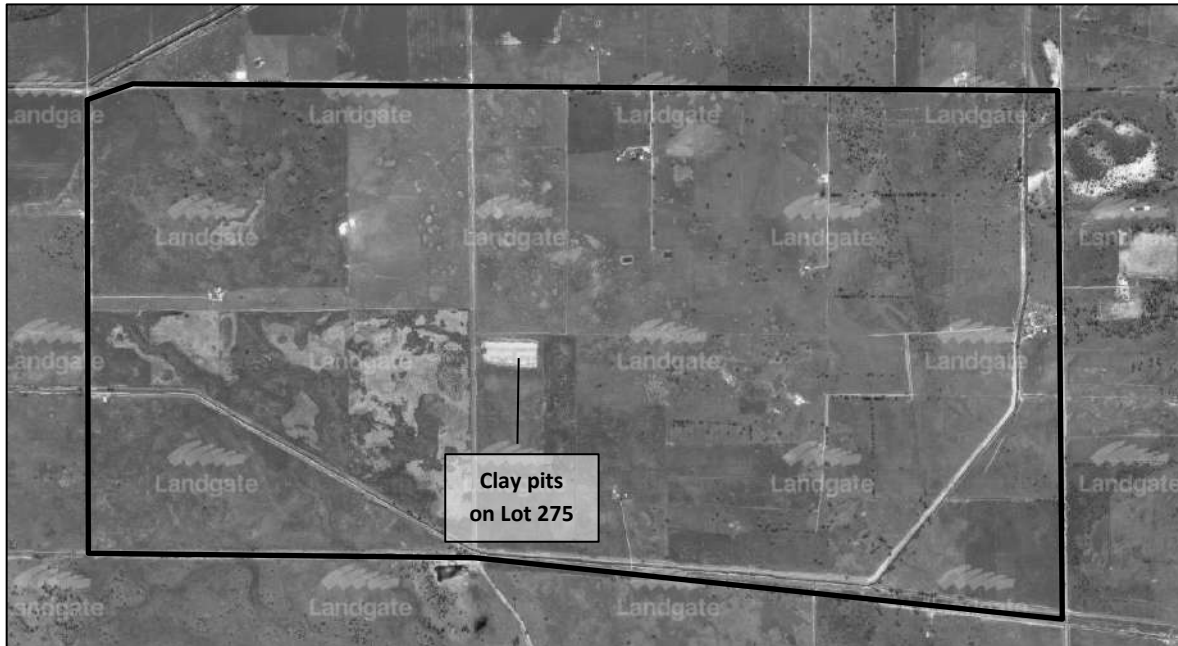


PLATE 15: CLAY PITS ON LOT 275 (AUGUST 1981)



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PLATE 16: PART REHABILITATION OF CLAY PITS ON LOT 275 (AUGUST 2018)



2.6.2 Surrounding Land Uses

Recent aerial photography was reviewed to identify land uses which have the potential to be regarded as inconsistent with sensitive land uses such as residential (Plate 17). The following land uses were identified:

West

West of the study area is rural zoned land, primarily used for agricultural activities. Other land uses of note include:

- King Road Brewery is immediately west of the study area (west of King Road). Breweries can be sources of gaseous, noise, dust and odour emissions. According to EPA (2015), breweries generally require buffers of between 200m and 500m depending on the size of the brewery and the type of product being manufactured.
- To the north of the Brewery is a facility operated by Community Greenwaste Recycling Pty Ltd (CGR) on Lot 102 (766) King Road. CGR collects green waste (including prunings, lawn clippings and wood products) and inert waste (including concrete, bitumen, sand, clay, street sweepings and building rubble). According to CGR's website, the waste is sorted and tested to find suitable uses within a range of industries, with the aim of complete recyclability. There are few details available about the operation of this facility and it is uncertain if there is potential for issues such as noise or odour issues to emanate from this facility and therefore whether it requires a buffer. The generic buffer for a Class 1 inert landfill is 300m (EPA, 2015). The buffer requirements for a greenwaste/composting facility are variable and relate to the size of the operation and the composting methods adopted. Further investigation of the CGR operation is required to be able to provide further guidance on the potential buffer requirements. Clarification on whether composting is being undertaken on the site and the volumes produce annually are needed.
- Approximately 950m north-west of the study area is a site which appears to

	<p>have a number of old greenhouses. Greenhouses using composts or manures generally require a buffer of between 200 and 300m (EPA, 2015).</p> <ul style="list-style-type: none"> Approximately 1 km north-west of the study area appears to be a poultry farm. Generic buffers for Poultry operations range from 300m – 1,000m (EPA, 2015). The study area appears to be sufficiently separated from this poultry farm.
North	<p>North of the study area is rural zoned land, primarily used for agricultural activities. Other land uses of note include:</p> <ul style="list-style-type: none"> North of Leipold Road are rural activities which appear to be similar to those in the study area i.e. horse keeping and stock grazing. Waste Transfer Station (?) on Pt Lot 54 King Road is approximately 200m north of the north-western portion of the study area. The site appears to be used as a waste transfer station. It is difficult to determine who is operating the facility and the types of wastes received. The generic buffer for a solid waste depot is 200m (EPA, 2015). Timber Mill (Jarrahwood Australia) - approximately 600m north (36 Bird Road, Oldbury) which manufactures Jarrah timber products. The generic buffer for a timber sawmill ranges from 500m to 1,000m depending on the size of the mill. Bulk haulage rail is north of the study area. Its closest point to the study area is approximately 650m from the north-western corner of the study area. Plant nursery (163 Boomerang Road, Oldbury) – small plant nursery approximately 800m north of the study area. The generic buffer requirements for plant nurseries (no composting on site) is 100m (EPA, 2015). West Australian Large Scale Off-road Association (9 Bird Road, Oldbury) – off-road remote controlled vehicle racing club is approximately 1 km north of the study area.
East	<p>Currently the majority of the land east of the study area is being used for agricultural purposes. A Special Rural development is also located approximately 800m east of the study area.</p> <p>However, the land to the east of the study area has been identified for future industrial development (West Mundijong Industrial Zone). It is understood that a Feasibility Assessment for the Industrial Zone recommended that land be used for a range of ‘non-heavy’ industry uses. The specific nature of these uses remains unknown at the time of preparing this report. However, Calibre (2018) reported that many of the uses are likely to be low emission industries concerned with logistics with more noise assessments to be conducted at the local structure plan stage. It is noted that the intent is for land 1 km to the west and north of the West Mundijong Industrial Area be retained as rural zoning to act as a buffer. It is understood that the ‘noisiest’ uses are to be centrally located in the future industrial area and those uses with lesser impacts located towards the periphery of the site.</p>
South	<p>Land to the south of the study area is currently used for agricultural purposes. Our desktop research has identified that land south of Mundijong Road appears to be used for agricultural purposes and primarily associated with cattle farming.</p> <p>Of note are the following:</p> <ul style="list-style-type: none"> Peel Feedlot which is a Category 55 Prescribed Premises (Livestock Sale Yard or

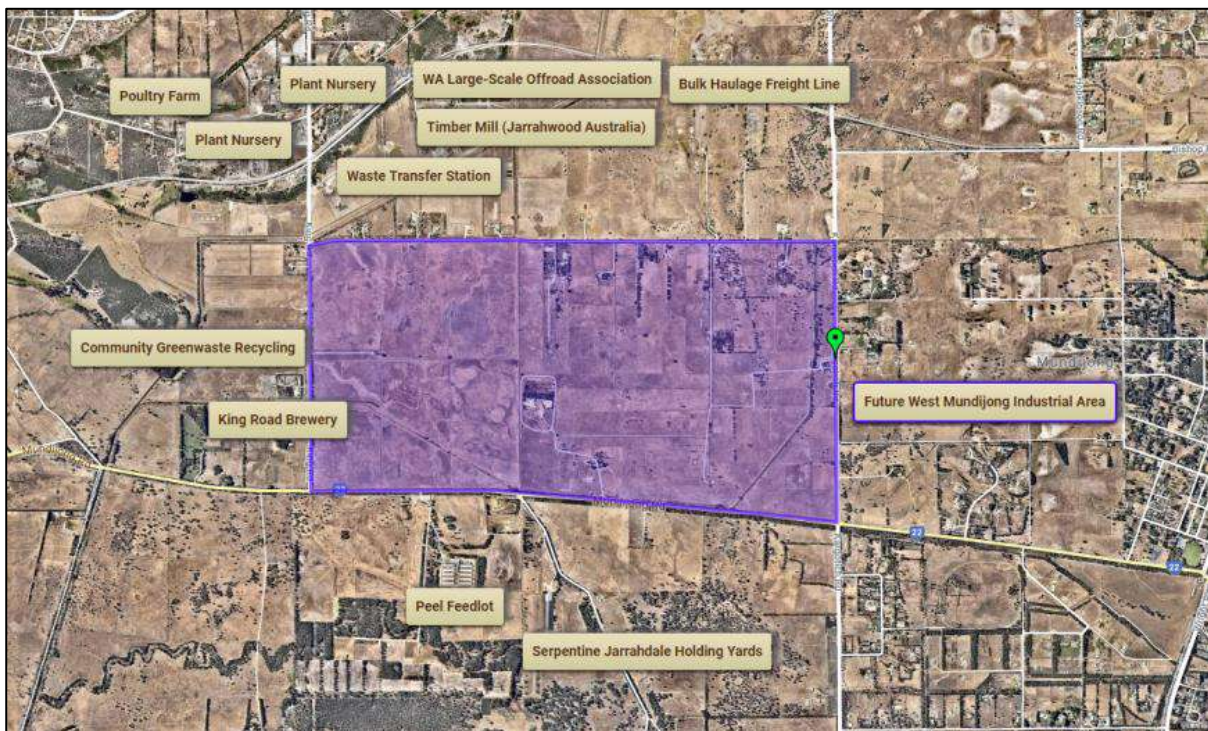
Holding Pen); and

- Serpentine-Jarrahdale Holding Yards a Category 1 Prescribed Premises (Cattle Feedlot).

Feedlots have the potential to cause noise, dust and odour emissions which can impact local amenity. The buffer distance required between feedlots and sensitive land uses will vary depending on the size of the feedlot. The EPA (2015) recommended a separation of 1,000m for noise and dust and at least 5 km from towns. However, the EPA (2015) recommends a buffer of 1,000m for livestock sale yards.

Further investigation of the surrounding land uses and in particular the buffer requirement for each is recommended so that the amenity of future landholders in the study area is not compromised. Less sensitive land uses should be planned for the portion of the study area impacted by land use buffer requirements.

PLATE 17: SURROUNDING LAND USES



2.6.3 Contamination

According to the DWER's Contaminated Sites Database (DWER, 2019c) there are no contaminated sites within the study area or within a 5km radius of the study area. Given that the study area has had continuous use for low intensity agriculture for more than 60 years, the risk of widespread contamination being present is regarded as low.

2.7 FLORA AND VEGETATION

2.7.1 Beard's Vegetation Mapping

Broad scale (1:250,000) pre-European vegetation mapping of the area has been completed by Beard (1979) at an association level. The mapping indicates that Association 968 (Medium woodland Jarrah Marri and Wandoo) was originally across the site.

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A vegetation association is considered under-represented if there is less than 30% of its original distribution remaining. From a representation and biodiversity perspective (not taking into account any other land degradation issues) there are several criteria being applied to vegetation (EPA, 2000):

- the threshold level below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European/pre-1750 extent of vegetation association;
- a level of 10% of the original extent is regarded as being a level representing 'Endangered'; and
- clearing which would put the threat level into the class below should be avoided.

At the State level, Vegetation Association 968 has greater than 30% of its pre-European extent remaining.

2.7.2 Vegetation Complexes

Hedde *et al.* (1980) mapped the Perth area vegetation at a finer scale than Beard (1979). Vegetation complexes indicate patterns of vegetation at a regional scale, and are based upon factors such as landform, soil and climate.

Pre-European Vegetation in the study area as shown in Plate 18 is mapped as (Australian Government, 2019):

- **Guildford Complex** - The majority of the study area is mapped as the Guildford Complex which is described as a mixture of open forest to tall open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) - *Eucalyptus marginata* (Jarrah) and woodland of *Eucalyptus wandoo* (Wandoo) (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum)). Minor components include *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark).
- **Serpentine River Complex** - The north-west corner of the study area is mapped as the Serpentine River Complex described as a closed scrub of *Melaleuca* species and fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark) along streams.
- **Beermullah Complex** - The northeast corner of the study area is mapped as the Beermullah Complex which is a mixture of low open forest of *Casuarina obesa* (Swamp Sheoak) and open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) - *Eucalyptus marginata* (Jarrah). Minor components include closed scrub of *Melaleuca* species and occurrence of *Actinostrobus pyramidalis* (Swamp Cypress).

There are no intact areas of native vegetation in the study area. The only native vegetation remaining comprises scattered paddock trees of Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) in low-lying areas and Swamp Sheoak (*Casuarina obesa*). Due to on-going low level agricultural uses in the study area, there are no areas of natural regeneration occurring.

Given the current site conditions, the vegetation in the study area has been assessed as Completely Degraded.

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PLATE 18: PRE-EUROPEAN VEGETATION COMPLEX MAPPING



2.7.3 Conservation Significant Vegetation

Table 1 lists the Commonwealth Threatened Ecological Communities (TEC) identified in the Protected Matters Search Report (Appendix 1) as occurring within a 2 km buffer of the study area. State endorsed TECs recorded as occurring on the site are shown in Plate 19 (Australian Government, 2019).

TABLE 1: COMMONWEALTH THREATENED ECOLOGICAL COMMUNITIES WITHIN 2KM OF THE STUDY AREA

TEC	EPBC Act	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	May occur within the search area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Likely to occur within the search area
<i>Corymbia calophylla</i> – <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain	Endangered	Known to occur within the search area
<i>Corymbia calophylla</i> – <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal plain	Endangered	Known to occur within the search area

Due to the Completely Degraded structure and condition of the vegetation in the study area, the above TECs are not present. The study area does not contain any regionally significant vegetation.

There are TECs and one PEC mapped (inclusive of buffers) that encroach into the south-east and north-west corners of the study area (Plate 19). The portion of the ecological communities in the study area do not contain any intact areas of native vegetation and therefore are regarded as Completely Degraded. These areas are not representative of any TECs or PECs. The northern portion of the Mundijong Road reserve (and abutting the southern boundary of the study area) was noted as

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containing a deep surface drain, extensive infestation of *Watsonia (Watsonia bulbilifera)* and being poorly vegetated.

PLATE 19: THREATENED ECOLOGICAL COMMUNITIES



The conservation significant flora identified in the NatureMap Species Report (Appendix 2) and the Protected Matters Search Report as potentially occurring within 2 km of the study area are listed in Table 2.

TABLE 2: CONSERVATION SIGNIFICANT FLORA SPECIES WITHIN 2KM OF THE STUDY AREA

Species Name	Common Name	EPBC Act	BC Act ¹ / DBCA
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant		-	Priority 1
<i>Andersonia gracilis</i>	Slender Andersonia	Endangered	Vulnerable
<i>Caladenia huegelii</i>	King Spider-orchid	Endangered	Critically Endangered
<i>Diuris micrantha</i>	Dwarf Bee-orchid	Vulnerable	Vulnerable
<i>Diuris purdiei</i>	Purdie's Donkey-orchid	Endangered	Endangered
<i>Drakaea elastica</i>	Glossy-leaved Hammer Orchid	Endangered	Critically Endangered
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	Vulnerable	Endangered
<i>Eucalyptus x balanites</i>	Cadda Road Mallee	Endangered	Critically Endangered
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	Narrow curved-leaf Grevillea	Endangered	Endangered
<i>Stylidium aceratum</i>		-	Priority 3

¹ Biodiversity Conservation Act 2016

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TABLE 2: CONSERVATION SIGNIFICANT FLORA SPECIES WITHIN 2KM OF THE STUDY AREA

Species Name	Common Name	EPBC Act	BC Act ¹ / DBCA
<i>Synaphea</i> sp. <i>Fairbridge Farm</i>	Selena's Synaphea	Critically Endangered	Critically Endangered
<i>Synaphea</i> sp. <i>Serpentine</i>		Critically Endangered	Critically Endangered
<i>Tetraria australiensis</i>	Southern Tetraria	Vulnerable	Vulnerable

It is highly unlikely that any of the conservation significant flora species listed in Table 2 would be present in the study area due to previous clearing and the long history of grazing.

2.7.4 Bush Forever

Bush Forever is a strategic plan which formally commenced in 2000 to protect approximately 51,200 ha of regionally significant bushland, representing, where achievable, a target of at least 10% of each of the original 26 vegetation complexes of the Swan Coastal Plain portion of the Perth Metropolitan Region (WAPC, 2000).

Bush Forever Site 360 (Mundijong and Watkins Roads Bushland, Mundijong/Peel Estate) traverses the southern boundary of the study area (Plate 20). Bush Forever Site 360 occupies 73.8 ha (some not mapped) (Australian Government, 2019). During the site inspection the vegetation along the northern side of Mundijong Road was observed to be impacted by a dense infestation of *Watsonia bulbifera* and was more sparsely vegetated in part due to the deep open drain that runs along the southern boundary of the study area. However, the vegetation on the southern side of Mundijong Road was in better condition.

PLATE 20: BUSH FOREVER SITE 360



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2.7.5 Environmentally Sensitive Areas

Environmentally sensitive areas (ESA) are mapped as encroaching into the study area (Plate 21). These areas are attributable to the mapped conservation category wetland, Bush Forever site and TEC in the Mundijong Road reserve. Generally the extent of ESA mapping includes a buffer and therefore is often overstated in terms of area. Given the portion of the mapped ESA within the study area is devoid of native vegetation, it is unlikely that these areas are representative of an ESA.

PLATE 21: ENVIRONMENTALLY SENSITIVE AREAS



2.8 BUSH FIRE RISK

Designated bush fire prone areas have been identified by the Fire and Emergency Services Commissioner as being subject, or likely to be subject, to bushfire attack (DFES, 2019). A bushfire prone area is identified by the presence of and proximity to bush fire prone vegetation, and includes both the area containing the bush fire prone vegetation and a 100 metre buffer zone immediately surrounding it.

The study area is mapped within a bush fire prone area (Landgate, 2019b). State Planning Policy 3.7 *Planning in Bushfire Prone Areas* (WAPC, 2015b) defines 'bushfire risk' as *"the chance of a bushfire igniting, spreading and causing damage to people, property and infrastructure."*

2.9 FAUNA

The conservation significant fauna species identified in the NatureMap Species Report and the EPBC Act Protected Matters Report as potentially occurring within 2 km of the study area are listed in Table 3. Marine species have been excluded from Table 3.

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TABLE 3: CONSERVATION SIGNIFICANT FAUNA SPECIES WITHIN 2KM OF THE STUDY AREA

Species Name	Common Name	EPBC Act	BC Act / DBCA
BIRDS			
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered	Critically Endangered
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	Vulnerable	Vulnerable
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	Endangered	Endangered
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Endangered	Endangered
<i>Leipoa ocellata</i>	Malleefowl	Vulnerable	Vulnerable
<i>Numenius madagascariensis</i>	Eastern Curlew	Critically Endangered	Critically Endangered
<i>Rostratula australis</i>	Australian Painted-snipe	Endangered	Endangered
MAMMALS			
<i>Bettongia penicillata ogilbyi</i>	Woylie	Endangered	Critically Endangered
<i>Dasyurus geoffroii</i>	Chuditch	Vulnerable	Vulnerable
<i>Isoodon fusciventer</i>	Southwestern brown bandicoot / Quenda	-	Priority 4
<i>Notamacropus eugenii subsp. derbianus</i>	Tammar Wallaby	-	Priority 4
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	Critically Endangered	Critically Endangered
<i>Setonix brachyurus</i>	Quokka	Vulnerable	Vulnerable

The Environmental Planning Tool (WALGA, 2019) indicates that the site:

- Contains possible breeding area for Carnaby's Black Cockatoo in the south-east corner of the site;
- Contains confirmed (buffered) roosting area for Carnaby's Black Cockatoo in the north-west corner of site;
- Is within the known foraging area of Baudin's Black Cockatoo (DSEWPac, 2012);
- Is within the known breeding and non-breeding range of Carnaby's Black Cockatoo; and
- Is within the known range of the Forest Red-tailed Black Cockatoo.

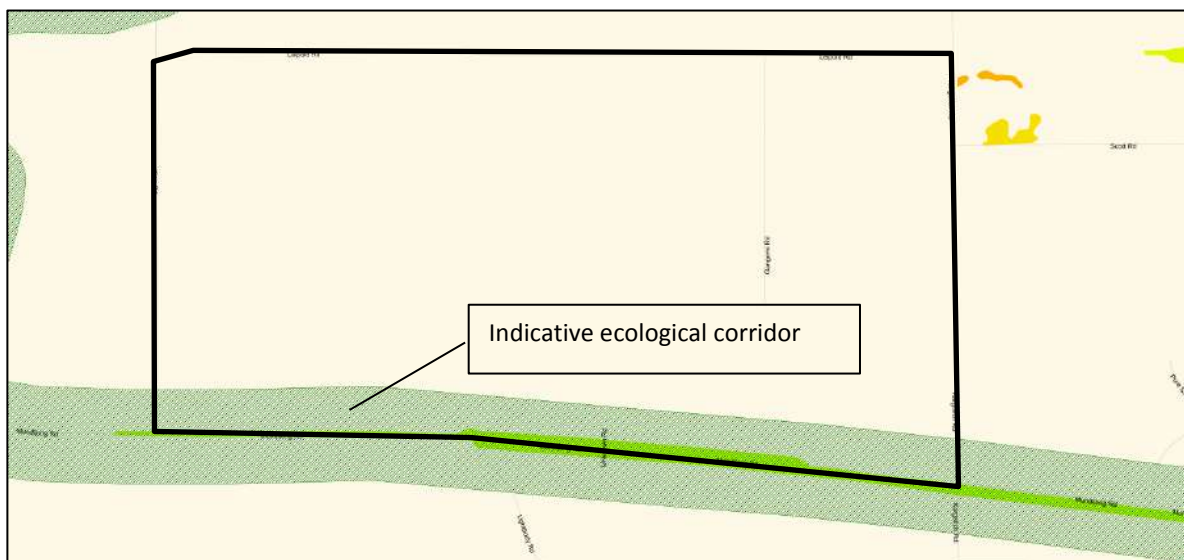
Due to the degraded condition of the available habitat, the study area contains very few values for native fauna. No conservation significant fauna species were observed during the site visit. Of those species listed in Table 3, the three species of Black Cockatoos may be present in the study area on occasions. A thorough assessment of all properties and potential habitat trees was not possible as part of the site inspection. However, the scattered paddock trees observed on Lots 272-275 were

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generally 5m or less in height with the occasional tree up to 7m – 8m tall. None of the trees contained hollows that would support black cockatoo breeding. The scattered Marri trees in the paddock areas provide very limited foraging resources which the black cockatoos may opportunistically feed upon as they move through the landscape. The loss of these trees would not represent a significant impact on the species and could be adequately compensated on-site through selection of appropriate plant species for use in landscape treatments as part of future planning and design.

Regional ecological linkages are a network of natural areas that provide “stepping stones” for species to migrate and disperse between patches of remnant vegetation. Habitat fragmentation is a key threatening process leading to loss of biodiversity, so it is important to protect and enhance ecological linkages. A notional regional ecological linkage (associated with Bush Forever Site 360) extends into the southern portion of the study area (Plate 22) along Mundijong Road (WALGA, 2019).

PLATE 22: REGIONAL ECOLOGICAL LINKAGES



2.10 ABORIGINAL HERITAGE

The Aboriginal Heritage Inquiry System (DPLH, 2019) shows there are no registered aboriginal heritage sites on the site or within a 1km radius of the site.

2.11 PREVIOUS EPA ADVICE

The West Mundijong Industrial Precinct Scheme Amendment (1298/41) which rezoned land from Rural to Industrial in the MRS was referred to the EPA under Section 48A of the *Environmental Protection Act 1986*. This amendment covered 449 ha of land situated immediately east of the study area.

The EPA considered that the scheme amendment was unlikely to have a significant effect on the environment and did not require formal assessment under Part IV of the *Environmental Protection Act 1986*. The key environmental factors relevant to the scheme amendment included: Flora and Vegetation, Inland Waters and Amenity. The EPA considered that the environmental impacts associated with the development of the area subject to the amendment can be adequately managed through local scheme provisions, noting that in particular provisions relating to noise impacts and

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wetland management would be required. The EPA considered that structure planning can also manage industrial design to minimise impacts to surrounding land uses.

In relation to the Flora and Vegetation factor, the EPA noted that the amendment area contains the Guildford vegetation complex which is mapped as having less than 10% remaining on the Swan Coastal Plain. The EPA's view was that this vegetation should be protected and included as an ecological linkage at the structure planning stage.

The EPA also indicated that the area mapped as conservation category wetland (Manjedal Brook) be managed and protected by a minimum buffer of 50m.

The proposed development of the industrial area has the potential to impact the amenity of adjacent landholders. As such the EPA outlined their expectation that an adequate separation between the intended industrial development and sensitive land uses would be provided.

Following the scheme amendment there have been various reports prepared for the West Mundijong Industrial Area. These include:

- Draft District Structure Plan Report (TME, 2014);
- District Water Management Strategy (TME, 2015a); and
- Feasibility Study (TME, 2015b) which was originally prepared in 2012.

It is difficult to determine the potential separation requirements for future uses in the Industrial Area based on the notional plans that have been prepared for the Industrial Area. Herring Storer Acoustics (2012) recommended that uses across the industrial area should be graduated with 'quieter' uses located around the periphery and the 'noisier' uses being centrally located as a principle to reduce adverse impacts upon surrounding land uses. A draft District Structure Plan (Appendix 3) includes a drainage corridor between approximately 200m and 600m wide along Kargotich Road which forms the western boundary. This drainage corridor will be of benefit in terms of separation of the industrial area and the study area.

3 ENVIRONMENTAL ASSESSMENT

The site itself contains few environmental constraints and would be suitable to support future development. From an ecological perspective, the degraded nature of the site due to historic clearing and many years of agriculture mean that sensitive environments are unlikely to be adversely impacted. Possible environmental issues or impacts of relevance to the study area are discussed below.

3.1 SOILS

3.1.1 *Permeability*

The soils in the study area are likely to have a low permeability and not be suited to the infiltration of stormwater. It is recommended that permeability testing be conducted at the structure plan stage to assist with planning future stormwater management.

3.1.2 *Acid Sulphate Soils*

Targeted investigations can be conducted once disturbance (either dewatering or excavation) details are known. If present, an ASS Management Plan should be prepared and implemented in accordance with DWER guidance. The potential presence of ASS will not preclude the rezoning or development of the site as it can be managed via further investigation and site management and monitoring.

3.2 WATER MANAGEMENT

Groundwater and surface water constraints represent one of the main environmental issues that requires further investigation and management. It is recommended that the Better Urban Water Management Framework be followed during the planning stages. The first step will involve the preparation of a District Water Management Strategy (DWMS) in support of a scheme amendment. This will be followed by a Local Water Management Strategy (LWMS) at the structure planning stage and an Urban Water Management Plan (UWMP) at subdivision. At a broad level, these documents will need to:

- Summarise the pre-development groundwater and surface water conditions;
- Identify key areas of ecological value (such as wetlands, waterways, etc.);
- Describe the soil conditions at the site;
- Discuss existing and required water and wastewater infrastructure;
- Outline proposed approach to management of groundwater levels (if required);
- Outline how surface run off will be managed, noting the expectation that post-development discharge rates should be approximately similar to pre-development conditions;
- Identify irrigation requirements and potential sources;
- Describe water measures to be implemented in regards to water quality improvement and water efficiency;
- Provide a post-development monitoring framework; and
- Outline the steps for implementation, noting key responsibilities.

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Groundwater and surface water conditions will require further investigation via a monitoring program to better define pre-development water quality as well as maximum groundwater levels and groundwater flow direction. As the study area is in the catchment of the Peel-Harvey Estuary system, it will be prudent to demonstrate the water quality improvement measures that will be implemented to manage nutrient export from the study area.

The drainage channels identified during the site visit link to the conservation category wetland to the south of the study area. These channels have the potential to be enhanced from an ecological perspective as part of a living stream or to incorporate passive recreation opportunities.

Future development of the study area will need to ensure that there is sufficient land set aside for drainage management. Finished levels across the site will need to ensure there is sufficient separation to maximum groundwater levels (potentially achieved via use of fill and sub-soil drains) as well as sufficient clearance to the 100-year flood levels.

3.3 CONTAMINATION RISK

The study area has been cleared and used for grazing and horse keeping for more than 60 years. There are scattered homesteads, sheds and associated farming infrastructure across the study area. The risk of widespread contamination being present in the study area is regarded as low. Any areas of contamination would need to be managed in accordance with the requirements of the *Contaminated Sites Act 2003*.

The rehabilitation of the clay extraction pits on Lot 275 has resulted in 'contaminated' fill being backfilled in the pits. During inspections of the site in 2015 DWER officers identified fragments of plastic, PVC piping, irrigation piping, scrap metal, brick and green waste (wood chips etc.) within the fill material placed on site (DWER, 2018). The fill material is to be excavated and screened, and separated into conforming and non-conforming material stockpiles. At this stage, it is not proposed that material will be placed back in the redundant clay pits (SERS, 2017). It is understood that the proposed works at the site includes acceptance of excess sand and construction and demolition material from building sites in the metropolitan area to fill the existing clay pits. These are to be predominantly sourced from new housing and commercial sub-divisions. The waste material will be sorted, screened and raked (DWER, 2018). It will be important to demonstrate that the backfilled material is 'clean' and suitable to support a higher use, if this area is to be developed in the future. It would be prudent to obtain geotechnical advice about construction on the backfilled pits.

3.4 ECOLOGICALLY SENSITIVE AREAS

The study area contains very few ecologically sensitive areas that would preclude rezoning. Based on the current wetland mapping, the conservation category wetland (which coincides with Bush Forever Site 360) to the south of the study area will need to be retained and a buffer of 50m provided, unless the wetland is reclassified and downgraded to a lower management category. A management plan for the treatment of the interface with the wetland and the management of the buffer is likely to be required.

If the landowners wish to apply to have the wetland management category downgraded (to Resource Enhancement or Multiple Use) to reduce the buffer associated with the wetland, this would involve a site assessment to map the vegetation types and condition, collection of site photos and investigation of the presence of any threatened flora or ecological communities. Once the

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background information has been compiled, it would then be submitted to the DBCA Wetlands section who will review the supporting information and make an assessment.

A TEC and PEC are mapped as occurring south of the study area. It is likely that these areas are associated with the vegetation on the southern side of Mundijong Road where there is intact native vegetation. The TEC and PEC are unlikely to be directly impacted by the development of the study area.

There are no areas of intact native vegetation in the study area. The only remaining native vegetation is comprised of scattered trees. Due to continued farming in the area, there appears to be no areas of natural regeneration occurring. For this reason, the study area has been assessed as being Completely Degraded and it is considered that there is minimal risk of rare plants or conservation significant ecological communities being present in the study area.

The development of the study area will likely result in the loss of the majority of scattered paddock trees. The loss of this vegetation is not regarded as significant from a flora and vegetation perspective. However, the value of the mature trees from a black cockatoo perspective should be assessed via a targeted survey at the local structure plan stage.

3.5 BUSH FIRE RISK

As the site is within a Bush Fire Prone Area, additional planning and building requirements may apply to developments within designated bush fire prone areas, in accordance with Schedule 2 Part 10A of the *Planning and Development (Local Planning Schemes) Regulations 2015*, State Planning Policy 3.7 *Planning in Bushfire Prone Areas* (WAPC, 2015b), the supporting *Guidelines for Planning in Bushfire Prone Areas* (WAPC, 2017) and the Building Code of Australia. An assessment of bushfire risk and approaches to managing the risk are recommended to be completed at a more detailed stage of planning i.e. during the preparation of a structure plan.

3.6 FAUNA

The development of the study area will likely result in the loss of the majority of scattered paddock trees. Where possible, mature trees should be retained in areas of open space which can be determined at the local structure plan stage.

3.7 SURROUNDING LAND USES

An analysis of the current surrounding land uses has identified a number of possible activities that could result in emissions (such as noise, dust and odour) that may impact local amenity within the study area. The EPA's *Draft Environmental Assessment Guidelines for the Separation Distances between Industrial and Sensitive Land Uses* (EPA, 2015) provides generic buffer distances to various uses. The generic buffer distances are not intended to be absolute separation distances; rather they are a default distance. Section 2.6.2 outlines the generic buffer distances for the relevant land uses as described by the EPA (2015). A reduction in these buffers will need to be supported by site specific technical studies to demonstrate that the amenity of landholders in the study area will not be adversely impacted by a smaller buffer.

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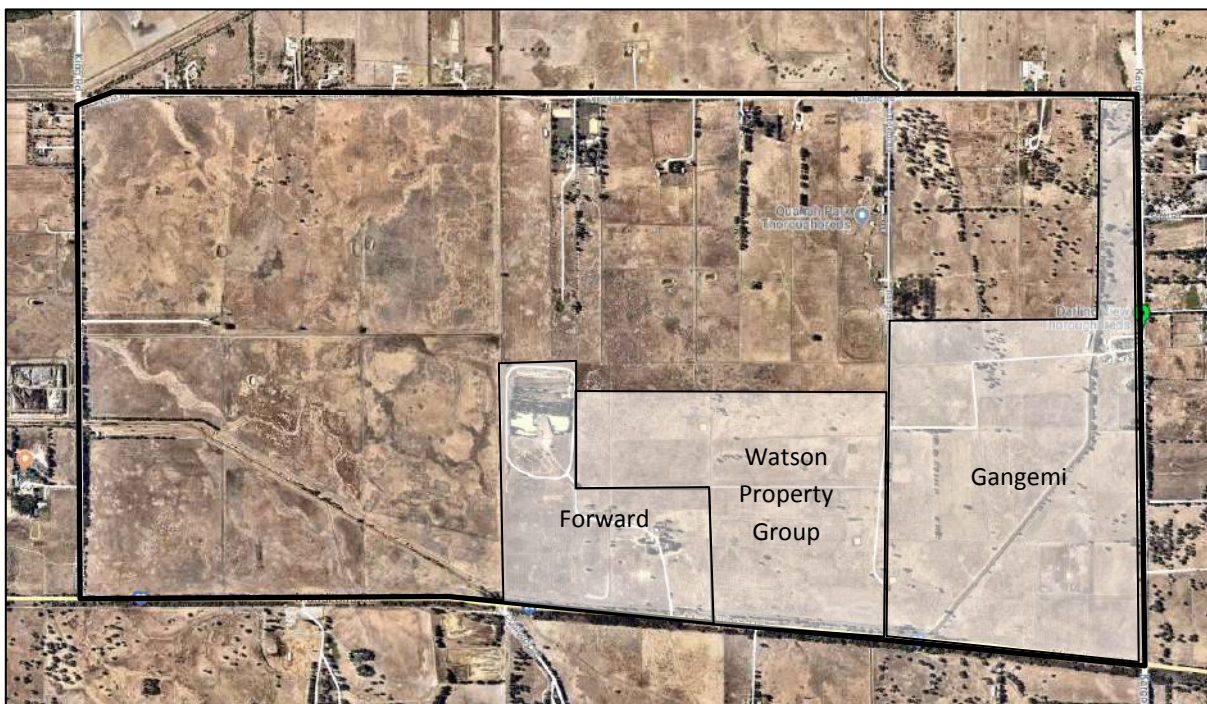
4 VIABILITY OF AGRICULTURE

Aurora Environmental were requested to seek comment from major landholders (Plate 23) in the study area on the viability of the rural pursuits. Of the two contacts provided, only one was available to meet on site on the 13 February 2019.

Mr Nino Gangemi advised Aurora Environmental that he had lived in Mundijong for approximately 60 years. Mr Gangemi has run cattle on his property over this period. Mr Gangemi indicated that he had recently divested some of his property (Lots 272 to 275) to Watson Property Group. He noted that whilst the soils are generally rich and retain moisture, the study area was not really well suited to growing crops due to waterlogging in the winter months. The ability to retain moisture is advantageous from a pasture perspective. However, when Mr Gangemi was asked about the viability of running cattle on his property, he indicated that farming beef was not really profitable at this scale. He mainly ran cattle on his landholding to manage the pasture grasses and reduce the fire risk.

Mr Graham Forward was contacted on 26 February 2019 by Aurora Environmental. He advised that he has had his property for approximately ten years but it was his Father-In Law's property for the prior 30 years or so. Mr Forward indicated that due to the operating costs of maintaining the land (such as rates, etc.) and with the small amount of pasture on the property, agisting stock (which is the current use) is not a commercially viable operation.

PLATE 23: MAJOR LANDHOLDERS



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5 ENVIRONMENTAL APPROVALS

The main environmental approvals for projects can be split into State and Commonwealth approvals. These are described in further detail below.

5.1 STATE APPROVALS PROCESS

5.1.1 Scheme Amendment

The rezoning of the study area will firstly require an amendment to the MRS followed by an amendment to the Shire of Serpentine-Jarrahdale’s Town Planning Scheme. The process to amend the MRS is outlined in Plate 23 below. This process includes a step where the amendment is referred to the EPA for consideration under the *Environmental Protection Act 1986*. The EPA considers the environmental impact of the amendment and determines if a formal assessment (Environmental Review) is needed. This takes place prior to the amendment being advertised for public comment.

PLATE 23: METROPOLITAN REGION SCHEME AMENDMENT PROCESS



Given the EPA decision to not assess the scheme amendment for the West Mundijong Industrial Area and the similarities of the study area (with respect to relevant environmental factors) there is a lower risk that the MRS amendment for the study area would be assessed by the EPA.

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5.1.2 Section 38 Referral

A proponent or a relevant decision making authority (DMA) should refer a subdivision to the EPA to be assessed under Section 38 of the *Environmental Protection Act 1986*, if the proposal has environmental issues not considered in the assessment of the Scheme Amendment, or the proposal does not comply with the assessed Scheme.

A referral to the EPA under Section 38 of the Act is made where a proposal has the potential to have a significant environmental impact. Referral under Section 38 of the EP Act can be made by:

- The proponent;
- A decision making authority (DMA); or
- A third party.

Referral to the EPA is generally undertaken where a project or proposal is deemed to have a high risk of causing a significant environmental impact. It is Aurora Environmental's view that the proposed development of the site is unlikely to have a significant impact on the environment as the potential environmental impacts can be managed and mitigated by conducting the appropriate investigations as well as via the preparation and implementation of the relevant environmental management plans. Therefore, a referral to the EPA under Section 38 is not recommended.

5.1.3 Rights in Water and Irrigation Act 1914

The *Rights in Water and Irrigation Act 1914* governs the regulation and rights associated with water resources in Western Australia. The Act is administered by the DWER who issues licences and permits to:

- Take water (for groundwater abstraction or for dewatering);
- Construct wells (including bores and soaks); and
- Interfere with the bed and banks of a watercourse.

In accordance with Schedule 1, Division 2, clause 7(2) of the *Rights in Water and Irrigation Act 1914*, the DWER ensures the proposed taking and using of water are ecologically sustainable and environmentally acceptable. Approvals to construct a groundwater bore and to abstract groundwater for irrigation purposes will need to be obtained if the study area is developed.

5.2 COMMONWEALTH APPROVALS PROCESS

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the Department of the Environment and Energy (DoEE) the authority to assess an action that may significantly impact a matter of national environmental significance. A significant impact is defined as an impact which is important, notable, or of consequence, having regard to its context or intensity (DoE, 2013).

Scheme Amendments are not considered 'actions' under the EPBC Act and therefore do not require referral to and assessment by the DoEE (OEPA, 2015) as part of the Scheme Amendment process. Section 524 of the EPBC Act defines things that are not actions in relation to government bodies – this applies to decisions by a State or an agency of a State (DSEWPoC, 2013).

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Subdivisions are considered ‘actions’ and must be referred to the Commonwealth if they may have a significant impact on MNES. The EPBC Act applies to ‘actions’ which:

- have a ‘significant impact’ on ‘matters of national environmental significance’;
- are undertaken by Commonwealth government agencies and have a significant impact on the environment anywhere in the world; or
- are undertaken by any person and have a significant impact on Commonwealth land (even if the activity is not actually carried out on the Commonwealth land).

If a proposal fits one of these descriptions, it will be required to be referred to the DoEE. If the proposal is not consistent with any of the above descriptions, the environmental impact assessment provisions of the EPBC Act will not apply and there is no need to obtain the approval of the Commonwealth Minister for the Environment (EDO, 2012).

The majority of the MNES identified in this report (Sections 2.7.3 and 2.9) are not relevant to the study area due to the absence of suitable habitat and the long history of grazing. Of the MNES, the following are potentially relevant:

Ecological Communities

- Clay Pans of the Swan Coastal Plain;
- *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain;
- *Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal plain;

Threatened Species

- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo);
- *Calyptorhynchus baudinii* (Baudin’s Cockatoo);
- *Calyptorhynchus latirostris* (Carnaby’s Cockatoo); and

Wetlands of International Significance

- Peel-Yalgorup System.

None of the ecological communities listed above are present in the study area (which is completely degraded of vegetation) however, there are known occurrences of these communities nearby. A referral to the DoEE is unlikely to be required if it can be demonstrated that the ecological communities will not be directly or indirectly impacted as a result of developing the study area.

The scattered paddock trees in the study area provide very limited foraging resources for the three black cockatoo species. The potential loss of these trees and the subsequent reduction in foraging resources is unlikely to be seen as a significant impact on the three species. However, the roosting and potential breeding value of the trees has not been investigated and it is recommended that a targeted assessment be conducted to confirm whether there are any breeding or roosting trees in the study area.

Although the study area is located in the Serpentine River sub-catchment of the Peel-Yalgorup system, it is Aurora Environmental’s view that the rezoning of the study area would not lead to a significant impact on the Peel-Yalgorup system, particularly if a water sensitive urban design approach is adopted.

6 SUMMARY

Aurora Environmental has conducted an assessment of the study area's environmental attributes and values. Overall, the study area itself has few environmental values of significance that would preclude development. Based upon our assessment, the following matters should be considered in the development of the study area:

- Based on discussions with landowners the current rural land use (livestock) is not commercially viable and waterlogging in the wet months has prevented owners from using their land for cropping.
- Soil permeability is anticipated to be low and potentially not suitable for infiltration of stormwater. Testing should be conducted to inform stormwater management options. This can be undertaken at the structure plan stage, or potentially at the Local structure plan stage.
- Consider targeted ASS investigations and the preparation and implementation of Management Plans (if required) once disturbance details are known. This is best undertaken at the subdivision stage when more detailed engineering design has been completed.
- Implement a pre-development groundwater and surface water monitoring program to capture water quality data and groundwater levels. It is likely that fill material and sub-soil drainage will be needed to provide adequate separation from shallow groundwater levels and 100-year flood levels. The pre-development monitoring should be undertaken at the structure plan stage.
- Implement the Better Urban Water Management framework, commencing with the preparation of a DWMS. Ensure that a water sensitive urban design approach is adopted to planning for the study area. The DWMS should be prepared in support of the scheme amendment or potentially at the structure planning stage. A LWMS may be prepared at the local structure plan stage and an UWMP is to be prepared as condition of subdivision.
- Any areas of contamination identified are to be managed in accordance with the requirements of the *Contaminated Sites Act 2003*.
- A buffer of 50m to the mapped conservation category wetland along Mundijong Road, which is also a Bush Forever Site, is provided and a management plan prepared for the treatment of the buffer/interface with the proposed development in the study area. The buffer should be reflected in the structure plans and the management plan could be prepared at local structure plan stage or as a condition of subdivision.
- If the landowners wish to apply to have the CCW management category downgraded to reduce the buffer, this would involve a site assessment of vegetation types and condition, presence of any threatened flora or ecological communities and collection of site photos. This background information would then be compiled and submitted to the DBCA Wetlands section to review the supporting information and make an assessment.
- Complete a bushfire risk assessment and if necessary prepare a bushfire management plan. This is best conducted at the structure planning stage. Appropriate setbacks and building design considerations may be required to ensure that bushfire risks are taken into account during the development of the site.

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- Conduct a black cockatoo assessment of the paddock trees to identify any breeding or roosting trees in the study area. This is best conducted at the structure planning stage.
- Research the surrounding land uses and where necessary conduct site specific buffer studies to ensure buffers are provided to protect the amenity of future landholders in the study area. This is best completed at the structure plan stage. Where potential land use incompatibilities exist, consider alternative land uses in the buffer area that are not regarded as sensitive uses, or consider using the affected areas for drainage management.

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APPENDIX 1

Protected Matters Search Tool Report



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 29/01/19 17:13:38

[Summary](#)

[Details](#)

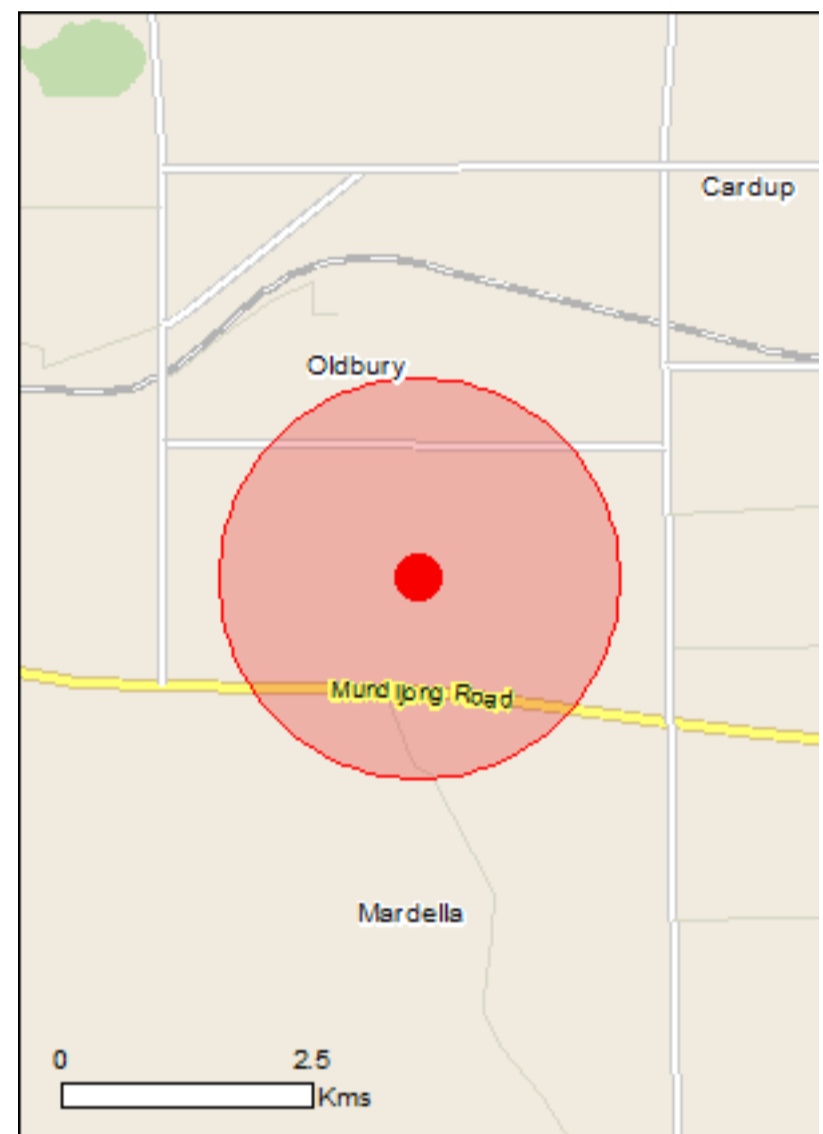
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

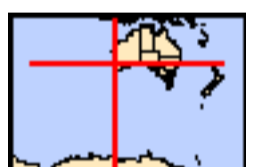
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 2.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	22
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	36
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [\[Resource Information \]](#)

Name	Proximity
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
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Birds

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species

Name	Status	Type of Presence
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		habitat may occur within area Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur

Name	Status	Type of Presence
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		within area Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom,		Species or species

Name	Status	Type of Presence
Common Broom, French Broom, Soft Broom [20126]		habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.28516 115.92943

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

© Commonwealth of Australia
 Department of the Environment
 GPO Box 787
 Canberra ACT 2601 Australia
 +61 2 6274 1111

APPENDIX 2

NatureMap Species Report

NatureMap Species Report

Created By Guest user on 29/01/2019

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 55' 55" E, 32° 17' 02" S
Buffer 2km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	148	458
Priority 1	1	2
Priority 3	1	3
Priority 4	2	4
TOTAL	152	467

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Priority 1				
1.	14932 <i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)		P1	
Priority 3				
2.	18564 <i>Stylidium aceratum</i>		P3	
Priority 4				
3.	48588 <i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
4.	48024 <i>Notamacropus eugenii</i> subsp. <i>derbianus</i> (Tamar Wallaby, Tamar)		P4	
Non-conservation taxon				
5.	11519 <i>Acacia lasiocarpa</i> var. <i>bracteolata</i>			
6.	3557 <i>Acacia stenoptera</i> (Narrow Winged Wattle)			
7.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
8.	184 <i>Aira caryophylla</i> (Silvery Hairgrass)	Y		
9.	197 <i>Amphipogon debilis</i>			
10.	29487 <i>Anigozanthos manglesii</i> var. <i>x angustifolius</i>			
11.	1117 <i>Aphelia cyperoides</i>			
12.	7838 <i>Arctotheca calendula</i> (Cape Weed, African Marigold)	Y		
13.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
14.	<i>Astartea</i> aff. <i>fascicularis</i> sthctst			
15.	20350 <i>Astartea affinis</i> (West-coast <i>Astartea</i>)			
16.	17233 <i>Austrostipa campylachne</i>			
17.	<i>Austrostipa semibarbata</i> /campylachne			Y
18.	233 <i>Avena barbata</i> (Bearded Oat)	Y		
19.	32576 <i>Banksia dallanneyi</i> (Couch Honey-pot)			
20.	1272 <i>Borya scirpoidea</i>			
21.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
22.	245 <i>Briza minor</i> (Shivery Grass)	Y		
23.	1385 <i>Burchardia multiflora</i> (Dwarf Burchardia)			
24.	1276 <i>Caesia micrantha</i> (Pale Grass Lily)			
25.	36600 <i>Callitris pyramidalis</i> (Swamp Cypress)			
26.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
27.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
28.	6539 <i>Centaurium erythraea</i> (Common Centaury)	Y		
29.	1121 <i>Centrolepis aristata</i> (Pointed Centrolepis)			
30.	1132 <i>Centrolepis mutica</i>			
31.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
32.	763 <i>Chorizandra enodis</i> (Black Bristlerush)			
33.	6543 <i>Cicendia filiformis</i> (Slender Cicendia)	Y		
34.	<i>Coryza</i> sp. Mud07			Y
35.	17104 <i>Corymbia calophylla</i> (Marri)			
36.	3136 <i>Crassula alata</i>	Y		
37.	768 <i>Cyathochaeta avenacea</i>			
38.	815 <i>Cyperus tenellus</i> (Tiny Flatsedge)	Y		

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
39.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
40.	16595 <i>Desmodocladus flexuosus</i>			
41.	306 <i>Dichelachne crinita</i> (Longhair Plumegrass)			
42.	19649 <i>Disa bracteata</i>	Y		
43.	3092 <i>Drosera bulbosa</i> (Red-leaved Sundew)			
44.	3098 <i>Drosera glanduligera</i> (Pimpernel Sundew)			
45.	3101 <i>Drosera heterophylla</i> (Swamp Rainbow)			
46.	3109 <i>Drosera menziesii</i> (Pink Rainbow)			
47.	8911 <i>Drosera rosulata</i>			
48.	347 <i>Ehrharta calycina</i> (Perennial Veldt Grass)	Y		
49.	349 <i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
50.	376 <i>Eragrostis curvula</i> (African Lovegrass)	Y		
51.	3880 <i>Eutaxia virgata</i>			
52.	434 <i>Gastridium phleoides</i> (Nitgrass)	Y		
53.	1518 <i>Gladiolus angustus</i> (Long Tubed Painted Lady)	Y		
54.	29362 <i>Goodenia coerulea</i>			
55.	12551 <i>Goodenia micrantha</i>			
56.	14282 <i>Grtiola pubescens</i>			
57.	1468 <i>Haemodorum laxum</i>			
58.	1472 <i>Haemodorum simplex</i>			
59.	2179 <i>Hakea marginata</i>			
60.	2214 <i>Hakea trifurcata</i> (Two-leaf Hakea)			
61.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
62.	12741 <i>Hyalosperma cotula</i>			
63.	6226 <i>Hydrocotyle callicarpa</i> (Small Pennywort)			
64.	6229 <i>Hydrocotyle diantha</i>			
65.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
66.	8086 <i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
67.	917 <i>Isolepis marginata</i> (Coarse Club-rush)			
68.	919 <i>Isolepis oldfieldiana</i>			
69.	7396 <i>Isotoma hypocrateriformis</i> (Woodbridge Poison)			
70.	4029 <i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			
71.	1180 <i>Juncus capitatus</i> (Capitate Rush)	Y		
72.	5835 <i>Kunzea micrantha</i>			
73.	17461 <i>Kunzea micrantha</i> subsp. <i>micrantha</i>			
74.	19955 <i>Lachnagrostis plebeia</i>			
75.	<i>Lepidosperma</i> aff. <i>pubisquamum</i> (#166)			
76.	925 <i>Lepidosperma angustatum</i>			
77.	930 <i>Lepidosperma costale</i>			
78.	<i>Lepidosperma eastern terete</i> scps (BJK&NG 232)			
79.	1077 <i>Leptocarpus canus</i> (Hoary Twine-rush)			
80.	1078 <i>Leptocarpus coangustatus</i>			
81.	2355 <i>Leptomeria squarrolosa</i>			
82.	1085 <i>Lepyrodia glauca</i>			
83.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
84.	476 <i>Lolium perenne</i> (Perennial Ryegrass)	Y		
85.	478 <i>Lolium rigidum</i> (Wimmera Ryegrass)	Y		
86.	<i>Lolium</i> sp.			
87.	1232 <i>Lomandra micrantha</i> (Small-flower Mat-rush)			
88.	<i>Lotus</i> sp. <i>Mud3</i>			Y
89.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
90.	20297 <i>Melaleuca osullivanii</i>			
91.	5946 <i>Melaleuca pauciflora</i>			
92.	5959 <i>Melaleuca raphiophylla</i> (Swamp Paperbark)			
93.	957 <i>Mesomelaena tetragona</i> (Semaphore Sedge)			
94.	10954 <i>Microtis media</i> (Tall Mignonette Orchid)			
95.	7410 <i>Monopsis debilis</i>	Y		
96.	492 <i>Neurachne alopecuroidea</i> (Foxtail Mulga Grass)			
97.	2401 <i>Nuytsia floribunda</i> (Christmas Tree, Mudja)			
98.	18255 <i>Opercularia vaginata</i> (Dog Weed)			
99.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
100.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
101.	16478 <i>Pericalymma ellipticum</i> var. <i>floridum</i>			
102.	2308 <i>Petrophile seminuda</i>			
103.	1172 <i>Philydrella drummondii</i>			
104.	1173 <i>Philydrella pygmaea</i> (Butterfly Flowers)			
105.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
106.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
107.	16177 <i>Phyllangium paradoxum</i>			
108.	<i>Phytophthora cinnamomi</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
109.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
110.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
111.	1556 <i>Romulea rosea</i> (Guildford Grass)	Y		
112.	40425 <i>Rytidosperma caespitosum</i>			
113.	40430 <i>Rytidosperma pilosum</i>			
114.	7619 <i>Scaevola lanceolata</i> (Long-leaved Scaevola)			
115.	<i>Schoenus aff. brevisetis</i> (Mud2, #135)			
116.	975 <i>Schoenus bifidus</i>			
117.	978 <i>Schoenus brevisetis</i>			
118.	1002 <i>Schoenus nanus</i> (Tiny Bog Rush)			
119.	1006 <i>Schoenus odontocarpus</i>			
120.	17614 <i>Schoenus plumosus</i>			
121.	1026 <i>Schoenus unispiculatus</i>			
122.	6 <i>Selaginella gracillima</i> (Tiny Clubmoss)			
123.	8225 <i>Siloxerus humifusus</i> (Procumbent Siloxerus)			
124.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
125.	1558 <i>Sparaxis bulbifera</i>	Y		
126.	4733 <i>Stackhousia monogyna</i>			
127.	<i>Stylidium aff. androsaceum</i>			
128.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
129.	7712 <i>Stylidium despectum</i> (Dwarf Triggerplant)			
130.	7742 <i>Stylidium inundatum</i> (Hundreds and Thousands)			
131.	23511 <i>Stylidium thesioides</i> (Delicate Triggerplant)			
132.	7806 <i>Stylidium utricularioides</i> (Pink Fan Triggerplant)			
133.	1036 <i>Tetradia octandra</i>			
134.	1701 <i>Thelymitra antennifera</i> (Vanilla Orchid)			
135.	1705 <i>Thelymitra crinita</i> (Blue Lady Orchid)			
136.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
137.	<i>Thysanotus manglesianus/patersonii</i> complex			
138.	1351 <i>Thysanotus sparteus</i>			
139.	1481 <i>Tribonanthes australis</i>			
140.	1362 <i>Tricoryne humilis</i>			
141.	4292 <i>Trifolium campestre</i> (Hop Clover)	Y		
142.	4295 <i>Trifolium dubium</i> (Suckling Clover)	Y		
143.	1139 <i>Trithuria bibracteata</i>			
144.	8255 <i>Ursinia anthemoides</i> (Ursinia)	Y		
145.	6088 <i>Verticordia huegellii</i> (Variegated Featherflower)			
146.	6107 <i>Verticordia pennigera</i>			
147.	4325 <i>Viminaria juncea</i> (Swishbush, Koweda)			
148.	722 <i>Vulpia bromoides</i> (Squirrel Tail Fescue)	Y		
149.	724 <i>Vulpia myuros</i> (Rat's Tail Fescue)	Y		
150.	18108 <i>Watsonia meriana</i> var. <i>bulbillifera</i>	Y		
151.	<i>Watsonia</i> sp. <i>Mud09</i>			
152.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			

Conservation Codes

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

APPENDIX 3

West Mundijong Industrial Draft District Structure Plan

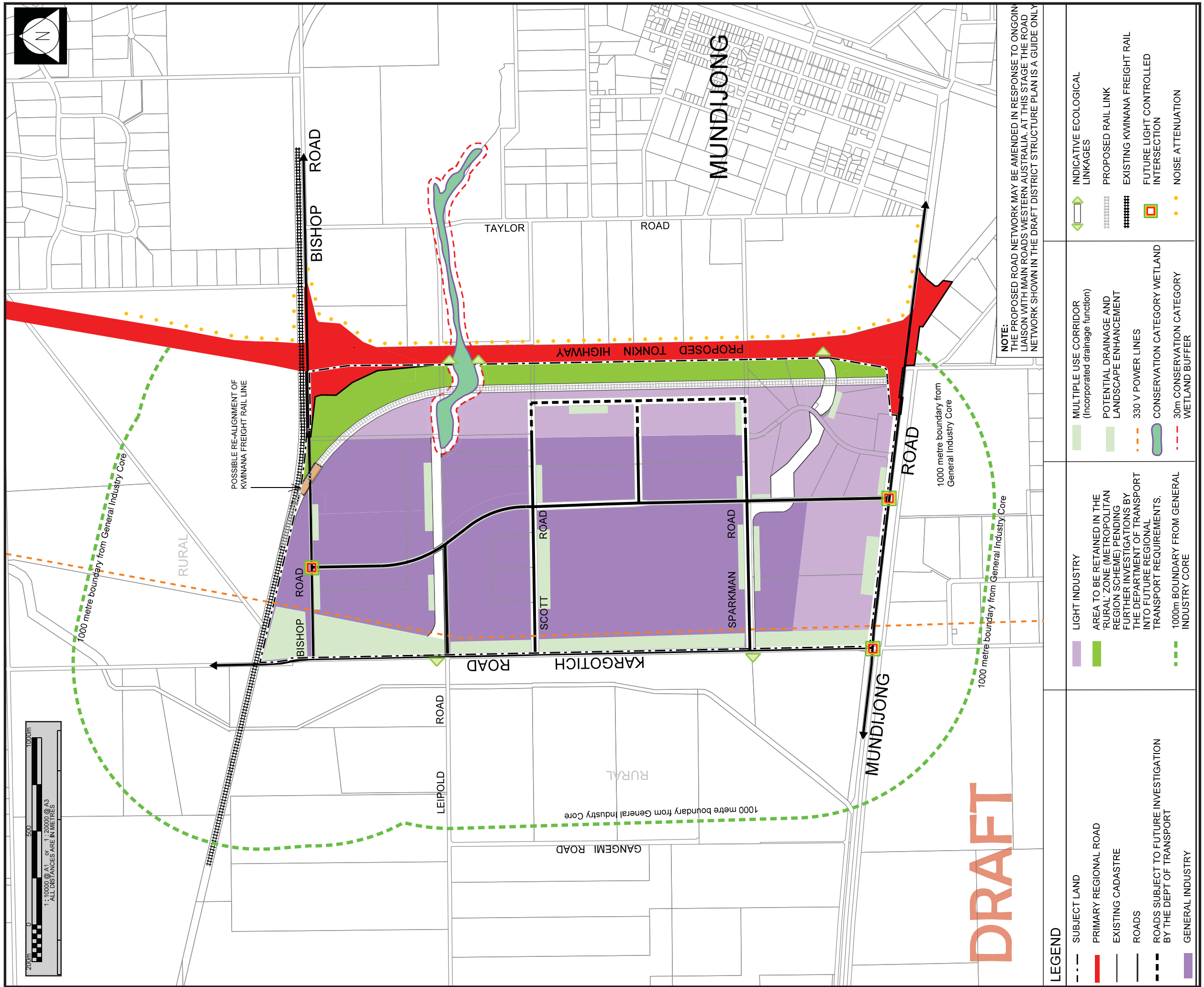


Figure 1 - West Mundijong District Structure Plan

APPENDIX 5

Subject Site Engineering Constraints Assessment (Porters Eng. - March 2019)

Our Ref: SCH/SA/L020C.19
Job No: 19-1-10

14 March 2019

WPG Landholdings Pty Ltd
c/o Watson Property Group
Suite 6/110 Erindale Road
BALCATTA WA 6021

Level 2 Kishorn Court
58 Kishorn Road
Mount Pleasant WA 6153

PO Box 1036
Canning Bridge WA 6153

Tel: (08) 9315 9955
Email: office@portereng.com.au
www.portereng.com.au

Attention: Mr Stuart Griffiths

Dear Stuart,

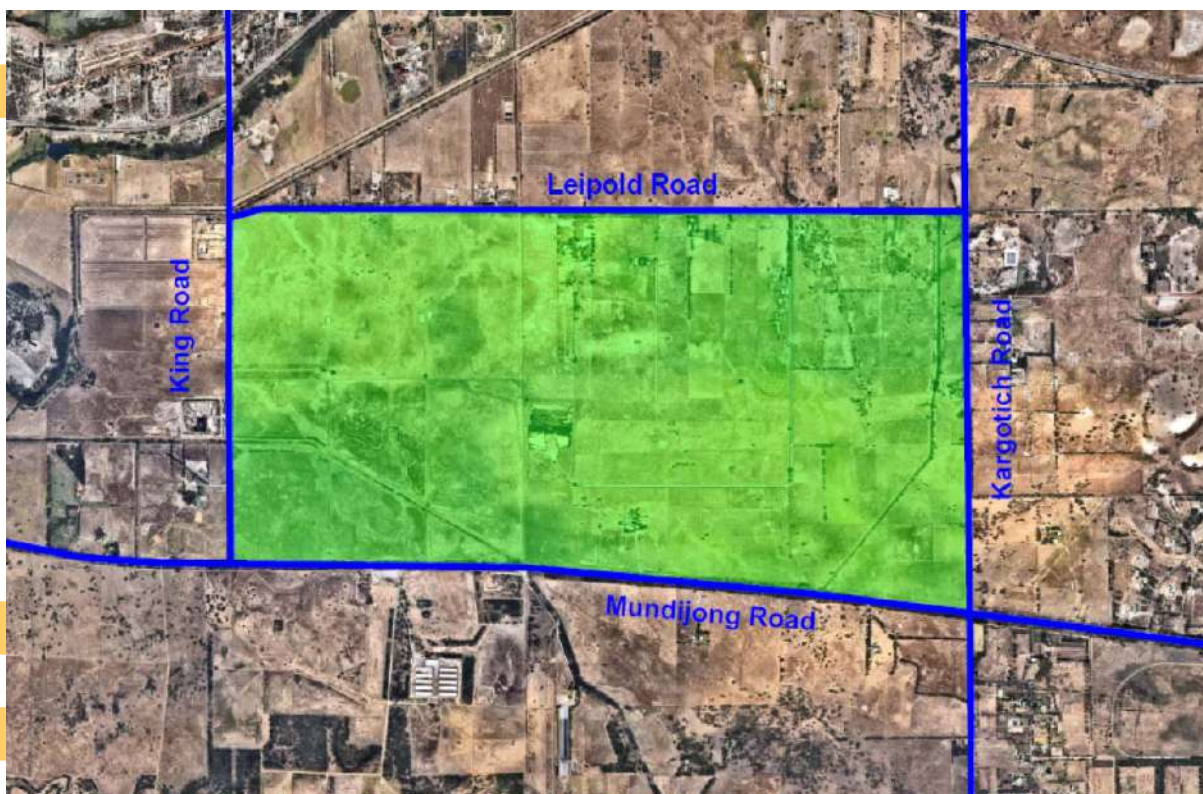
PROPOSED MUNDIJONG WEST DEVELOPMENT INFRASTRUCTURE AND ENGINEERING CONSTRAINT ASSESSMENT

Porter Consulting Engineers was commissioned by WPG Landholdings Pty Ltd to complete an engineering constraint assessment on a parcel of land that falls outside of the proposed Mundijong District Structure Plan. The intent being to ultimately rezone the land to facilitate urban development.

The following are the outcomes of our investigation.

Landform

The site is located approximately 3km west of the Mundijong town site. It is bordered by Leipold Road to the north, Kargetich Road to the east, Mundijong Road to the south and King Road to the west. Refer the below for the site location.



The site is approximately 860 hectares in size and has a gradual fall from the south east down to the north west. The site is predominantly vacant farmland with houses and sheds scattered throughout. There is sparse vegetation

For its size, the site has a very small number of individual properties. This mitigates risk during the rezoning phase and simplifies the planning stage, all of which enables an efficient design with regards to site layout and positioning of key infrastructure.

There is a formal Water Corporation open drain that flows south along Kargotich Road west parallel to Mundijong and then crosses King Road approximately 700m north of Mundijong. There are other shallow farm drains throughout that connect into this Water Corporation open drain. There are various drainage structures at the road crossings.

Ground Conditions

Mapping suggest the ground consists of sandy clay to depth and is commonly defined as Guildford Formation. It is expected a layer of topsoil will be present. The western portion of the Water Corporation open drain falls within a clay sandy silt zone defined as alluvial origin. These ground conditions are relatively common in regions along the bottom of the Darling Scarp.

Detailed geotechnical investigations will be required throughout the planning and design phases to verify the ground profile.

Detailed groundwater investigations will be completed during the planning phase to establish the profile. This profile will be used to establish drainage arrangements and ultimately finished lot levels. Due to the Guildford Formation, it is expected groundwater will be shallow.

Acid Sulphate Soil (ASS) mapping indicates that the site falls within a moderate to low risk of ASS occurring within 3m of natural source surface but high to moderate risk of ASS beyond 3m. It is expected that any dewatering will require a preliminary ASS investigation and where required, an ASS Management Plan. It is expected standard construction methods will be utilised to manage the ASS.

Environmental

Aurora Environmental have been engaged to complete a Desktop Environmental Assessment of the site. An environmental review and assessment was not completed as part of this investigation, please refer to Aurora's report for further details.

Siteworks and Earthworks

The site is generally feature free apart from the various open drains and a borrow pit that appears to have been formed in the 1970's.

Pending the outcomes of the geotechnical investigations, it is expected topsoil will be stripped prior to the placement of structural fill to establish the finished surface level. It is expected topsoil will be reused across the development where appropriate.

Some clay layer shaping may be required pending the outcomes of the standard drainage studies and the detailed engineering designs.

Wastewater

There is currently no existing wastewater infrastructure in the surrounding area. As the site falls outside of the current planning area, the Water Corporation does not have any conceptual wastewater planning.

The nearest wastewater pumping station will be located on Scott Street, approximately 1.8 km to the north east. This pumping station is currently under design (commissioning scheduled for 2021) however its catchment does not extend over this site.

The Water Corporation confirmed its ultimate planning for the region details a large Type 1000 relay pumping station on Scott Street. This will convey effluent west to either Rockingham or Kwinana treatment plants. The pumping station will service a significant area, likely to include Byford to the north, down to Serpentine to the south, and its catchment is expected to cover this site due to its close proximity. The Water Corporation has confirmed it has secured a parcel of land adjacent to the proposed Scott Street pumping station for this Type 1000 pumping station, and that a service corridor will be required along Mundijong Road for its pressure main. Below is an extract of the Water Corporation Planning (Byford SD086) showing the location of the Scott Street pumping station.



As the planning phases progress for the subject site, the Water Corporation will prepare wastewater concepts. It is expected the site will have one central wastewater pumping station which will receive gravity inflow and will pump the effluent east towards Scott Road. Due to the limited number of individual properties, it is expected the placement of the pumping station, pressure main and the associated incoming infrastructure will be easy to plan resulting in an efficient design.

Water Reticulation

The Water Corporations Serpentine Trunk Main (Ø1370 and Ø1220) runs north-south through the centre of the site and conveys water into the metropolitan area. These are primary Water Corporation assets and are located within a dedicated service corridor. The Water Corporation also has a Ø1065 steel water main that extends west from the Serpentine Trunk Main along Mundijong Road. It is expected these mains will remain. Refer the below extract from Water Corporations database for details.



There are no water distribution or reticulation mains of suitable size in the surrounding area that can be connected to provide a supply point for this site.

As the site falls outside of the current planning area, the Water Corporation does not have any water supply concepts. As the planning phases progress for this site, the Water Corporation will consider concepts to facilitate development. The Water Corporation advised its concepts would cover an area much larger than the site as typically undertaken with water planning.

Discussions with the Water Corporation confirmed there are two potential options, those being a connection to the existing large water mains or establishing an elevated reservoir on the scarp to supply the greater area. As part of the elevated reservoir option, a main will be extended to the site with reticulation connections servicing the development. It is also likely this main will connect into the existing Mundijong network to reinforce the water supply.

Drainage

Drainage investigations will be required as part of the planning process. These will investigate and nominate groundwater and flood level criteria as well as provide commentary on the existing open drain network. It is expected existing open drains will be realigned or contoured to become drainage features and incorporated into the greater development. It is expected the planning for this will be straight forward due to the limited number of individual and affected lots.

Pending the outcomes of the geotechnical and drainage investigations, it is expected the site will require fill with dedicated lot connections to manage groundwater separation and onsite disposal at the lot level. A street drainage network will be required to convey stormwater to treatment and detention areas prior to release off site. This is consistent with developments along the bottom of the Darling Scarp. These arrangements will be considered and detailed as part of the various management strategies.

Roads

The four roads that surround the site are controlled by the Shire of Serpentine Jarrahdale. Mundijong Road provides primary access to the Kwinana Freeway and South Western Highway, with King Road and Kargotich Road extending north to Thomas Road.

The four intersections on the corners of the site are level and are controlled by stop or give way lines. It appears all intersections have sufficient lines of sight.

Traffic investigations will be required to support the planning process. The outcomes will nominate road corridor widths on both existing and proposed networks as well as nominating primary and secondary traffic control devices throughout. Upgrade and duplication works may be required on the existing road network.

It is probable each of the perimeter roads will have intersections to allow access into the site. It is not expected the geometry or profile of the existing perimeter roads will impact on the locations of these future intersections. Intersections off Mundijong Road will require a bridge or culvert arrangement to allow the road to pass over the existing open drain.

The Main Roads WA Restricted Access Vehicle (RAV) mapping confirms King Road and the Western portion of Mundijong Road are RAV 4 compliant with Kargotich Road being RAV 3 compliant. RAV 4 access is an accepted minimum standard for an industrial estate however RAV access is typical not required for a residential development.

Main Roads WA plans to extend Tonkin Highway past Mundijong Road to the South West Highway, the timing of which is unknown. It is expected the extension will cross Mundijong Road approximately 2km east of the site via an interchange. It is understood the road reserve for the future Tonkin Highway exists and federal funding has been committed.

There is a rail corridor running parallel to Leipold Road located approximately 700m north of the site at its closest point. To the west, the rail heads north to the Rockingham and Kwinana Industrial Areas and to the east, it heads south. The King and Kargotich crossings are at grade and fully controlled (boom and light). Refer the below for further details.



Due to Mundijong Road's connectivity, primary vehicle access to the site will be from the south. Due to the separation, the rails impact on this development is expected to be negligible.

Power

A review of the Western Power database shows two high voltage transmission lines running north-south through the site. One appears to be contained within Serpentine Trunk Main corridor and the other is approximately 500m west of Kargotich Road (contained in its own service corridor). It is expected these transmissions lines will remain. There are existing high voltage distribution lines along portions of the existing road reserves as typically expected.

A review of the Western Power mapping (2021) confirms the south western corner of the site has approximately 25 to 30 MVA spare capacity whereas the balance of the site has less than 5 MVA spare capacity. Previous Western Power advice indicated reinforcing works are required on their Byford Station to increase the supply in the broader area. These reinforcing works will increase available power to not only this site but also the greater Serpentine Jarrahdale district. It is likely a high voltage feeder extension is needed to provide a point of supply to the site as expected with all large scale developments.

Early engagement with Western Power is recommended to progress the power supply discussions. This will outline the scope of any feeder works as well as emphasize to Western Power the importance of upgrading supply to their Byford Station. It is expected this process will take several years to complete however this can be undertaken concurrently with the planning phase.

Once a point of supply has been established, it is expected the development will have a traditional high and low voltage network.

Communications

There are existing communication networks in the surrounding road reserves. Due to the size and scale of development, it is expected NBN will established a point of supply for the site and each of the individual lots. Early engagement with the NBN is recommended to ensure connections are available when required.

Gas Supply

ATCO's distribution mapping confirms they have a high pressure feeder that runs south along Soldiers Road terminating at Mundijong. There is a feeder that heads west along Bishop Road that terminates approximately 4 km from the north eastern corner of the site. If a gas supply is required for this development, it is likely an extension from Bishop Road is needed. A standard gas reticulation network would be established from this extension to service each of the lots.

It is recommended early engagement with ATCO is arranged to manage this gas service if required.

The Australia Gas Infrastructure Group have advised the Dampier Bunbury Natural Gas Pipeline corridor is positioned well clear of the site, some 7km to the south west.

Summary

The size of the site and limited number of individual lots simplifies the rezoning and development process resulting in shorter timeframes and efficient designs (road, POS and infrastructure).

The subject sites form and expected ground conditions are not dissimilar to other residential areas within close proximity to the bottom of the Darling Scarp.

Detailed drainage investigations are required as part of the overall planning process. These will set groundwater, flood and lot separation criteria. There appears to be opportunities to incorporate the existing drainage network into any future subdivision which will create features for the development as well as improve the overall water quality.

There is minimal services planning for the site due to its current zoning. When the rezoning application is initiated, each of the service authorities will consider how they can establish a point of supply. Early discussions with the service authorities are recommended to ensure their planning and the provision of primary or feeder services does not impact on the critical path for this development.

Primary access to the site is via Mundijong Road. This intersects with both Kwinana Freeway and South Western Highway as well as the future Tonkin Highway interchange. Access into the site can be off Mundijong Rd or any of the other three bounding roads.

If you have any queries regarding the engineering constraints associated with this site, please contact the undersigned.

Yours faithfully



SHANE HIGHMAN
DIRECTOR DEVELOPMENT

APPENDIX 6

MDSP Precincts Botanist Survey (PGV Environmental – November 2019)

PRECINCTS B, D AND PART F, MUNDIJONG

ENVIRONMENTAL FEATURES SURVEY

Prepared for: Aurora Environmental

Report Date: 26 November 2019

Version: 3

Report No. 2019-477

The logo for PGV Environmental is displayed in white text on an orange background. The letters 'PGV' are in a large, bold, sans-serif font, with the 'G' being particularly prominent. Below 'PGV', the word 'ENVIRONMENTAL' is written in a smaller, all-caps, sans-serif font. The background of the logo area is a vibrant orange with a subtle pattern of fine, parallel lines radiating from the bottom left towards the top right.

PGV
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EXECUTIVE SUMMARY

PGV Environmental was commissioned by Aurora Environmental on behalf of the Watson Property Group to undertake an assessment of the vegetation in Precincts B, D and the western side of Precinct F within the Mundijong District Structure Plan (DSP) area with particular reference to the potential impact of the DSP on areas containing significant flora and vegetation values.

The assessment included desktop reviews of reports, databases and mapping as well as a preliminary site investigation.

The assessment found that Precincts B, D and the western side of Precinct F contained some native vegetation as either isolated trees or stands of trees in road reserves and on some private lots. The dominant native tree species present were Marri and Jarrah with some Sheoak, Banksia and Flooded Gum.

The balance of the Precincts contained non-native trees with River Red Gum very common particularly in Precinct F West.

Two areas containing native vegetation in Precinct B and F West may some have conservation significance as a Threatened Ecological Community (FCT 20a and Banksia Woodland TEC) and the possible presence of Threatened and Priority plant species. Further investigation into the flora and vegetation values of these areas may need to be undertaken as part of more detailed structure planning for the DSP area.

All three Precincts contain foraging, potential breeding and roosting habitat for Black Cockatoo species. The habitat includes native trees as well as non-native tree and shrub species. Any proposal to clear Black Cockatoo habitat will need further assessment to determine the level of impact and whether a referral under the EPBC Act is required.

Future development of Mundijong in accordance with the DSP is likely to result in the clearing of native and non-native vegetation that currently exists in private lots and road reserves. The vegetation contains some important ecological attributes such as potential State and Commonwealth listed TECs and conservation significant flora as well as foraging, roosting and potential breeding habitat for Black Cockatoos.

PGV Environmental considers that further studies will be required to assess the presence and extent of TECs, Black Cockatoo habitat, and possible Threatened flora species, as part of more detailed structure planning and proposals to clear vegetation for development.

1 INTRODUCTION

1.1 Background

The Mundijong District Structure Plan (DSP) was adopted by the Shire of Serpentine Jarrahdale in December 2018. The DSP plans for a future population projection of between 40,000 and 50,000 people in a mix of land uses including residential, commercial, industrial and rural residential.

Future development of Mundijong is highly likely to require the clearing of vegetation on existing lots and road reserves to facilitate the density of development envisaged in the DSP. PGV Environmental was commissioned by Aurora Environmental on behalf of the Watson Property Group to undertake an assessment of the vegetation in Precincts B, D and the western side of Precinct F with particular reference to the potential impact of the DSP on areas containing significant flora and vegetation values.

1.2 Location

Precincts B, D and Part F, Mundijong are located close to the Mundijong town centre which is located approximately 38km south-east of the Perth Central Business District (Figure 1). Precinct B is to the north-east of the town centre and is bounded by Manjedal Brook Reserve to the north, South-Western Highway to the east, Galvin Road to the south and the rail line to the west. Precinct D is to the south-east and is bound by Watkins Road to the north and the rail line to the south and west. Precinct F is to the west of the townsite and is bound by the rail reserve to the east, Kiernan Street to the north, Baskerville Road to the west and Mundijong Road to the south (Figure 2).

1.3 Purpose and Scope of Works

As requested, the Environmental Features Survey for Precincts B, D and Part of F (the site) is a high level survey to:

- Assess the flora and vegetation on the site to determine any areas that may be of conservation significance including;
- whether the vegetation has potential to be a Threatened Ecological Community, particularly the Banksia Woodland of the Swan Coastal Plain TEC which was listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) after the DSP environmental studies were prepared; and
- Undertake a high level survey of habitat for the three listed species of Black Cockatoo:
 - Baudin’s Black Cockatoo (*Calyptorhynchus baudinii*) (Endangered);
 - Carnaby’s Black Cockatoo (*Calyptorhynchus latirostris*) (Endangered); and
 - Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (Vulnerable).

2 EXISTING ENVIRONMENT

2.1 Land Use

Aerial photography from 1977 shows Precinct B and D are largely cleared with some scattered trees remaining and the western part of Precinct F is mostly cleared with small areas of remnant vegetation (Plate 1).

Plate 1: Aerial photography from 1977 (Landgate, 2019)



The Precincts are currently developed as large 'Rural' lots that have significant areas that have been cleared of native vegetation and small remnant areas of vegetation and/or isolated trees.

2.2 Geology and Soils

2.2.1 Geology

The site is located on the eastern side of the Swan Coastal Plain. The Swan Coastal Plain is generally flat and is approximately 20 to 30 kilometres wide, consisting of a series of geomorphic entities running parallel to the coastline. The site is situated in a transitional area between the soil systems with the Bassendean Dune System in the western parts of the site, Pinjarra Plain in the central part and the Forrestfield complex to the east (National Map, 2019).

The Bassendean Dune and Sandplain System consists of very low relief, leached, grey siliceous Pleistocene sand dunes, intervening sandy and clayey swamps and gently undulating plains (Bolland,

1998). These occur immediately west of, and partly overlie, the Pinjarra Plain. Topography becomes more subdued from west to east.

The Pinjarra Plain System consists of broad low relief plain west of the foothills, comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium associated with major current drainage systems. The major soils are naturally poorly drained and many swamps occur (DPIRD, 2019).

The Forrestfield System is described as the laterised undulating foot slopes of the Darling and Whicher Scarps (Shire of Kalamunda, 2010). The soils are described as duplex sandy gravels, pale deep sands and grey deep sandy duplexes (DPIRD, 2019).

2.2.2 Soils

The soil phases mapped on the site are outlined in Table 1.

Table 1: Soil Phases (DPIRD, 2019)

Name	Reference	Description
Bassendean B1a Phase	212Bs_B1a	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.
Bassendean B2 Phase	212Bs_B2	Flat to very gently undulating well drained sandplain. Deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.
Bassendean B2a Phase	212Bs_B2a	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.
Bassendean B6 Phase	212Bs_B6	Imperfectly drained sandplain and broad extremely low rises. Deep or very deep grey siliceous sands.
Pinjarra P1b Phase	213Pj_P1b	Flat to very undulating plain with deep acidic mottled yellow duplex (or "effective duplex") soils comprising moderately deep pale sand to sandy loam over clay; imperfectly drained and moderately susceptible to salinity in limited areas.
Pinjarra P1d Phase	213Pj_P1d	Pale grey sand to sandy loam over clay; imperfect to poorly drained and moderately susceptible to salinity
Pinjarra P1e Phase	213Pj_P1e	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or γ effective duplex γ) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.
Forrestfield 2a Phase	213Fo_F2a	Low slopes and foot slopes up to 5-10% with well drained shallow to moderately deep, very gravelly acidic yellow duplex soils and common laterite.
Forrestfield 2b Phase	213Fo_F2b	Low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.
Forrestfield 2c Phase	213Fo_F2c	Low slopes and foot slopes up to 5-10% slopes with well drained deep uniform yellowish brown sands which are generally free of laterite or gravel.
Forrestfield 3 Phase	213Fo_F3	1-3% foot slopes with deep, imperfectly drained yellow and, less commonly, acidic gley duplex soils.

Name	Reference	Description
Forrestfield 4 Phase	213Fo_4	Incised stream channels within gentle slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.

The soils on the site vary and are sandy soils, alluvial clays and laterites.

2.3 Hydrology

The Superficial Swan overlays the Leederville aquifer which is further described as the sub area Wanneroo member under the site and consists of poorly sorted fine- to medium-grained quartz with feldspar and occasionally trace heavy minerals. This overlays the Cattamara Coal Measures (DoW, 2012a). Groundwater flows from east to west across the region (Hames Sharley, 2018).

Much of the site is mapped as a Multiple Use Palusplain (Unique Feature Identifier (UFI) 16021). There is a small Conservation Category Wetland in Precinct D that contains vegetation. This wetland is a Palusplain (UFI 14971) (National Map, 2019).

3 FLORA AND VEGETATION

3.1 Methodology

A high level Reconnaissance Flora and Vegetation Survey was undertaken by PGV Environmental. The survey included initial desktop studies to identify environmental features that could occur on the site. A site visit was undertaken by PGV Environmental on 21 October 2019. The site visit examined areas of vegetation from the roadside as access to private lots was not able to be granted. The vegetation on some lots away from the road was not able to be determined from the road. These areas have not been assessed.

The site visit recorded, as much as possible from the roadside, any areas that contained native species. This predominantly included recording native tree species in road reserves and lots. Where more intact native vegetation was present the vegetation type and condition were assessed. The presence and type of non-native tree species was also assessed in the survey.

3.2 Desktop Studies

3.2.1 Vegetation Complex

Vegetation Complexes are a broad level of vegetation description which is based on the underlying geomorphology and rainfall (Heddle *et al.*, 1980). The vegetation over Precincts B and D is part of the Forrestfield Complex which is described as “Vegetation ranges from open forest of *E. calophylla* – *E. wandoo* – *E. marginata* to open forest of *E. marginata* – *E. calophylla* – *C. fraseriana* – *Banksia* spp. Fringing woodland of *E. rudis* in the gullies that dissect this landform” (Heddle *et al.*, 1980).

The western part of Precinct F is mapped as Guildford Complex which is described as “A mixture of open forest to tall open forest of *E. calophylla* – *E. wandoo* – *E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis* – *M. raphiophylla*” (Heddle *et al.*, 1980).

3.2.2 TEC/PEC Database Searches

Threatened Ecological Communities (TECs) identified in the Protected Matters Search Tool Report (Appendix 1) and TECs and Priority Ecological Communities (PECs) from previous studies (PGV Environmental, 2012 and 2014) that have been recorded in the Mundijong area are outlined in Table 3.

Plate 2 shows the TECs that are mapped in the Mundijong DSP area. NationalMap does not identify the specific TECs that are mapped. At least three TECs appear to be mapped in Precinct B, one in Precinct D and none in the western side of Precinct F (although there are several on the eastern side).

Table 3: TEC and PECs identified in the Mundijong Area

Number	Description	Conservation Status in WA	Status under the EPBC Act
SCP3a	<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain	Critically Endangered	Endangered

Number	Description	Conservation Status in WA	Status under the EPBC Act
SCP02	Southern wet shrublands, Swan Coastal Plain	Endangered	
SCP20b	<i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain	Endangered	Endangered as part of Banksia Woodlands
SCP3b	<i>Eucalyptus calophylla</i> - <i>Eucalyptus marginata</i> woodlands on sandy clay soils of the southern Swan Coastal Plain	Vulnerable	
SCP08	Herb rich shrublands in clay pans	Vulnerable	Critically Endangered as part of Claypans TEC
SCP09	Dense shrublands on clay flats	Vulnerable	Critically Endangered as part of Claypans TEC
	<i>Casuarina obesa</i> Association	Priority 1	
Banksia Woodlands	Banksia Woodlands of the Swan Coastal Plain	Priority 3	Endangered
Tuart Woodlands	Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological community	Priority 3	Critically Endangered

Plate 2: Threatened Ecological Communities mapped on or near the Site



3.2.3 Flora Database Searches

A search of the Department of Biodiversity, Conservation and Attractions (DBCA) Naturemap (Appendix 2) indicates that a number of species that are listed as Endangered, Threatened or Priority are identified as being recorded within 10km of the site and the EPBC Act Protected Matters Search Tool (Appendix 1) indicates species that potentially have habitat within 5km of the site (Table 4).

Table 4: Conservation Significant Flora identified in Database Searches

Species	Common Name	Conservation Status in WA	Status Under EPBC Act 1999
<i>Caladenia huegelii</i>	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	Schedule 1	Endangered
<i>Calectasia cyanea</i>	Blue Tinsel Lily	Schedule 1	Critically Endangered
<i>Drakaea elastica</i>	Glossy-leafed Hammer Orchid	Schedule 1	Endangered
<i>Eucalyptus x balanites</i>	Cadda Road Mallee	Schedule 1	Endangered
<i>Lasiopetalum pterocarpum</i>	Wing-fruited Lasiopetalum	Schedule 1	Endangered
<i>Synaphea</i> sp. Fairbridge Farm (D Papenfus 696)	Selena's Synaphea	Schedule 1	Critically Endangered
<i>Synaphea</i> sp. Serpentine (G.R Brand 103)		Schedule 1	Critically Endangered
<i>Verticordia plumosa</i> var. <i>ananeotes</i>	Tufted Plumed Featherflower	Schedule 1	Endangered
<i>Diuris purdiei</i>	Purdie's Donkey-orchid	Schedule 2	Endangered
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	Schedule 2	Vulnerable
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	Narrow curved-leaf Grevillea	Schedule 2	Endangered
<i>Lepidosperma rostratum</i>	Beaked Lepidosperma	Schedule 2	Endangered
<i>Synaphea</i> sp. Pinjarra Plain (A.S George 17182)		Schedule 2	Endangered
<i>Thelymitra stellata</i>	Star Sun-orchid	Schedule 2	Endangered
<i>Andersonia gracilis</i>	Slender Andersonia	Schedule 3	Endangered
<i>Anthocercis gracilis</i>	Slender Tailflower	Schedule 3	Vulnerable
<i>Diuris micrantha</i>	Dwarf Bee-orchid	Schedule 3	Vulnerable
<i>Eleocharis keigheryi</i>	Keighery's Eleocharis	Schedule 3	Vulnerable
<i>Tetraria australiensis</i>	Southern Tetraria	Schedule 3	Vulnerable
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)		Priority 1	
<i>Synaphea odocoileops</i>		Priority 1	
<i>Grevillea crowleyae</i>		Priority 2	
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>		Priority 2	
<i>Levenhookia pulcherrima</i>	Beautiful Stylewort	Priority 2	
<i>Millotia tenuifolia</i> var. <i>laevis</i>		Priority 2	
<i>Acacia horridula</i>		Priority 3	
<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>		Priority 3	
<i>Amanita carneiphylla</i>	Miller's Pink-Gilled Lepidella	Priority 3	
<i>Amanita fibrillopes</i>		Priority 3	
<i>Amanita kalamundae</i>	Kalamunda Lepidella	Priority 3	
<i>Amanita wadjukiorum</i>		Priority 3	
<i>Angianthus drummondii</i>		Priority 3	
<i>Babingtonia urbana</i>	Coastal Plain Babingtonia	Priority 3	
<i>Carex tereticaulis</i>		Priority 3	
<i>Dillwynia dillwynioides</i>		Priority 3	
<i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459)		Priority 3	

Species	Common Name	Conservation Status in WA	Status Under EPBC Act 1999
<i>Isopogon drummondii</i>		Priority 3	
<i>Jacksonia gracillima</i>		Priority 3	
<i>Pithocarpa corymbulosa</i>		Priority 3	
<i>Schoenus capillifolius</i>		Priority 3	
<i>Schoenus pennisetis</i>		Priority 3	
<i>Schoenus</i> sp. Waroona (G.J. Keighery 12235)		Priority 3	
<i>Stylidium aceratum</i>		Priority 3	
<i>Drosera occidentalis</i>	Western Sundew	Priority 4	
<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i>		Priority 4	
<i>Parsonsia diaphanophleba</i>		Priority 4	
<i>Pimelea rara</i>		Priority 4	
<i>Senecio leucoglossus</i>		Priority 4	
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		Priority 4	

Definitions of the Conservation Codes are in Appendix 4.

3.3 Vegetation

3.3.1 Precinct B

Precinct B has largely been cleared of native vegetation and replaced by planted exotic trees. A patch of Jarrah (*Eucalyptus marginata*) trees and some *Xanthorrhoea preissii* shrubs occurred in lots and the road reserve at the northern end of Evelyn Street (Plate 3).

Plate 3: Jarrah and *Xanthorrhoea preissii* at the northern end of Evelyn Street



At the southern end of Evelyn Street, a stand of Jarrah and Sheoak (*Allocasuarina fraseriana*) occurred in lots either side of the road (Figure 3a). The understorey contained *Jacksonia sternbergiana* and *Xanthorrhoea preissii* and other species and was considered to be in Good to Very Good condition.

The Jarrah/Sheoak area may be representative the TEC identified as FCT 20a 'Banksia attenuata woodlands over species rich dense shrublands' (Plate 4).

Plate 4: Jarrah/Sheoak vegetation at the southern end of Evelyn Street



A large stand of Marri trees occurs in a drainage line to the north of Galvin Road. The understorey of the Marri stand is nearly all weed species.

Marri trees occur along the northern part of the Keirnan Street road reserve between Galvin Road and the South-West Highway and extend partially into some of the lots. The condition of the vegetation in the road reserve is all Completely Degraded.

3.3.2 Precinct D

The vegetation in Precinct D is very similar to Precinct B in that most of the native vegetation has been cleared with the exception of large trees retained in a parkland cleared setting mostly in road reserves. The condition of all vegetated areas in Precinct D is Completely Degraded. The trees in this Precinct are predominantly Marri with some Jarrah. A small area of Flooded gum (*Eucalyptus rudis*) occurs in the north-western part of the precinct with a few Paperbark trees (*Melaleuca preissiana*) (Figure 3b).

3.3.3 Western Part of Precinct F

The western part of Precinct F contains fewer native trees than Precincts B and D. A large part of the Precinct has been replanted with River Red Gums (*Eucalyptus camaldulensis*). A Fauna and Flora reserve is located at the north-west corner of Baskerville Road and Tonkin Street. The vegetation is described as a Low Woodland of Jarrah (*Eucalyptus marginata*), Sheoak (*Allocasuarina fraseriana*) and Banksia (Plate 5). *Banksia grandis* is the main species with *B. attenuata* and *B. menziesii* also present (Figure 3c). The vegetation condition was rated as Degraded due to the high number of invasive weeds in the understorey.

Plate 5: Jarrah, Sheoak and Banksia Low Woodland in the Fauna and Flora Reserve



3.4 Conservation Significance of Flora and Vegetation

3.4.1 Flora

Table 5 examines the preferred habitat of each flora species identified in the database searches.

Table 5: Preferred Habitat of Significant Flora Species

Scientific Name	Common Name	Preferred Habitat*
<i>Caladenia huegelii</i>	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	The Grand Spider-orchid prefers sand or clay loam. This species generally does not survive in disturbed areas.
<i>Calectasia cyanea</i>	Blue Tinsel Lily	The Blue Tinsel Lily prefers white, grey or yellow sand or gravel.
<i>Drakaea elastica</i>	Glossy-leafed Hammer Orchid	The Glossy-leafed Hammer Orchid prefers low-lying situations adjoining winter-wet swamps. This species does not survive in disturbed areas.
<i>Eucalyptus x balanites</i>	Cadda Road Mallee	The Cadda Road Mallee prefers sandy soils with lateritic gravel.
<i>Lasiopetalum pterocarpum</i>	Wing-fruited Lasiopetalum	The Wing-fruited Lasiopetalum prefers dark red-brown loam or clayey sand over granite on sloping banks near creeklines.
<i>Synaphea</i> sp. Fairbridge Farm (D Papenfus 696)	Selena's Synaphea	Selena's Synaphea occurs in sandy with lateritic pebbles near winter-wet flats, in low woodland with weedy grasses.
<i>Synaphea</i> sp. Serpentine (G.R Brand 103)		<i>Synaphea</i> sp. Serpentine occurs in brown sandy clay.
<i>Verticordia plumosa</i> var. <i>ananeotes</i>	Tufted Plumed Featherflower	Tufted Plumed Featherflower occurs in sandy loam on seasonally inundated plains.
<i>Diuris purdiei</i>	Purdie's Donkey-orchid	Purdie's Donkey Orchid occurs in grey-black sand in moist winter-wet swamps.

Scientific Name	Common Name	Preferred Habitat*
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	Dwarf Hammer-orchid occurs in grey sands over dark, grey to blackish, sandy clay-loam substrates in winter wet depressions or swamps.
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	Narrow curved-leaf Grevillea	Narrow curved-leaf Grevillea prefers sand, sandy loam in winter-wet heath.
<i>Lepidosperma rostratum</i>	Beaked Lepidosperma	Beaked Lepidosperma is found in peaty sand, clay.
<i>Synaphea</i> sp. Pinjarra Plain (A.S George 17182)		<i>Synaphea</i> sp. Pinjarra Plain occurs in grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite on flats, seasonally wet areas, railroad reserves often with wet depressions or drains.
<i>Thelymitra stellata</i>	Star Sun-orchid	The Star Sun-orchid prefers sand, gravel or lateritic loam.
<i>Andersonia gracilis</i>	Slender Andersonia	Slender Andersonia occurs in white/grey sand, sandy clay, gravelly loam in winter-wet areas, near swamps.
<i>Anthocercis gracilis</i>	Slender Tailflower	Slender Tailflower occurs in sandy or loamy soils near granite outcrops.
<i>Diuris micrantha</i>	Dwarf Bee-orchid	The Dwarf Bee-orchid is usually found on cleared firebreaks or open sandy patches that have been disturbed with in Jarrah Banksia woodland or thickets of Spearwood (<i>Kunzea ericifolia</i> / <i>glabrescens</i>) (Williams et al., 2001).
<i>Eleocharis keigheryi</i>	Keighery's Eleocharis	Keighery's Eleocharis occurs in clay, sandy loam and is emergent in freshwater: creeks, claypans.
<i>Tetraria australiensis</i>	Southern Tetraria	Southern Tetraria occurs in grey sand over clay; also described as yellow and sandy or clayey lateritic soils favouring winter-wet swampy depressions, drainage lines or rises surrounding swamps.
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)		This variant of <i>Acacia lasiocarpa</i> occurs in grey or black sand over clay in swampy areas, winter wet lowlands.
<i>Synaphea odocoileops</i>		<i>Synaphea odocoileops</i> occurs on brown-orange loam and sandy clay, granite on swamps, winter-wet areas.
<i>Grevillea crowleyae</i>		<i>Grevillea crowleyae</i> has been recorded in gravel in a gravel pit.
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>		<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i> occurs on grey-white-yellow sand on flats on seasonally-wet sites
<i>Levenhookia pulcherrima</i>	Beautiful Stylewort	Beautiful Stylewort grows in sand.
<i>Millotia tenuifolia</i> var. <i>laevis</i>		<i>Millotia tenuifolia</i> var. <i>laevis</i> grows in granite or laterite soils.
<i>Acacia horridula</i>		<i>Acacia horridula</i> grows in gravelly soils over granite, sand on rocky hillsides.
<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>		<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i> occurs in granitic soils

Scientific Name	Common Name	Preferred Habitat*
<i>Amanita carneiphylla</i>	Miller's Pink-Gilled Lepidella	Miller's Pink-Gilled Lepidella is a deeply rooting species and grows in sandy soil
<i>Amanita fibrillopes</i>		<i>Amanita fibrillopes</i> is recorded on grey sand on tracks (Davison et al., 2013)
<i>Amanita kalamundae</i>	Kalamunda Lepidella	<i>Kalamunda Lepidella</i> is found In deep litter under <i>Eucalyptus patens</i> and <i>Agonis eriofolia</i> (Amanitaceae Org, 2018).
<i>Amanita wadjukiorum</i>		<i>Amanita wadjukiorum</i> is solitary to gregarious, in sandy soil in degraded native vegetation (Davidson et al, 2013)
<i>Angianthus drummondii</i>		<i>Angianthus drummondii</i> grows in grey or brown clay soils, ironstone on seasonally wet flats.
<i>Babingtonia urbana</i>	Coastal Plain Babingtonia	Coastal Plain Babingtonia occurs in orange sand, brown loam, white sandy clay on low flats, winter-wet swamps
<i>Carex tereticaulis</i>		<i>Carex tereticaulis</i> prefers black peaty sand.
<i>Dillwynia dillwynioides</i>		<i>Dillwynia dillwynioides</i> occurs in sandy soils in winter-wet depressions.
<i>Eryngium pinnatifidum</i> subsp. Palustre (G.J. Keighery 13459)		<i>Eryngium pinnatifidum</i> subsp. Palustre is recorded from a winter wet claypan, water to 20 cm deep in grey-brown clay (Western Australian Herbarium, 1989)
<i>Isopogon drummondii</i>		<i>Isopogon drummondii</i> occurs in white, grey or yellow sand, often over laterite.
<i>Jacksonia gracillima</i>		<i>Jacksonia gracillima</i> occurs in grey and brown well-drained sand.
<i>Pithocarpa corymbulosa</i>		<i>Pithocarpa corymbulosa</i> occurs in gravelly or sandy loam amongst granite outcrops.
<i>Schoenus capillifolius</i>		<i>Schoenus capillifolius</i> grows in brown mud on claypans.
<i>Schoenus pennisetis</i>		<i>Schoenus pennisetis</i> occurs in grey or peaty sand, sandy clay in swamps, winter-wet depressions.
<i>Schoenus</i> sp. Waroona (G.J. Keighery 12235)		<i>Schoenus</i> sp. Waroona occurs in clay or sandy clay on winter-wet flats.
<i>Stylidium aceratum</i>		<i>Stylidium aceratum</i> occurs in sandy soils in swamp heathland.
<i>Drosera occidentalis</i>	Western Sundew	The Western Sundew occurs in sandy and clayey soils in swamps and wet depressions.
<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i>		<i>Eucalyptus rudis</i> subsp. <i>cratyantha</i> grows in loam on flats, hillsides.
<i>Parsonsia diaphanophleba</i>		<i>Parsonsia diaphanophleba</i> occurs in alluvial soils along rivers.
<i>Pimelea rara</i>		<i>Pimelea rara</i> occurs in lateritic soils.
<i>Senecio leucoglossus</i>		<i>Senecio leucoglossus</i> prefers gravelly lateritic or granitic soils with granite outcrops on slopes.
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i> prefers sand, sandy clay in winter-wet depressions.

* sourced from Florabase (DPaW, 2014) and DoEE SPRAT Database (DoEE, 2018)

The National Map website shows the potential location of Threatened flora species either in or in very close proximity to Precinct B and D (National Map, 2019) (Table 6). National Map does not identify which species or the precise location. The populations are likely to be in the rail reserve and/or road reserves.

Plate 6: Location of Threatened (T) and Priority (P) flora near the site



Three Threatened and one Priority flora species have previously been recorded in the Mundijong Road Reserve within the Mundijong District Structure Plan Area (SMEC, 2009). The nature of the site investigations for this Environmental Features Survey did not allow any detailed searching for Threatened or Priority flora in the survey area. The potential for any occurrences of Threatened species being present on the site is considered highly unlikely for most of the area and possible for the Fauna and Flora reserve in Precinct F and the area of Jarrah/Sheoak at the southern end of Evelyn Street in Precinct B.

3.4.2 Vegetation

3.4.2.1 Vegetation Complex

The vegetation on the site is part of the Forrestfield and Guildford vegetation complexes. Approximately 2,524ha of the original 21,211ha extent of the Forrestfield Complex remains on the Southern Swan Coastal Plain, representing 11.9% (WALGA, 2013). The EPA considers that vegetation complexes with less than 10% remaining in constrained areas such as the Perth Metropolitan Region are regionally significant and that for these complexes there is a presumption that all areas of remnant native vegetation where less than 10% remains will be retained and conserved. The 11.9% retention amount for the Forrestfield Complex is above the 10% target.

The Guildford Complex is considered to be poorly reserved with 5% of the original extent of the vegetation remaining and 0.2% (143ha) of the original extent in secure tenure (WALGA, 2013).

The survey area contains very little intact native vegetation. Areas containing native trees in otherwise cleared road reserves and lots have no conservation significance in terms of protecting good quality vegetation within the two vegetation complexes.

The small Fauna and Flora reserve in Precinct F West and the Jarrah/Sheoak vegetation on Evelyn Street in Precinct B contain vegetation that is part of the Guildford and Forrestfield Vegetation Complexes in the Mundijong area, respectively.

3.4.2.2 Threatened Ecological Communities

Several locations of TECs are mapped in Precincts B and D. The specific nature of the TECs is not able to be identified on the National Map website. Some of the TECs may have been mapped after the environmental studies for the DSP were completed. In particular, an additional TEC has been listed under the EPBC Act since the preparation of the environmental reports for the DSP. The Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (Banksia Woodland TEC) was listed as an Endangered TEC under the EPBC Act, effective from 16 September 2016.

The description of the Banksia Woodland TEC contained in the Conservation Advice is as follows:

The ecological community is a woodland associated with the Swan Coastal Plain of southwest Western Australia. A key diagnostic feature is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range.

The Conservation Advice contains a number of criteria to identify areas of Banksia Woodland TEC.

Based on the criteria and PGV Environmental's assessment of the vegetation in Precinct B and D, no areas of vegetation contained the relevant Banksia species as dominant trees and therefore the Banksia Woodland TEC does not occur in these precincts.

The Fauna and Flora reserve on Baskerville Road in Precinct F West contains native vegetation where Banksia tree species are quite common (Plate 7). The main Banksia species, *B. grandis*, is not one of the key Banksia species required for the TEC, however two other species present, *B. attenuata* and *B. menziesii* are two of the key species required for the TEC. As a result, there is potential for the Commonwealth listed Threatened Ecological Community 'Banksia Woodlands of the Swan Coastal Plain' to occur in this area.

Plate 7: Native vegetation in the Fauna and Flora Reserve Precinct F West containing Banksia species



An assessment of the vegetation in the Fauna and Flora reserve against the Banksia Woodland TEC criteria resulted in the vegetation in the reserve likely to be the Banksia Woodland TEC as the vegetation is in Good condition, the reserve contains *Banksia attenuata* and *B. menziesii* and the size of the area of native vegetation is above the minimum required to be the TEC.

4 BLACK COCKATOO HABITAT

4.1 Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black Cockatoo is found in the south-west of Australia from Kalbarri through to Ravensthorpe. It has a preference for feeding on the seeds of *Banksia*, *Hakea*, *Eucalyptus*, *Grevillea*, *Pinus* and *Allocasuarina* spp. It is nomadic, often moving toward the coast after breeding. It breeds in tree hollows that are 2.5 – 12m above the ground and have an entrance of 23-30cm with a depth of 1-2.5m. Nesting mostly occurs in smooth-barked trees (e.g. Salmon Gum, Wandoo, Red Morrell). Eggs are laid from July to October, with incubation lasting 29 days (DoE, 2014).

The site is inside the boundary of the modelled distribution and breeding range for Carnaby's Black Cockatoos (SEWPaC, 2012).

Carnaby's Black Cockatoo was observed on the site in Precinct D during the site assessment.

4.2 Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)

Baudin's Black Cockatoo is most common in the far south-west of Western Australia. It is known to breed from the southern forests north to Collie and east to near Kojonup. Baudin's Black Cockatoo is typically found in vagrant flocks and utilises the taller, more open Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) woodlands where it feeds mainly on Marri seeds and various Proteaceous species (Johnstone and Kirkby, 2011).

The site is inside the modelled distribution for Baudin's Black Cockatoos (SEWPaC, 2012).

4.3 Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

Forest Red-tailed Black Cockatoos are endemic to the humid to sub-humid south-west of Western Australia (SEWPaC, 2012). The range of Forest Red-tailed Black Cockatoos is bound by Gingin in the north to Mt Helena, Christmas Tree Well, West Dale, North Bannister, Mt Saddleback, Kojonup, Rocky Gully, upper King River and Green Range (east of Albany) (SEWPaC, 2012; DoE, 2014). It nests in tree hollows with a depth of 1-5m, that are predominately Marri, Jarrah and Karri (*E. diversicolor*) and it feeds primarily on the seeds of Marri and Jarrah (Johnstone and Kirkby, 2011).

The site is inside the modelled distribution for Forest Red-tailed Black Cockatoos (SEWPaC, 2012). Forest Red-tailed Black Cockatoos are known to forage in the surrounding area (Peck *et al.*, 2018).

4.4 Foraging Habitat

Foraging habitat species recorded on the site during the site investigations are shown in Table 1 (Valentine and Stock, 2008; Groom, 2011).

Table1: Foraging Species for Black Cockatoos in Mundijong Precincts B, D and Part of F

Scientific Name	Common Name
<i>Allocasuarina fraseriana</i>	Sheoak
<i>Banksia attenuata</i>	Candlestick Banksia
<i>Banksia grandis</i>	Bull Banksia
<i>Banksia menziesii</i>	Firewood Banksia
<i>Banksia sessilis</i>	Parrot Bush
<i>Callistemon</i> spp	Bottlebrush
<i>Corymbia calophylla</i>	Marri
<i>Eucalyptus marginata</i>	Jarrah
<i>Pinus radiata</i>	Pine trees

The main foraging species in Precincts B, D and F West was Marri with Jarrah also common in one part of Precinct B. Marri, Banksia and Jarrah trees are considered to be a High Resource for Black Cockatoos and therefore the foraging habitat on the site is considered to be 'quality' foraging.

Carnaby's Cockatoos were observed foraging on some Bottlebrush shrubs in Precinct D (Plate 8).

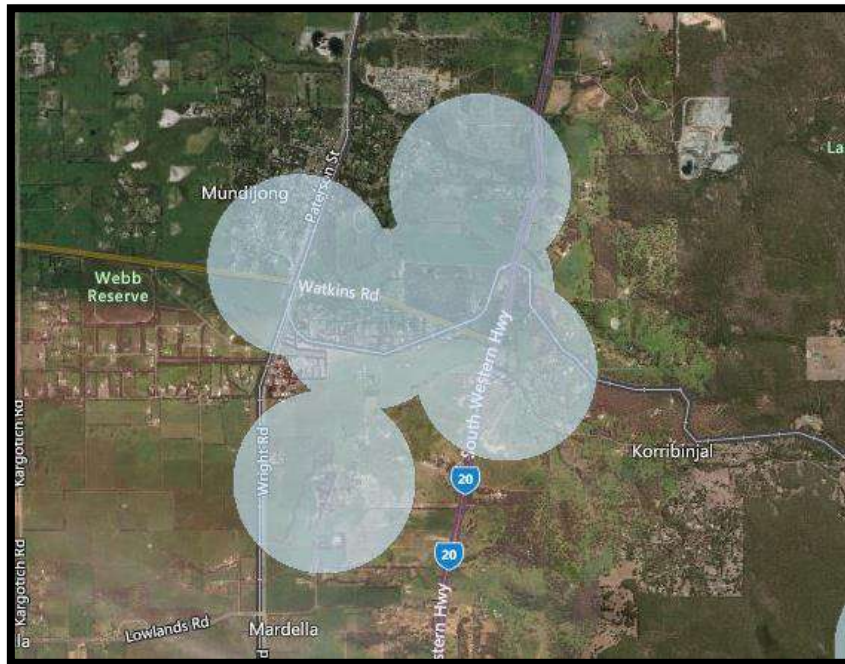
Plate 8: Carnaby's Black Cockatoo recorded on the site

4.5 Roosting Habitat

There are several areas that are mapped as confirmed roost sites by the Department of Biodiversity, Conservation and Attractions (DBCA) (National Map, 2019) (Plate 9). The exact location of the roost sites was not able to be determined from the mapping. However, it is likely that the roost sites shown in Plate 4 occur within or on the edge of the survey area.

Any foraging habitat that is located close to a roost site has added importance as foraging habitat for Black Cockatoos.

Plate 9: Roost sites as mapped by DBCA (National Map, 2019)



Black Cockatoos roost in both native and non-native trees. The site contains an abundance of tall non-native trees such as River Red Gums (*Eucalyptus camaldulensis*) in Precinct F West that are suitable for roosting by Black Cockatoos (Plate 10).

Plate 10: River Red Gum Potential Roosting Trees



4.6 Breeding Habitat

Black Cockatoos are known to breed in hollows of large eucalypts. The site is not known as a breeding site for Black Cockatoos (DoP, 2011; Peck *et al.*, 2018; National Map, 2019).

The Black Cockatoo Referral Guidelines define trees of certain species with a suitable Diameter at Breast Height (DBH) as breeding habitat regardless of the presence or not of hollows. The theory behind this definition is the concept that while the trees may not currently contain hollows, they are mature enough that in the next 50 years or so a hollow might form and be of use to Black Cockatoos for the purposes of breeding. The tree species on the site that are considered to be potential breeding habitat are Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) and Flooded Gums (*Eucalyptus rudis*). The appropriate DBH for these species is 500mm DBH.

Many Marri trees that are likely to have a DBH greater than 500mm (Plate 11) were observed during the site visit. Most of the trees were within road reserves in all Precincts. A few large Jarrah trees were observed on private lots. Some of the trees had hollows that may be large enough for cockatoos to breed in (Plate 12).

Plate 11: Marri trees with a DBH greater than 500mm



Plate 12: Large Jarrah trees on private lot in Precinct B



4.7 Conclusion

Precincts B, D and the western part of Precinct F all contain foraging, known or potential roosting habitat and potential breeding habitat for three species of Black Cockatoos that are listed under both State and Federal Environmental legislation. Any proposal to clear Black Cockatoo habitat will need further assessment to determine the level of impact and whether a referral under the EPBC Act is required.

5 SUMMARY AND CONCLUSIONS

5.1 Summary

The Environmental Features Survey of Precincts B, D and F West concludes the following:

- Native vegetation occurs in all Precincts and predominantly consists of isolated trees or stands of trees in road reserves and some private lots. The dominant native tree species present are Marri and Jarrah with some Sheoak, Banksia and Flooded Gum on small sites;
- A small area of Jarrah and Sheoak woodland occurs in Precinct B at the southern end of Evelyn Street that may have conservation significance as a Threatened Ecological Community and/or presence of Threatened and Priority plant species. Further investigation into the flora and vegetation values of this area may need to be undertaken as part of more detailed structure planning for this area;
- A small Fauna and Flora reserve of approximate 2.2ha occurs on the corner of Baskerville Street and Tonkin Street in Precinct F West. The reserve contains Jarrah/Sheoak/Banksia Woodland vegetation in Good condition. There is a limited potential for species of conservation significance to occur on the site. The vegetation was assessed as meeting the criteria for the Federally Listed 'Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community';
- All precincts contain foraging, potential breeding and roosting habitat for Black Cockatoo species. The habitat includes native trees as well as non-native tree and shrub species. Any proposal to clear Black Cockatoo habitat will need further assessment to determine the level of impact and whether a referral under the EPBC Act is required.

5.2 Conclusion

Future development of Mundijong in accordance with the DSP is likely to result in the clearing of native and non-native vegetation that currently exists in private lots and road reserves. The vegetation contains some important ecological attributes such as potential State and Commonwealth listed TECs and conservation significant flora as well as foraging, roosting and potential breeding habitat for Black Cockatoos.

PGV Environmental considers that further studies will be required to assess the presence and extent of TECs, Black Cockatoo habitat, and possibly Threatened flora species, as part of more detailed structure planning and proposals to clear vegetation for development.

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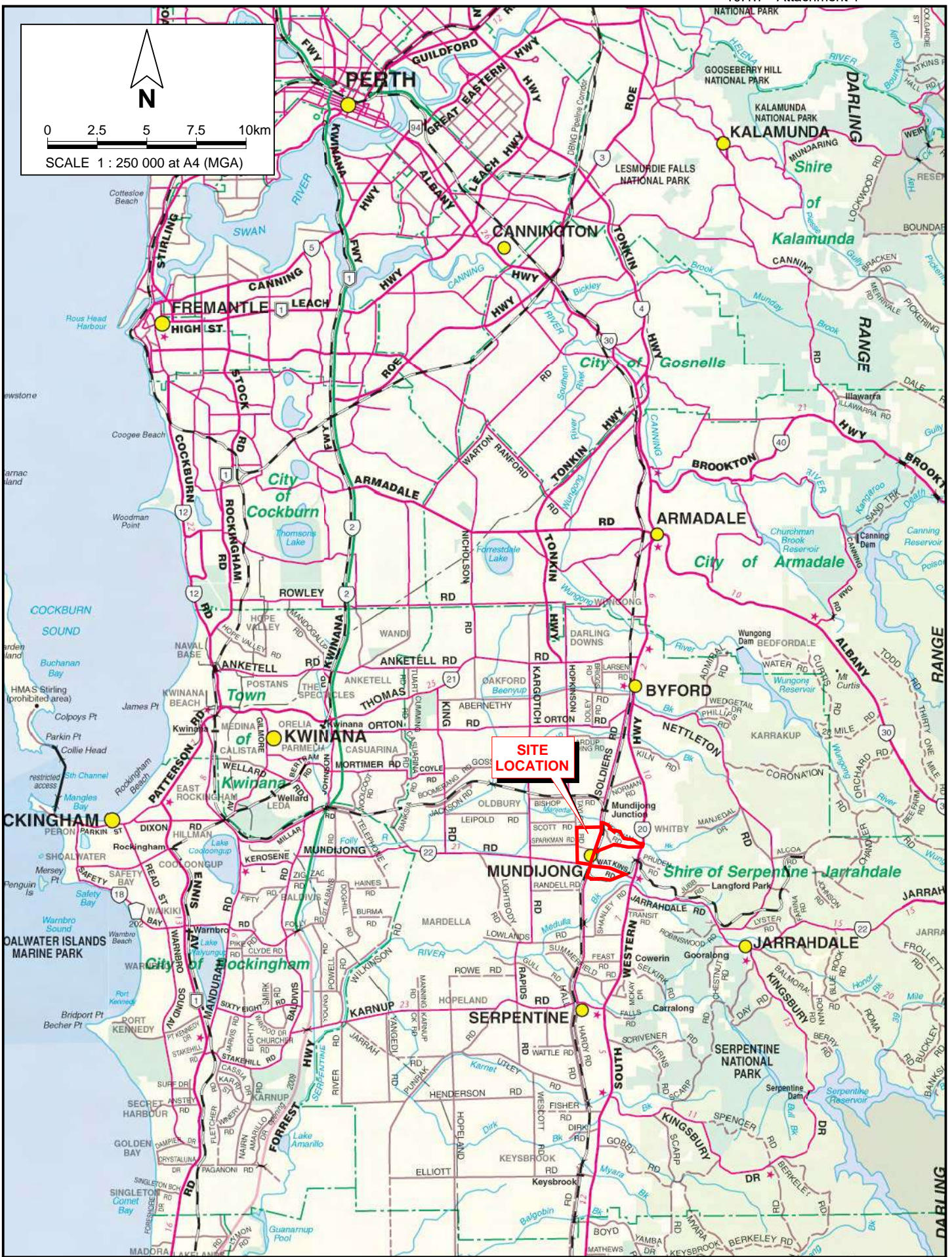
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FIGURES



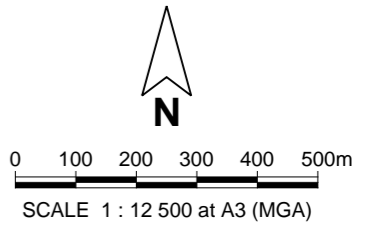
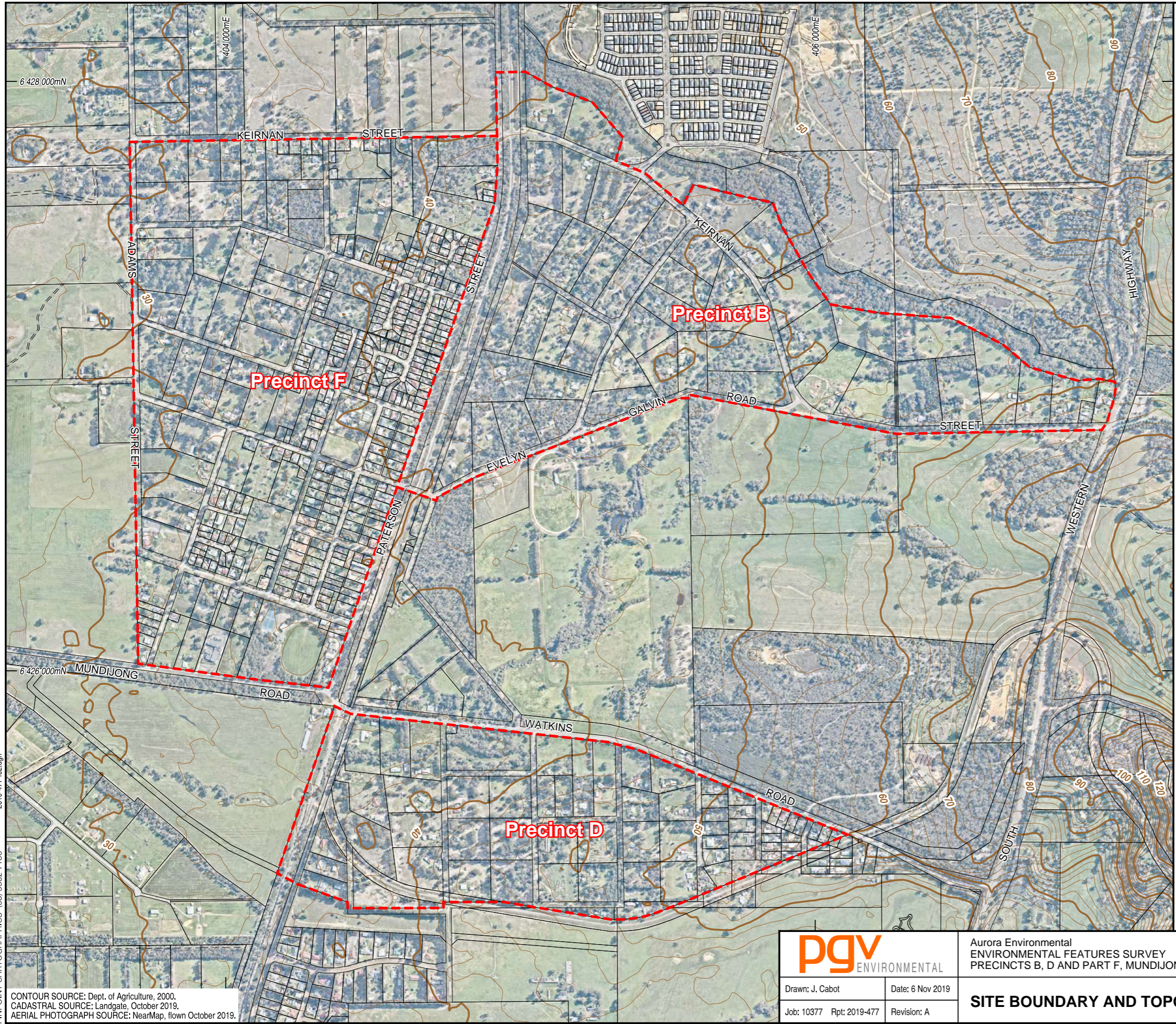
Aurora Environmental
 ENVIRONMENTAL FEATURES SURVEY
 PRECINCTS B, D AND PART F, MUNDIJONG

Drawn: J. Cabot	Date: 6 Nov 2019
Job: 10377 Rpt: 2019-477	Revision: A

SITE LOCATION

Figure 1

PINPOINT CARTOGRAPHICS (08) 9562 7136 2019-477-401.dgn



- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - - - Easement Boundary
 - Topographic Contour

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PINPOINT CARTOGRAPHICS (08) 9562 7136

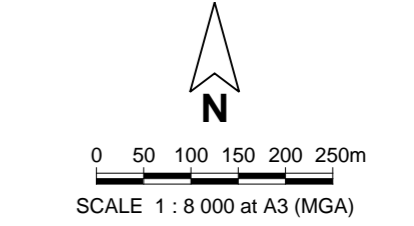
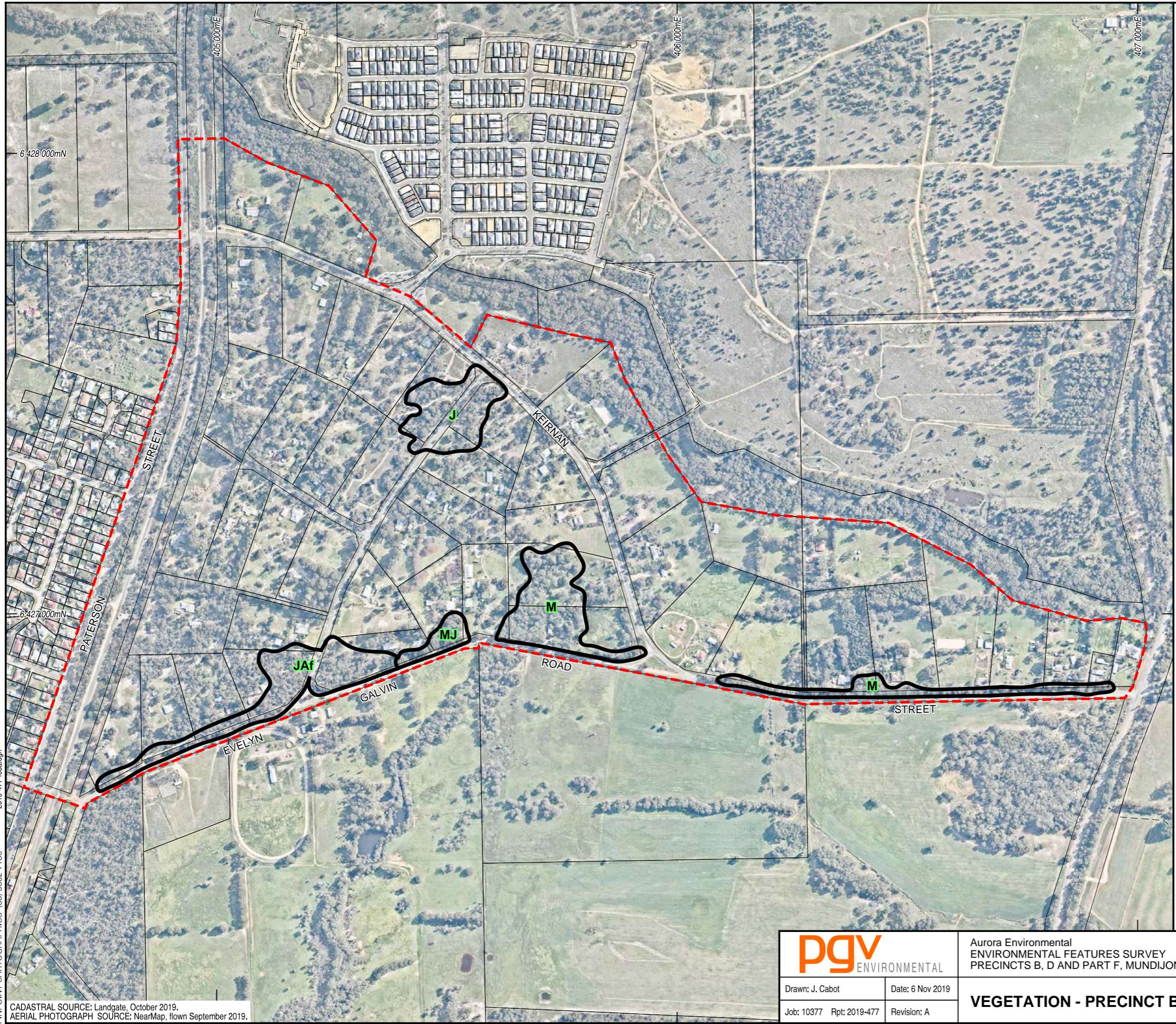
CONTOUR SOURCE: Dept. of Agriculture, 2000.
 CADASTRAL SOURCE: Landgate, October 2019.
 AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2019.

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Drawn: J. Cabot	Date: 6 Nov 2019
Job: 10377 Rpt: 2019-477	Revision: A

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 ENVIRONMENTAL FEATURES SURVEY
 PRECINCTS B, D AND PART F, MUNDIJONG

SITE BOUNDARY AND TOPOGRAPHY

Figure 2



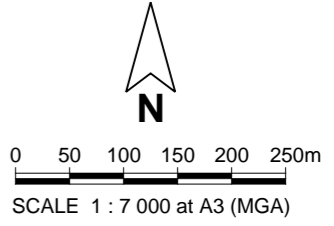
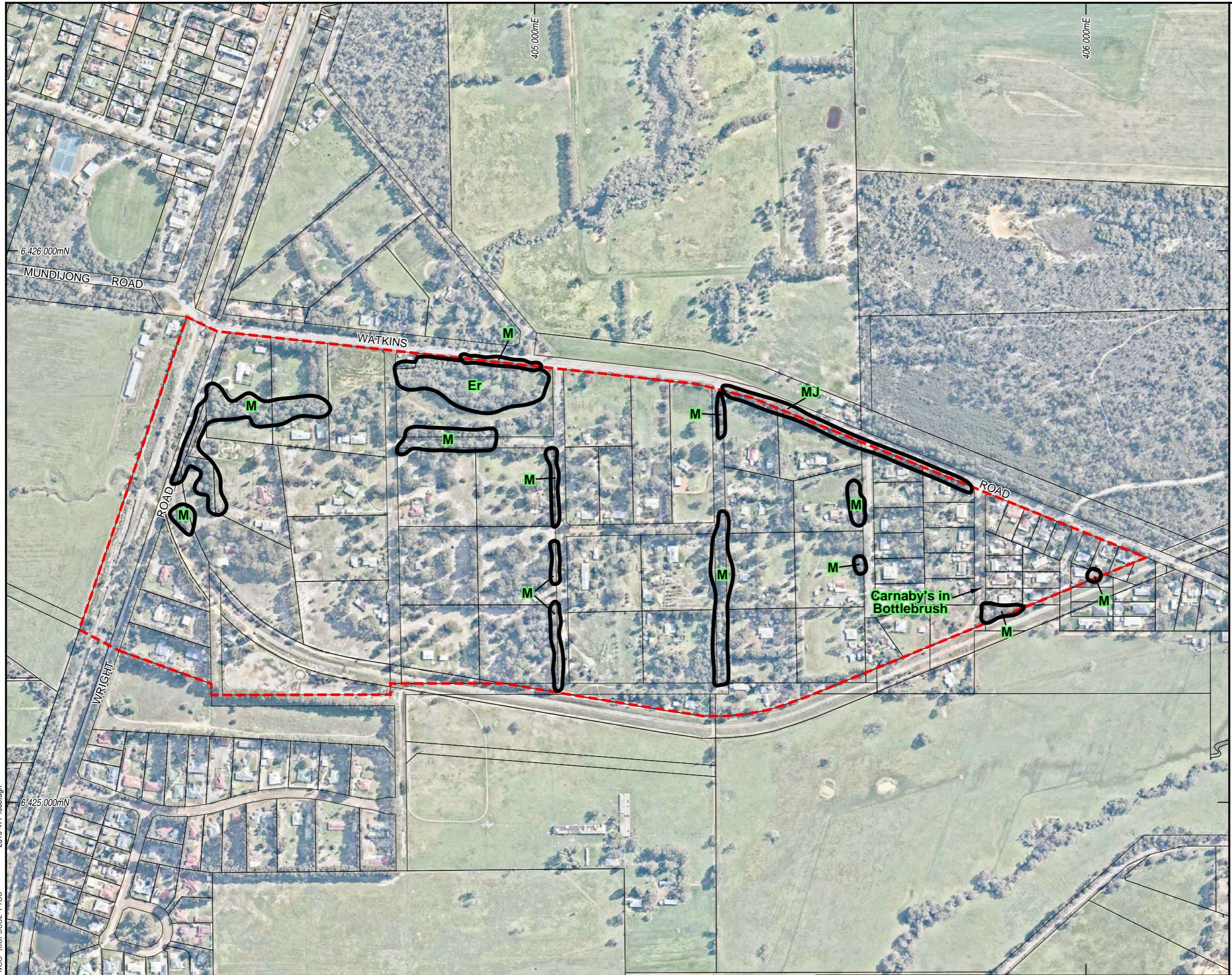
- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - - - Easement Boundary
- Legend**
- M Marri (*Corymbia calophylla*)
 - J Jarrah (*Eucalyptus marginata*)
 - Af Sheoak (*Allocasuarina fraseriana*)

2019-477-103a.dgn
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CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2019.

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Drawn: J. Cabot	Date: 6 Nov 2019	VEGETATION - PRECINCT B	
Job: 10377 Rpt: 2019-477	Revision: A		

Figure 3a



- Legend**
- - - Site Boundary
 - Cadastral Boundary
 - - - Easement Boundary
- Legend**
- M** Marri (*Corymbia calophylla*)
 - J** Jarrah (*Eucalyptus marginata*)
 - Af** Sheoak (*Allocasuarina fraseriana*)
 - Er** Flooded Gum (*Eucalyptus rudis*)

2019-477-103b.dgn
PINPOINT CARTOGRAPHICS (08) 9562 7136

CADASTRAL SOURCE: Landgate, October 2019.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2019.


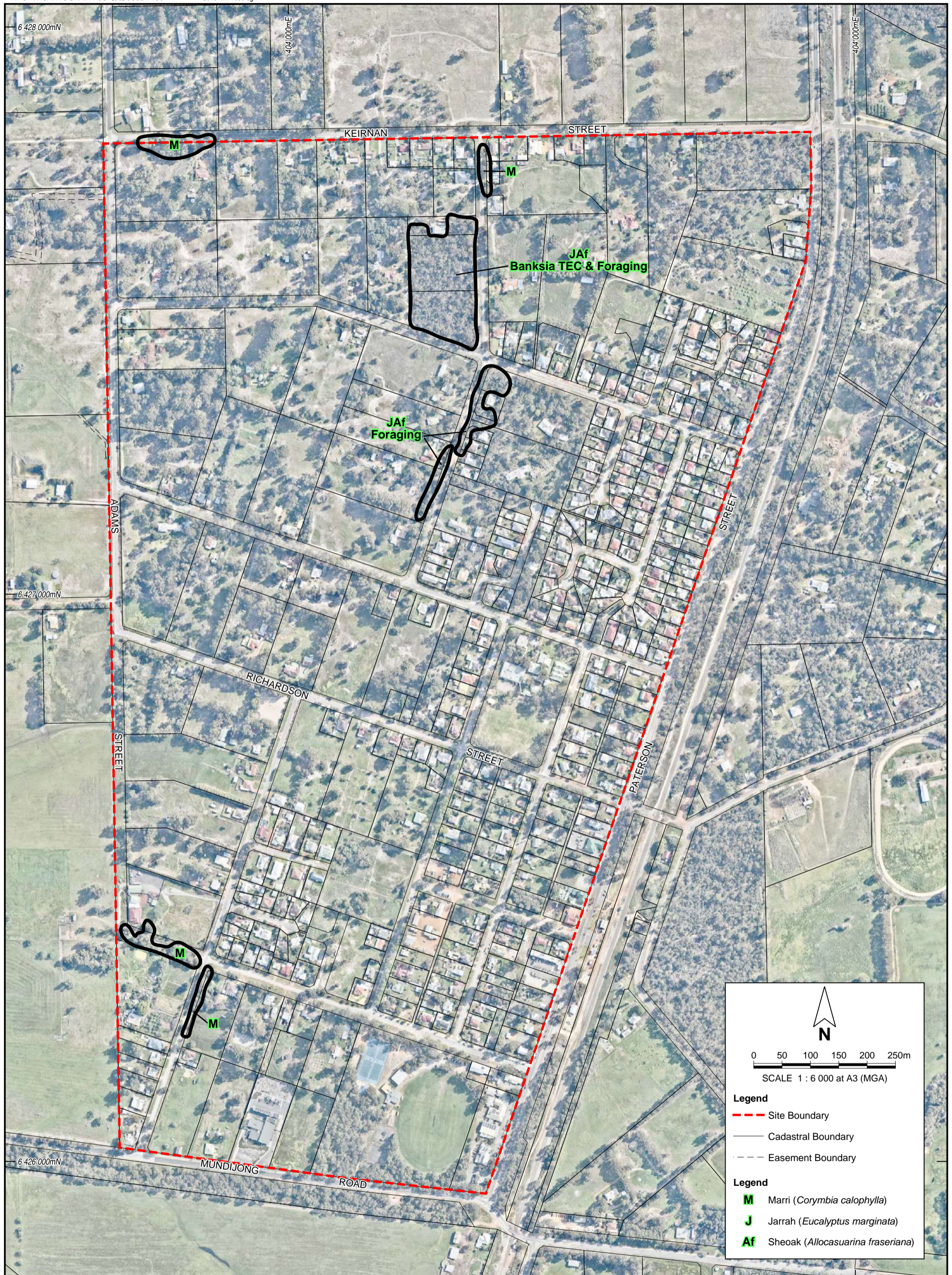
		Aurora Environmental ENVIRONMENTAL FEATURES SURVEY PRECINCTS B, D AND PART F, MUNDIJONG
Drawn: J. Cabot	Date: 6 Nov 2019	<h3>VEGETATION - PRECINCT D</h3>
Job: 10377 Rpt: 2019-477	Revision: A	

Figure 3b



N

0 50 100 150 200 250m

SCALE 1 : 6 000 at A3 (MGA)

Legend

- - - Site Boundary
- Cadastral Boundary
- Easement Boundary

Legend

- M Marri (*Corymbia calophylla*)
- J Jarrah (*Eucalyptus marginata*)
- Af Sheoak (*Allocasuarina fraseriana*)

	Aurora Environmental ENVIRONMENTAL FEATURES SURVEY PRECINCTS B, D AND PART F, MUNDIJONG		VEGETATION - PART PRECINCT F	Figure 3c
	Drawn: J. Cabot Date: 6 Nov 2019	Ordinary Council Meeting - 11 December 2023		
CADASTRAL SOURCE: Landgate, October 2019. AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2019.		Job: 10377 Rpt: 2019-477 Revision: A		

APPENDIX 1

Protected Matters Search Tool Report



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 22/10/19 19:28:49

[Summary](#)

[Details](#)

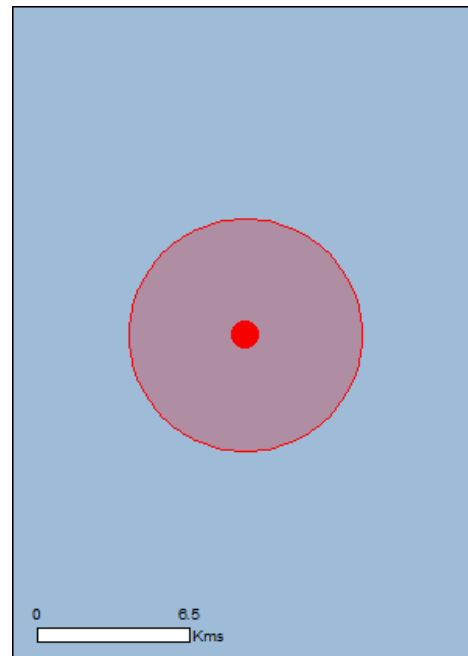
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

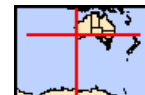
[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	27
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar
Peel-yalgorup system	30 - 40km upstream

Listed Threatened Ecological Communities	[Resource Information]
For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.	

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species	[Resource Information]	
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis		
Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
10.1.7 - Attachment 1		
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroi Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Anthocercis gracilis Slender Tailflower [11103]	Vulnerable	Species or species habitat may occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lasiopetalum pterocarpum Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	10.1.7 - Attachment 1 habitat may occur within area Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
------	------------	------------------

Migratory Marine Birds

Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
---	--	--

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
---	--	--

Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
--	--	--

Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
--	--	--

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
---	-----------------------	--

Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
--	--	--

Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
---	-----------------------	--

Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
---	--	--

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
------	------------	------------------

Birds

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
--	--	--

Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
---	--	--

Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
--	--	--

Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
--	--	--

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Cardup	WA
Unnamed WA46818	WA
Watkins Road	WA

Regional Forest Agreements	[Resource Information]
Note that all areas with completed RFAs have been included.	
Name	State
South West WA RFA	Western Australia

Invasive Species	[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.	

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.29104 115.98987

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
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- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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 Department of the Environment
 GPO Box 787
 Canberra ACT 2601 Australia
 +61 2 6274 1111

APPENDIX 2

Naturemap Report

NatureMap Species Report

Created By Guest user on 22/10/2019

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 59' 43" E, 32° 17' 19" S
Buffer 10km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	1495	17326
Other specially protected fauna	4	21
Presumed extinct	2	6
Priority 1	2	3
Priority 2	4	16
Priority 3	23	89
Priority 4	12	99
Protected under international agreement	3	7
Rare or likely to become extinct	24	953
TOTAL	1569	18520

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct				
1.	24162 <i>Bettongia penicillata</i> subsp. <i>ogilbyi</i> (Woylie, Brush-tailed Bettong)		T	
2.	1596 <i>Caladenia huegellii</i> (Grand Spider Orchid)		T	
3.	1213 <i>Calectasia cyanea</i> (Blue Tinsel Lily)		T	
4.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
5.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		T	
6.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		T	
7.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
8.	48400 <i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		T	
9.	24092 <i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
10.	1637 <i>Diuris purdiei</i> (Purdie's Donkey Orchid)		T	
11.	1639 <i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)		T	
12.	17000 <i>Lasiopetalum pterocarpum</i>		T	
13.	24557 <i>Leipoa ocellata</i> (Malleefowl)		T	
14.	942 <i>Lepidosperma rostratum</i>		T	
15.	24146 <i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		T	
16.	24166 <i>Pseudocheirus occidentalis</i> (Western Ringtail Possum, ngwayir)		T	
17.	24145 <i>Setonix brachyurus</i> (Quokka)		T	
18.	18590 <i>Synaphea</i> sp. Fairbridge Farm (D. Papenius 696)		T	
19.	30751 <i>Synaphea</i> sp. Pinjarra Plain (A.S. George 17182)		T	
20.	28354 <i>Synaphea</i> sp. Serpentine (G.R. Brand 103)		T	
21.	1033 <i>Tetraria australiensis</i>		T	
22.	24157 <i>Trichosurus vulpecula</i> subsp. <i>arnhemensis</i> (northern brushtail possum (Kimberley))		T	
23.	12448 <i>Verticordia plumosa</i> var. <i>ananeotes</i>		T	
24.	34113 <i>Westralunio carteri</i> (Carter's Freshwater Mussel)		T	
Presumed extinct				
25.	24155 <i>Perameles eremiana</i> (Desert Bandicoot, waliliya)		X	
26.	24164 <i>Potorous platyops</i> (Broad-faced Potoroo)		X	
Protected under international agreement				
27.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
28.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
29.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
Other specially protected fauna				
30.	24724 <i>Cacatua pastinator</i> subsp. <i>pastinator</i> (Muir's Corella, Muir's Corella (Western Corella SW WA))		S	
31.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
32.	25508 <i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)		S	

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
33.	48070 <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
Priority 1				
34.	14932 <i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)		P1	
35.	16865 <i>Synaphea odocoileops</i>		P1	
Priority 2				
36.	14407 <i>Grevillea crowleyae</i>		P2	
37.	19272 <i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>		P2	
38.	7675 <i>Levenhookia pulcherrima</i> (Beautiful Stylewort)		P2	
39.	14337 <i>Millotia tenuifolia</i> var. <i>laevis</i>		P2	
Priority 3				
40.	3373 <i>Acacia horridula</i>		P3	
41.	14129 <i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>		P3	
42.	25242 <i>Acanthophis antarcticus</i> (Southern Death Adder)		P3	
43.	18195 <i>Amanita carneiphylla</i>		P3	
44.	43543 <i>Amanita fibrillops</i>		P3	
45.	46334 <i>Amanita kalamundae</i> (Kalamunda Lepidella)		P3	
46.	43542 <i>Amanita wadjukiorum</i>		P3	
47.	7829 <i>Angianthus drummondii</i>		P3	
48.	45402 <i>Babingtonia urbana</i> (Coastal Plain Babingtonia)		P3	
49.	759 <i>Carex tereticaulis</i>		P3	
50.	3863 <i>Dillwynia dillwynioides</i>		P3	
51.	41801 <i>Eryngium pinnatifidum</i> subsp. <i>Palustre</i> (G.J. Keighery 13459)		P3	
52.	48579 <i>Euoplos inornatus</i> (inornate trapdoor spider (northern Jarrah Forest))		P3	
53.	34030 <i>Geotria australis</i> (Pouched Lamprey)		P3	
54.	48935 <i>Idiosoma sigillatum</i> (Swan Coastal Plain shield-backed trapdoor spider)		P3	
55.	29775 <i>Isopogon drummondii</i>		P3	
56.	20462 <i>Jacksonia gracillima</i>		P3	
57.	24165 <i>Petropseudes dahlia</i> (Rock Ringtail Possum, Wogoit)		P3	
58.	8163 <i>Pithocarpa corymbulosa</i> (Corymbose Pithocarpa)		P3	
59.	980 <i>Schoenus capillifolius</i>		P3	
60.	1008 <i>Schoenus pennisetis</i>		P3	
61.	17731 <i>Schoenus</i> sp. <i>Waroona</i> (G.J. Keighery 12235)		P3	
62.	18564 <i>Stylidium aceratum</i>		P3	
Priority 4				
63.	25035 <i>Ctenotus delli</i> (Dell's skink, Darling Range southwest Ctenotus)		P4	
64.	3115 <i>Drosera occidentalis</i> (Western Sundew)		P4	
65.	13512 <i>Eucalyptus rudis</i> subsp. <i>cratyantha</i>		P4	
66.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
67.	48588 <i>Isoodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
68.	48024 <i>Notamacropus eugenii</i> subsp. <i>derbianus</i> (Tammar Wallaby, Tammar)		P4	
69.	48022 <i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
70.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
71.	6573 <i>Parsonsia diaphanophleba</i>		P4	
72.	5260 <i>Pimelea rara</i> (Summer Pimelea)		P4	
73.	8212 <i>Senecio leucoglossus</i>		P4	
74.	14714 <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		P4	
Non-conservation taxon				
75.	??			
76.	15429 <i>Acacia alata</i> var. <i>alata</i>			
77.	15466 <i>Acacia appplanata</i>			
78.	3233 <i>Acacia barbinervis</i>			
79.	15469 <i>Acacia barbinervis</i> subsp. <i>barbinervis</i>			
80.	3247 <i>Acacia browniana</i>			
81.	16975 <i>Acacia decurrens</i>	Y		
82.	3294 <i>Acacia dentifera</i>			
83.	3307 <i>Acacia divergens</i>			
84.	3310 <i>Acacia drewiana</i>			
85.	11926 <i>Acacia drewiana</i> subsp. <i>drewiana</i>			
86.	3320 <i>Acacia ephedroides</i>			
87.	3374 <i>Acacia huegelii</i>			
88.	3382 <i>Acacia incrassata</i>			
89.	3383 <i>Acacia incurva</i>			
90.	3409 <i>Acacia lasiocarpa</i> (Panjang)			
91.	11519 <i>Acacia lasiocarpa</i> var. <i>bracteolata</i>			
92.	3410 <i>Acacia lateriticola</i>			
93.	15476 <i>Acacia latipes</i> subsp. <i>latipes</i>			
94.	3442 <i>Acacia microbotrya</i> (Manna Wattle, Kalyang)			

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95.	3451 <i>Acacia multispicata</i>			
96.	3454 <i>Acacia nervosa</i> (Rib Wattle)			
97.	3464 <i>Acacia obovata</i>			
98.	17860 <i>Acacia podalyriifolia</i>	Y		
99.	3502 <i>Acacia pulchella</i> (Prickly Moses)			
100.	15481 <i>Acacia pulchella</i> var. <i>glaberrima</i>			
101.	15483 <i>Acacia pulchella</i> var. <i>pulchella</i>			
102.	15480 <i>Acacia pulchella</i> var. <i>reflexa</i>			
103.	3527 <i>Acacia saligna</i> (Orange Wattle, Kudjong)			
104.	30032 <i>Acacia saligna</i> subsp. <i>saligna</i>			
105.	3541 <i>Acacia sessilis</i>			
106.	<i>Acacia</i> sp.			
107.	3557 <i>Acacia stenoptera</i> (Narrow Winged Wattle)			
108.	3574 <i>Acacia teretifolia</i>			
109.	3591 <i>Acacia urophylla</i>			
110.	3602 <i>Acacia willdenowiana</i> (Grass Wattle)			
111.	3184 <i>Acaena echinata</i> (Sheep's Burr)			
112.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
113.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
114.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
115.	24265 <i>Acanthiza uropygialis</i> (Chestnut-rumped Thornbill)			
116.	1205 <i>Acanthocarpus canaliculatus</i>			
117.	1208 <i>Acanthocarpus preissii</i>			
118.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
119.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
120.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
121.	<i>Acritoptila margaretae</i>			
122.	<i>Acritoptila</i> sp.			
123.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
124.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
125.	6205 <i>Actinotus leucocephalus</i> (Flannel Flower)			
126.	14970 <i>Adenanthos barbiger</i>			
127.	1775 <i>Adenanthos cygnorum</i> (Common Woollybush)			
128.	1790 <i>Adenanthos meisneri</i>			
129.	1791 <i>Adenanthos obovatus</i> (Basket Flower)			
130.	25 <i>Adiantum aethiopicum</i> (Common Maidenhair)			
131.	<i>Adversaeschna brevistyla</i>			
132.	25544 <i>Aegotheles cristatus</i> (Australian Owllet-nightjar)			
133.	23474 <i>Agrostocrinum hirsutum</i>			
134.	1261 <i>Agrostocrinum scabrum</i> (Blue Grass Lily)			
135.	184 <i>Aira caryophyllea</i> (Silvery Hairgrass)	Y		
136.	185 <i>Aira cupaniana</i> (Silvery Hairgrass)	Y		
137.	48513 <i>Aizoon pubescens</i>	Y		
138.	1728 <i>Allocasuarina fraseriana</i> (Sheoak, Kondil)			
139.	1731 <i>Allocasuarina huegeliana</i> (Rock Sheoak, Kwoil)			
140.	1732 <i>Allocasuarina humilis</i> (Dwarf Sheoak)			
141.	1734 <i>Allocasuarina microstachya</i>			
142.	1739 <i>Allocasuarina thuyoides</i> (Horned Sheoak)			
143.	<i>Allothereua maculata</i>			
144.	38755 <i>Amanita ochroterrea</i>			
145.	<i>Ambicodamus marae</i>			
146.	<i>Amblyomma triguttatum</i>			
147.	13380 <i>Amphibromus nervosus</i>			
148.	197 <i>Amphipogon debilis</i>			
149.	198 <i>Amphipogon laguroides</i>			
150.	20184 <i>Amphipogon laguroides</i> subsp. <i>laguroides</i>			
151.	199 <i>Amphipogon strictus</i> (Greybeard Grass)			
152.	200 <i>Amphipogon turbinatus</i>			
153.	13267 <i>Amyema linophylla</i> subsp. <i>linophylla</i>			
154.	2380 <i>Amyema miquelii</i> (Stalked Mistletoe)			
155.	<i>Aname mainae</i>			
156.	<i>Aname tepperi</i>			
157.	1059 <i>Anarthria humilis</i>			
158.	24312 <i>Anas gracilis</i> (Grey Teal)			
159.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
160.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
161.	<i>Ancylidae</i> sp.			
162.	6300 <i>Andersonia aristata</i> (Rice Flower)			
163.	6314 <i>Andersonia lehmanniana</i>			
164.	7833 <i>Angianthus preissianus</i>			

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165.	1409 <i>Anigozanthos humilis</i> (Catspaw)			
166.	1411 <i>Anigozanthos manglesii</i> (Mangles Kangaroo Paw, Kurulbrang)			
167.	11261 <i>Anigozanthos manglesii</i> subsp. <i>manglesii</i>			
168.	29487 <i>Anigozanthos manglesii</i> var. <i>x angustifolius</i>			
169.	1416 <i>Anigozanthos viridis</i> (Green Kangaroo Paw, Kurulbardang)			
170.	11566 <i>Anigozanthos viridis</i> subsp. <i>viridis</i>			
171.	25449 <i>Antechinus flavipes</i> (Yellow-footed Antechinus)			
172.	24088 <i>Antechinus flavipes</i> subsp. <i>leucogaster</i> (Yellow-footed Antechinus, Mardo)			
173.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
174.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
175.	7411 <i>Anthotium humile</i> (Dwarf Anthotium)			
176.	12724 <i>Anthotium junciforme</i>			
177.	202 <i>Anthoxanthum odoratum</i> (Sweet Vernal Grass)	Y		
178.	25670 <i>Anthus australis</i> (Australian Pipit)			
179.	24599 <i>Anthus australis</i> subsp. <i>australis</i> (Australian Pipit)			
180.	3686 <i>Aotus cordifolia</i>			
181.	3688 <i>Aotus gracillima</i>			
182.	3692 <i>Aotus procumbens</i>			
183.	1117 <i>Aphelia cyperoides</i>			
184.	1119 <i>Aphelia nutans</i>			
185.	17845 <i>Apodasmia ceramophila</i>			
186.	24990 <i>Aprasia pulchella</i> (Granite Worm-lizard)			
187.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
188.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
189.	<i>Arachnura higginsi</i>			
190.	<i>Araneus cyphoxis</i>			
191.	<i>Araneus senicaudatus</i>			
192.	<i>Araneus stolidus</i>			
193.	7838 <i>Arctotheca calendula</i> (Cape Weed, African Marigold)	Y		
194.	24337 <i>Ardea garzetta</i> subsp. <i>nigripes</i> (Little Egret)			
195.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
196.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
197.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
198.	207 <i>Aristida contorta</i> (Bunched Kerosene Grass)			
199.	222 <i>Aristida ramosa</i> (Purple Wiregrass)	Y		
200.	<i>Aristida</i> sp.			
201.	<i>Arkys alticephala</i>			
202.	<i>Arkys walckenaeri</i>			
203.	<i>Armillaria luteobubalina</i>			
204.	1264 <i>Arnocrinum preissii</i>			
205.	<i>Arrenuridae</i> sp.			
206.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
207.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
208.	<i>Artoria flavimanus</i>			
209.	<i>Artoria schizocoides</i>			
210.	<i>Asadipus kunderang</i>			
211.	6580 <i>Asclepias curassavica</i> (Redhead Cottonbush)	Y		
212.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
213.	<i>Astartea</i> aff. <i>fascicularis</i> sthct			
214.	20350 <i>Astartea affinis</i> (West-coast Astartea)			
215.	20249 <i>Astartea leptophylla</i> (River-bank Astartea)			
216.	20283 <i>Astartea scoparia</i> (Common Astartea)			
217.	<i>Asterella drummondii</i>			
218.	7851 <i>Asteridea pulverulenta</i> (Common Bristle Daisy)			
219.	6323 <i>Astroloma ciliatum</i> (Candle Cranberry)			
220.	6334 <i>Astroloma pallidum</i> (Kick Bush)			
221.	6337 <i>Astroloma stomarrhena</i> (Red Swamp Cranberry)			
222.	<i>Aturidae</i> sp.			
223.	<i>Austracantha minax</i>			
224.	<i>Australotiphys barmutai</i>			
225.	<i>Austrogautieria manjimupana</i>			
226.	<i>Austrogomphus collaris</i>			
227.	17233 <i>Austrostipa campylachne</i>			
228.	17234 <i>Austrostipa compressa</i>			
229.	17237 <i>Austrostipa elegantissima</i>			
230.	17253 <i>Austrostipa semibarbata</i>			
231.	<i>Austrostipa semibarbata/campylachne</i>			Y
232.	17254 <i>Austrostipa tenuifolia</i>			
233.	17257 <i>Austrostipa variabilis</i>			
234.	231 <i>Avellinia michelii</i>	Y		

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235.	233 <i>Avena barbata</i> (Bearded Oat)	Y		
236.	235 <i>Avena sativa</i> (Common Oat)	Y		
237.	24318 <i>Aythya australis</i> (Hardhead)			
238.	18279 <i>Babiana angustifolia</i>	Y		
239.	36441 <i>Babingtonia camphorosmae</i> (Camphor Myrtle)			
240.	<i>Backbournkia brounii</i>			
241.	<i>Backbournkia heroine</i>			
242.	38979 <i>Badhamia utricularis</i>			
243.	<i>Ballarra longipalpus</i>			
244.	1800 <i>Banksia attenuata</i> (Slender Banksia, Piara)			
245.	32678 <i>Banksia bipinnatifida</i> subsp. <i>bipinnatifida</i>			
246.	32576 <i>Banksia dallanneyi</i> (Couch Honeypot)			
247.	32580 <i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i> var. <i>dallanneyi</i>			
248.	1819 <i>Banksia grandis</i> (Bull Banksia, Pulgarla)			
249.	1822 <i>Banksia ilicifolia</i> (Holly-leaved Banksia)			
250.	32214 <i>Banksia kippistiana</i>			
251.	1834 <i>Banksia menziesii</i> (Firewood Banksia)			
252.	32202 <i>Banksia nivea</i> (Honeypot Dryandra, Pudjarn)			
253.	1852 <i>Banksia telmatiaea</i> (Swamp Fox Banksia)			
254.	32053 <i>Banksia undata</i> (Urchin Dryandra)			
255.	32054 <i>Banksia undata</i> var. <i>undata</i>			
256.	32315 <i>Barbula calycina</i>			
257.	<i>Barnardius zonarius</i>			
258.	739 <i>Baumea acuta</i> (Pale Twig-rush)			
259.	740 <i>Baumea arthropphylla</i>			
260.	743 <i>Baumea juncea</i> (Bare Twigrush)			
261.	745 <i>Baumea preissii</i>			
262.	748 <i>Baumea vaginalis</i> (Sheath Twigrush)			
263.	5387 <i>Beaufortia macrostemon</i> (Darling Range Beaufortia)			
264.	7046 <i>Bellardia trixago</i> (Bellardia)	Y		
265.	48868 <i>Bellardia viscosa</i>	Y		
266.	<i>Berosus approximans</i>			
267.	4598 <i>Beyeria lechenaultii</i> (Pale Turpentine Bush)			
268.	25788 <i>Billardiera fraseri</i> (Elegant Pronaya)			
269.	3165 <i>Billardiera variifolia</i>			
270.	24319 <i>Biziura lobata</i> (Musk Duck)			
271.	1417 <i>Blancoa canescens</i> (Winter Bell)			
272.	46074 <i>Boletellus ananiceps</i>			
273.	<i>Boletellus obscurecoccineus</i>			
274.	<i>Boletus</i> sp.			
275.	4413 <i>Boronia crenulata</i> (Aniseed Boronia)			
276.	11503 <i>Boronia crenulata</i> subsp. <i>crenulata</i> var. <i>crenulata</i>			
277.	16636 <i>Boronia crenulata</i> subsp. <i>viminea</i>			
278.	4420 <i>Boronia fastigiata</i> (Bushy Boronia)			
279.	4429 <i>Boronia molloyae</i> (Tall Boronia)			
280.	11564 <i>Boronia ramosa</i> subsp. <i>ramosa</i>			
281.	16639 <i>Boronia scabra</i> subsp. <i>scabra</i>			
282.	1267 <i>Borya constricta</i>			
283.	1272 <i>Borya scirpoidea</i>			
284.	1273 <i>Borya sphaerocephala</i> (Pincushions)			
285.	48782 <i>Bossiaea angustifolia</i>			
286.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
287.	3714 <i>Bossiaea ornata</i> (Broad Leaved Brown Pea)			
288.	3718 <i>Bossiaea rufa</i>			
289.	<i>Bostockia porosa</i>			
290.	10915 <i>Brachychiton populneus</i> (Kurrajong)	Y		
291.	6341 <i>Brachyloma preissii</i> (Globe Heath)			
292.	8661 <i>Brachypodium distachyon</i> (False Brome)	Y		
293.	7867 <i>Brachyscome bellidioides</i>			
294.	7871 <i>Brachyscome ciliaris</i>			
295.	7883 <i>Brachyscome pusilla</i>			
296.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
297.	245 <i>Briza minor</i> (Shivery Grass)	Y		
298.	249 <i>Bromus diandrus</i> (Great Brome)	Y		
299.	250 <i>Bromus hordeaceus</i> (Soft Brome)	Y		
300.	1366 <i>Bulbine semibarbata</i> (Leek Lily)			
301.	12770 <i>Burchardia congesta</i>			
302.	1385 <i>Burchardia multiflora</i> (Dwarf Burchardia)			
303.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
304.	25715 <i>Cacatua roseicapilla</i> (Galah)			

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305.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
306.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
307.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
308.	<i>Caenidae</i> sp.			
309.	1276 <i>Caesia micrantha</i> (Pale Grass Lily)			
310.	1277 <i>Caesia occidentalis</i>			
311.	1586 <i>Caladenia discoidea</i> (Dancing Orchid)			
312.	1590 <i>Caladenia ferruginea</i> (Rusty Spider Orchid)			
313.	1592 <i>Caladenia flava</i> (Cowslip Orchid)			
314.	15348 <i>Caladenia flava</i> subsp. <i>flava</i>			
315.	1605 <i>Caladenia marginata</i> (White Fairy Orchid)			
316.	1613 <i>Caladenia reptans</i> (Little Pink Fairy Orchid)			
317.	15379 <i>Caladenia serotina</i>			
318.	16365 <i>Calandrinia</i> sp. <i>Kenwick</i> (G.J. Keighery 10905)			
319.	1214 <i>Calectasia grandiflora</i> (Blue Tinsel Lily)			
320.	19309 <i>Calectasia narragara</i>			
321.	5395 <i>Callistemon phoeniceus</i> (Lesser Bottlebrush, Dubarda)			
322.	4717 <i>Callitriche stagnalis</i> (Common Starwort)	Y		
323.	36600 <i>Callitriche pyramidalis</i> (Swamp Cypress)			
324.	5411 <i>Calothamnus hirsutus</i>			
325.	35816 <i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i>			
326.	5431 <i>Calothamnus torulosus</i>			
327.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
328.	5437 <i>Calytrix acutifolia</i>			
329.	5439 <i>Calytrix angulata</i> (Yellow Starflower)			
330.	5441 <i>Calytrix aurea</i>			
331.	5458 <i>Calytrix flavescens</i> (Summer Starflower)			
332.	5460 <i>Calytrix fraseri</i> (Pink Summer Calytrix)			
333.	38767 <i>Campanella gregaria</i>			
334.	32461 <i>Campylopus bicolor</i> var. <i>bicolor</i>			
335.	3005 <i>Cardamine hirsuta</i> (Common Bittercress)	Y		
336.	7909 <i>Carduus pycnocephalus</i> (Slender Thistle)	Y		
337.	1162 <i>Cartonema phylloides</i>			
338.	2951 <i>Cassytha flava</i> (Dodder Laurel)			
339.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
340.	2956 <i>Cassytha pomiformis</i> (Dodder Laurel)			
341.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
342.	18321 <i>Casuarina glauca</i>	Y		
343.	1742 <i>Casuarina obesa</i> (Swamp Sheoak, Kuli)			
344.	<i>Ceinidae</i> sp.			
345.	6539 <i>Centaureum erythraea</i> (Common Centaury)	Y		
346.	1121 <i>Centrolepis aristata</i> (Pointed Centrolepis)			
347.	1123 <i>Centrolepis caespitosa</i>			
348.	1125 <i>Centrolepis drummondiana</i>			
349.	1130 <i>Centrolepis humillima</i> (Dwarf Centrolepis)			
350.	1131 <i>Centrolepis inconspicua</i>			
351.	1132 <i>Centrolepis mutica</i>			
352.	1134 <i>Centrolepis polygyna</i> (Wiry Centrolepis)			
353.	2889 <i>Cerastium glomeratum</i> (Mouse Ear Chickweed)	Y		
354.	<i>Ceratopogonidae</i> sp.			
355.	<i>Cercophonius sulcatus</i>			
356.	<i>Cethegus fugax</i>			
357.	17685 <i>Chaetanthus aristatus</i>			
358.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattled Bat)			
359.	24187 <i>Chalinolobus morio</i> (Chocolate Wattled Bat)			
360.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
361.	11299 <i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>			
362.	5498 <i>Chamelaucium uncinatum</i> (Geraldton Wax)			
363.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
364.	31 <i>Cheilanthes austrotenuifolia</i>			
365.	12818 <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>			
366.	43380 <i>Chelodina colliei</i> (South-western Snake-necked Turtle)			
367.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
368.	33939 <i>Cherax cainii</i> (Marron)			
369.	<i>Cherax destructor</i>			
370.	<i>Cherax quinquecarinatus</i>			
371.	<i>Cheumatopsyche</i> sp. AV2 (SAP)			
372.	<i>Chiloscyphus semiteres</i> var. <i>semiteres</i>			
373.	<i>Chironominae</i> sp.			
374.	<i>Chironomus</i> aff. <i>alternans</i> (V24) (CB)			

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375.	<i>Chironomus tepperi</i>			
376.	<i>Chloris gayana</i> (Rhodes Grass)	Y		
377.	17706 <i>Chordifex sinuosus</i>			
378.	763 <i>Chorizandra enodis</i> (Black Bristlerush)			
379.	8971 <i>Chorizema cordatum</i>			
380.	3753 <i>Chorizema dicksonii</i> (Yellow-eyed Flame Pea)			
381.	3761 <i>Chorizema rhombeum</i>			
382.	<i>Chroicocephalus novaehollandiae</i>			
383.	11900 <i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Y		
384.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
385.	25601 <i>Chrysococcyx lucidus</i> (Shining Bronze Cuckoo)			
386.	6543 <i>Cicendia filiformis</i> (Slender Cicendia)	Y		
387.	7935 <i>Cichorium intybus</i> (Chicory)	Y		
388.	24288 <i>Circus approximans</i> (Swamp Harrier)			
389.	7937 <i>Cirsium vulgare</i> (Spear Thistle, Scotch Thistle)	Y		
390.	48177 <i>Cladia muelleri</i>			
391.	<i>Cladocera</i> (unident.)			
392.	28208 <i>Cladonia cervicornis</i> subsp. <i>verticillata</i>			
393.	27685 <i>Cladonia macilentata</i>			
394.	27697 <i>Cladonia tessellata</i>			
395.	<i>Cladopelma curtivalva</i>			
396.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
397.	<i>Cladotanytarsus</i> sp. A (SAP)			
398.	2929 <i>Clematis pubescens</i> (Common Clematis)			
399.	<i>Cloeon</i> sp.			
400.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
401.	24613 <i>Colluricincla harmonica</i> subsp. <i>rufiventris</i> (Grey Shrike-thrush)			
402.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
403.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
404.	4551 <i>Comesperma ciliatum</i>			
405.	4564 <i>Comesperma virgatum</i> (Milkwort)			
406.	<i>Condocerus aptus</i>			
407.	1863 <i>Conospermum capitatum</i>			
408.	1875 <i>Conospermum huegelii</i> (Slender Smokebush)			
409.	1882 <i>Conospermum stoechadis</i> (Common Smokebush)			
410.	15611 <i>Conospermum stoechadis</i> subsp. <i>stoechadis</i> (Common Smokebush)			
411.	6347 <i>Conostephium minus</i> (Pink-tipped Pearl flower)			
412.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
413.	6349 <i>Conostephium preissii</i>			
414.	1418 <i>Conostylis aculeata</i> (Prickly Conostylis)			
415.	11826 <i>Conostylis aculeata</i> subsp. <i>aculeata</i>			
416.	12109 <i>Conostylis aculeata</i> subsp. <i>preissii</i>			
417.	1423 <i>Conostylis aurea</i> (Golden Conostylis)			
418.	1436 <i>Conostylis juncea</i>			
419.	1454 <i>Conostylis setigera</i> (Bristly Cottonhead)			
420.	11597 <i>Conostylis setigera</i> subsp. <i>setigera</i>			
421.	1455 <i>Conostylis setosa</i> (White Cottonhead)			
422.	<i>Conyza</i> sp. <i>Mud07</i>			Y
423.	<i>Copepoda</i> sp.			
424.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
425.	24362 <i>Coracina novaehollandiae</i> subsp. <i>novaehollandiae</i> (Black-faced Cuckoo-shrike)			
426.	<i>Corixidae</i> sp.			
427.	<i>Cormocephalus aurantiipes</i>			
428.	<i>Cormocephalus hartmeyerii</i>			
429.	<i>Cormocephalus turneri</i>			
430.	<i>Cortinarius australiensis</i>			
431.	<i>Cortinarius erythraeus</i>			
432.	38874 <i>Cortinarius globuliformis</i>			
433.	48174 <i>Cortinarius hallowellensis</i>			
434.	<i>Cortinarius rotundisporus</i>			
435.	25592 <i>Corvus coronoides</i> (Australian Raven)			
436.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
437.	25593 <i>Corvus orru</i> (Torresian Crow)			
438.	24419 <i>Corvus splendens</i> (House Crow)			
439.	17104 <i>Corymbia calophylla</i> (Marri)			
440.	7943 <i>Cotula australis</i> (Common Cotula)			
441.	7946 <i>Cotula cotuloides</i> (Smooth Cotula)			
442.	7947 <i>Cotula turbinata</i> (Funnel Weed)	Y		
443.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
444.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			

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445.	24422 <i>Cracticus tibicen subsp. dorsalis</i> (White-backed Magpie)			
446.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
447.	13354 <i>Craspedia variabilis</i>			
448.	3136 <i>Crassula alata</i>	Y		
449.	17701 <i>Crassula closiana</i>			
450.	3137 <i>Crassula colorata</i> (Dense Stonecrop)			
451.	3138 <i>Crassula decumbens</i> (Rufous Stonecrop)			
452.	20271 <i>Crassula extrorsa</i>			
453.	15706 <i>Crassula natans var. minus</i>	Y		
454.	3144 <i>Crassula peduncularis</i> (Purple Stonecrop)			
455.	38780 <i>Crepidotus eucalyptorum</i>			
456.	7953 <i>Crepis foetida</i> (Foetid Hawksbeard)	Y		
457.	29054 <i>Crepis foetida subsp. foetida</i> (Stinking Hawksbeard)	Y		
458.	<i>Cricotopus 'brevicornis'</i>			
459.	<i>Cricotopus 'parbicinctus'</i>			
460.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
461.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
462.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
463.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
464.	35838 <i>Cristonia biloba subsp. biloba</i>			
465.	<i>Crustulina bicrucata</i>			
466.	30893 <i>Cryptoblepharus buchananii</i>			
467.	<i>Cryptochironomus griseidorsum</i>			
468.	24883 <i>Ctenophorus ornatus</i> (Ornate Crevice-Dragon)			
469.	25039 <i>Ctenotus fallens</i>			
470.	25047 <i>Ctenotus impar</i>			
471.	25049 <i>Ctenotus labillardieri</i>			
472.	<i>Culicidae sp.</i>			
473.	6663 <i>Cuscuta epithymum</i> (Lesser Dodder, Greater Dodder)	Y		
474.	768 <i>Cyathochaeta avenacea</i>			
475.	<i>Cyclosa trilobata</i>			
476.	40661 <i>Cyncogeton lineare</i>			
477.	24322 <i>Cygnus atratus</i> (Black Swan)			
478.	283 <i>Cynodon dactylon</i> (Couch)	Y		
479.	815 <i>Cyperus tenellus</i> (Tiny Flatsedge)	Y		
480.	10964 <i>Cyrtostylis robusta</i>			
481.	17692 <i>Cyrtogonidium leptocarpoides</i>			
482.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
483.	7420 <i>Dampiera alata</i> (Winged-stem Dampiera)			
484.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
485.	7462 <i>Dampiera pedunculata</i>			
486.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
487.	5508 <i>Darwinia citriodora</i> (Lemon-scented Darwinia)			
488.	5531 <i>Darwinia thymoides</i>			
489.	18193 <i>Darwinia thymoides subsp. thymoides</i>			
490.	1218 <i>Dasypogon bromeliifolius</i> (Pineapple Bush)			
491.	1220 <i>Dasypogon obliquifolius</i>			
492.	6960 <i>Datura ferox</i> (Fierce Thornapple)	Y		
493.	6218 <i>Daucus glochidiatus</i> (Australian Carrot)			
494.	15656 <i>Daviesia brachyphylla</i>			
495.	3799 <i>Daviesia cordata</i> (Bookleaf)			
496.	16579 <i>Daviesia decipiens</i>			
497.	3805 <i>Daviesia decurrens</i> (Prickly Bitter-pea)			
498.	19747 <i>Daviesia decurrens subsp. decurrens</i>			
499.	3815 <i>Daviesia horrida</i> (Prickly Bitter-pea)			
500.	16585 <i>Daviesia nudiflora subsp. nudiflora</i>			
501.	3832 <i>Daviesia physodes</i>			
502.	3835 <i>Daviesia preissii</i>			
503.	3845 <i>Daviesia triflora</i>			
504.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)			
505.	<i>Demadiana cerula</i>			
506.	<i>Dermocybe austroveneta</i>			
507.	17663 <i>Desmocladius asper</i>			
508.	15831 <i>Desmocladius castaneus</i>			
509.	17691 <i>Desmocladius fasciculatus</i>			
510.	16595 <i>Desmocladius flexuosus</i>			
511.	46362 <i>Desmocladius lateriflorus</i>			
512.	1259 <i>Dianella revoluta</i> (Blueberry Lily)			
513.	11636 <i>Dianella revoluta var. divaricata</i>			
514.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			

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515.	306 <i>Dichelachne crinita</i> (Longhair Plumegrass)			
516.	1287 <i>Dichopogon capillipes</i>			
517.	<i>Dicrotendipes</i> sp.			
518.	17838 <i>Dielsia stenostachya</i>			
519.	<i>Dingosa serrata</i>			
520.	<i>Dinocambala ingens</i>			
521.	1509 <i>Dioscorea hastifolia</i> (Warrine, Waram)			
522.	<i>Diplacodes bipunctata</i>			
523.	24939 <i>Diplodactylus polyophthalmus</i>			
524.	18589 <i>Diplopeltis huegellii</i> subsp. <i>lehmannii</i>			
525.	19649 <i>Disa bracteata</i>	Y		
526.	7055 <i>Dischisma capitatum</i> (Woolly-headed <i>Dischisma</i>)	Y		
527.	7961 <i>Dittrichia graveolens</i> (Stinkwort)	Y		
528.	12943 <i>Diuris brumalis</i>			
529.	10791 <i>Diuris carinata</i> (Bee Orchid)			
530.	11049 <i>Diuris corymbosa</i>			
531.	1632 <i>Diuris emarginata</i> (Tall Donkey Orchid)			
532.	1634 <i>Diuris laxiflora</i> (Bee Orchid)			
533.	1635 <i>Diuris longifolia</i> (Common Donkey Orchid)			
534.	12939 <i>Diuris magnifica</i>			
535.	46859 <i>Diuris ostrina</i>			
536.	1638 <i>Diuris setacea</i> (Bristly Donkey Orchid)			
537.	4757 <i>Dodonaea ceratocarpa</i>			
538.	<i>Dolichopodiidae</i> sp.			
539.	1640 <i>Drakaea glyptodon</i> (King-in-his-carriage)			
540.	11156 <i>Drakaea livida</i>			
541.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
542.	3092 <i>Drosera bulbosa</i> (Red-leaved Sundew)			
543.	48751 <i>Drosera drummondii</i>			
544.	3095 <i>Drosera erythrorhiza</i> (Red Ink Sundew)			
545.	3097 <i>Drosera gigantea</i> (Giant Sundew)			
546.	3098 <i>Drosera glanduligera</i> (Pimpernel Sundew)			
547.	3101 <i>Drosera heterophylla</i> (Swamp Rainbow)			
548.	48769 <i>Drosera indumenta</i>			
549.	3105 <i>Drosera leucoblata</i> (Wheel Sundew)			
550.	3106 <i>Drosera macrantha</i> (Bridal Rainbow)			
551.	3109 <i>Drosera menziesii</i> (Pink Rainbow)			
552.	3113 <i>Drosera neesii</i> (Jewel Rainbow)			
553.	3114 <i>Drosera nitidula</i> (Shining Sundew)			
554.	13189 <i>Drosera oreopodium</i>			
555.	3118 <i>Drosera pallida</i> (Pale Rainbow)			
556.	3123 <i>Drosera platystigma</i> (Black-eyed Sundew)			
557.	29178 <i>Drosera porrecta</i>			
558.	8911 <i>Drosera rosulata</i>			
559.	49090 <i>Drosera</i> sp. <i>Branched styles</i> (S.C. Coffey 193)			
560.	3131 <i>Drosera stolonifera</i> (Leafy Sundew)			
561.	3133 <i>Drosera subhirtella</i> (Sunny Rainbow)			
562.	<i>Dytiscidae</i> sp.			
563.	32351 <i>Eccremidium pulchellum</i>			
564.	<i>Ecnomidae</i> sp.			
565.	25096 <i>Egernia kingii</i> (King's Skink)			
566.	<i>Egretta novaehollandiae</i>			
567.	347 <i>Ehrharta calycina</i> (Perennial Veldt Grass)	Y		
568.	349 <i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
569.	<i>Elanus axillaris</i>			
570.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
571.	47937 <i>Elseyornis melanops</i> (Black-fronted Dotterel)			
572.	1643 <i>Elythranthera brunonis</i> (Purple Enamel Orchid)			
573.	1644 <i>Elythranthera emarginata</i> (Pink Enamel Orchid)			
574.	<i>Empididae</i> sp.			
575.	<i>Enchytraeidae</i> sp.			
576.	32356 <i>Entosthodon subnudus</i>			
577.	<i>Eolophus roseicapillus</i>			
578.	24651 <i>Eopsaltria australis</i> subsp. <i>griseogularis</i> (Western Yellow Robin)			
579.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
580.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
581.	373 <i>Eragrostis brownii</i> (Brown's Lovegrass)			
582.	376 <i>Eragrostis curvula</i> (African Lovegrass)	Y		
583.	379 <i>Eragrostis elongata</i> (Clustered Lovegrass)			
584.	13950 <i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>			

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585.	14104 <i>Eremaea pauciflora</i> var. <i>pauciflora</i>			
586.	7189 <i>Eremophila clarkei</i> (Turpentine Bush)			
587.	<i>Eremophila</i> sp.			
588.	1646 <i>Eriochilus dilatatus</i> (White Bunny Orchid)			
589.	<i>Eriophora biapicata</i>			
590.	<i>Ero aphana</i>			
591.	4332 <i>Erodium botrys</i> (Long Storksbill)	Y		
592.	4335 <i>Erodium cygnorum</i> (Blue Heronsbill)			
593.	15446 <i>Eryngium pinnatifidum</i> subsp. <i>pinnatifidum</i>			
594.	24379 <i>Erythronyctus cinctus</i> (Red-kneed Dotterel)			
595.	5616 <i>Eucalyptus decurva</i> (Slender Mallee)			
596.	5659 <i>Eucalyptus gomphocephala</i> (Tuart, Duart)			
597.	5688 <i>Eucalyptus laeliae</i> (Darling Range Ghost Gum)			
598.	5690 <i>Eucalyptus lane-poolei</i> (Salmon White Gum)			
599.	5708 <i>Eucalyptus marginata</i> (Jarrah, Djara)			
600.	13547 <i>Eucalyptus marginata</i> subsp. <i>marginata</i> (Jarrah)			
601.	13548 <i>Eucalyptus marginata</i> subsp. <i>thalassica</i> (Blue-leaved Jarrah)			
602.	5739 <i>Eucalyptus patens</i> (Swan River Blackbutt, Dwuda)			
603.	5763 <i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
604.	13511 <i>Eucalyptus rudis</i> subsp. <i>rudis</i>			
605.	5797 <i>Eucalyptus wandoo</i> (Wandoo, Wondu)			
606.	12906 <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>			
607.	3872 <i>Euchilopsis linearis</i> (Swamp Pea)			
608.	<i>Eucyrtops latior</i>			
609.	13753 <i>Euphorbia dallachyana</i>			
610.	4627 <i>Euphorbia helioscopia</i> (Sun Spurge)	Y		
611.	29940 <i>Euphorbia maculata</i>	Y		
612.	34757 <i>Euphorbia prostrata</i>	Y		
613.	4648 <i>Euphorbia terracina</i> (Geraldton Carnation Weed)	Y		
614.	3880 <i>Eutaxia virgata</i>			
615.	25621 <i>Falco berigora</i> (Brown Falcon)			
616.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
617.	25623 <i>Falco longipennis</i> (Australian Hobby)			
618.	24476 <i>Falco subniger</i> (Black Falcon)			
619.	24041 <i>Felis catus</i> (Cat)	Y		
620.	1747 <i>Ficus carica</i> (Common Fig)	Y		
621.	<i>Fistulina hepatica</i>			
622.	27748 <i>Flavoparmelia rutidota</i>			
623.	18392 <i>Freesia alba</i> x <i>leichtlinii</i>	Y		
624.	25727 <i>Fulica atra</i> (Eurasian Coot)			
625.	24761 <i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)			
626.	2969 <i>Fumaria capreolata</i> (Whiteflower Fumitory)	Y		
627.	31532 <i>Fumaria muralis</i> subsp. <i>muralis</i>	Y		
628.	32370 <i>Funaria hygrometrica</i>			
629.	900 <i>Gahnia aristata</i>			
630.	907 <i>Gahnia trifida</i> (Coast Saw-sedge)			
631.	34028 <i>Galaxias occidentalis</i> (Western Minnow)			
632.	7321 <i>Galium divaricatum</i>	Y		
633.	7323 <i>Galium murale</i> (Small Goosegrass)	Y		
634.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
635.	24765 <i>Gallirallus philippensis</i> subsp. <i>mellori</i> (Buff-banded Rail)			
636.	434 <i>Gastridium phleoides</i> (Nitgrass)	Y		
637.	20513 <i>Gastrolobium dilatatum</i>			
638.	20473 <i>Gastrolobium ebracteolatum</i>			
639.	3924 <i>Gastrolobium spinosum</i> (Prickly Poison)			
640.	42314 <i>Gavicalis virescens</i> (Singing Honeyeater)			
641.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
642.	4340 <i>Geranium retrorsum</i>			
643.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
644.	1518 <i>Gladiolus angustus</i> (Long Tubed Painted Lady)	Y		
645.	1520 <i>Gladiolus caryophyllaceus</i> (Wild Gladiolus)	Y		
646.	1524 <i>Gladiolus undulatus</i> (Wild Gladiolus)	Y		
647.	12624 <i>Gnephosis angianthoides</i>			
648.	7991 <i>Gnephosis drummondii</i>			
649.	<i>Gomphidae</i> sp.			
650.	6587 <i>Gomphocarpus fruticosus</i> (Narrowleaf Cottonbush)	Y		
651.	3945 <i>Gompholobium aristatum</i>			
652.	10909 <i>Gompholobium confertum</i>			
653.	3950 <i>Gompholobium knightianum</i>			
654.	3951 <i>Gompholobium marginatum</i>			

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655.	3954 <i>Gompholobium polymorphum</i>			
656.	3955 <i>Gompholobium preissii</i>			
657.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
658.	16746 <i>Gonocarpus benthamii</i> subsp. <i>benthamii</i>			
659.	6149 <i>Gonocarpus cordiger</i>			
660.	6160 <i>Gonocarpus paniculatus</i>			
661.	6161 <i>Gonocarpus pithyoides</i>			
662.	29362 <i>Goodenia coerulea</i>			
663.	12551 <i>Goodenia micrantha</i>			
664.	7538 <i>Goodenia pulchella</i>			
665.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
666.	14282 <i>Gratiola pubescens</i>			
667.	1964 <i>Grevillea bipinnatifida</i> (Fuchsia Grevillea)			
668.	19628 <i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>			
669.	13429 <i>Grevillea diversifolia</i> subsp. <i>diversifolia</i>			
670.	1997 <i>Grevillea endlicheriana</i> (Spindly Grevillea)			
671.	13450 <i>Grevillea manglesii</i> subsp. <i>manglesii</i>			
672.	2066 <i>Grevillea pilulifera</i> (Woolly-flowered Grevillea)			
673.	15990 <i>Grevillea pulchella</i> subsp. <i>ascendens</i>			
674.	2080 <i>Grevillea quercifolia</i> (Oak-leaf Grevillea)			
675.	2122 <i>Grevillea wilsonii</i> (Native Fuchsia)			
676.	<i>Gripopterygidae</i> sp.			
677.	<i>Gyrinidae</i> sp.			
678.	1464 <i>Haemodorum brevisepalum</i>			
679.	1465 <i>Haemodorum discolor</i>			
680.	1468 <i>Haemodorum laxum</i>			
681.	1472 <i>Haemodorum simplex</i>			
682.	1474 <i>Haemodorum sparsiflorum</i>			
683.	1475 <i>Haemodorum spicatum</i> (Mardja)			
684.	438 <i>Hainardia cylindrica</i> (Common Barbgrass)	Y		
685.	2128 <i>Hakea amplexicaulis</i> (Prickly Hakea)			
686.	2137 <i>Hakea ceratophylla</i> (Horned Leaf Hakea)			
687.	2152 <i>Hakea cyclocarpa</i> (Ramshorn)			
688.	2166 <i>Hakea incrassata</i> (Marble Hakea)			
689.	2175 <i>Hakea lissocarpha</i> (Honey Bush)			
690.	2179 <i>Hakea marginata</i>			
691.	2197 <i>Hakea prostrata</i> (Harsh Hakea)			
692.	2203 <i>Hakea ruscifolia</i> (Candle Hakea)			
693.	2206 <i>Hakea stenocarpa</i> (Narrow-fruited Hakea)			
694.	2212 <i>Hakea sulcata</i> (Furrowed Hakea)			
695.	2214 <i>Hakea trifurcata</i> (Two-leaf Hakea)			
696.	2215 <i>Hakea undulata</i> (Wavy-leaved Hakea)			
697.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
698.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
699.	<i>Halipilus fuscatus</i>			
700.	<i>Halipilus</i> sp.			
701.	3961 <i>Hardenbergia comptoniana</i> (Native Wisteria)			
702.	<i>Harrisius</i> sp. A (SAP)			
703.	32392 <i>Hedwigidium integrifolium</i>			
704.	25409 <i>Heleioporus barycragus</i> (Hooting Frog)			
705.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
706.	25412 <i>Heleioporus psammophilus</i> (Sand Frog)			
707.	<i>Hellyethira litua</i>			
708.	<i>Helochares tenuistriatus</i>			
709.	439 <i>Hemarthria uncinata</i> (Matgrass)			
710.	6839 <i>Hemiandra pungens</i> (Snakebush)			
711.	<i>Hemicordulia tau</i>			
712.	<i>Hemicordulidae</i> sp.			
713.	25115 <i>Hemiergis initialis</i> subsp. <i>initialis</i>			
714.	25119 <i>Hemiergis quadrilineata</i>			
715.	6856 <i>Hemigenia incana</i> (Silky Hemigenia)			
716.	<i>Henicops dentatus</i>			
717.	1293 <i>Hensmania turbinata</i>			
718.	5108 <i>Hibbertia acerosa</i> (Needle Leaved Guinea Flower)			
719.	5109 <i>Hibbertia amplexicaulis</i>			
720.	5114 <i>Hibbertia commutata</i>			
721.	20051 <i>Hibbertia diamesogenos</i>			
722.	5129 <i>Hibbertia glomerata</i>			
723.	19778 <i>Hibbertia glomerata</i> subsp. <i>darlingensis</i>			
724.	5134 <i>Hibbertia huegelii</i>			

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725.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
726.	45534 <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>			
727.	5148 <i>Hibbertia mylnei</i>			
728.	5150 <i>Hibbertia nymphaea</i>			
729.	5155 <i>Hibbertia pilosa</i> (Hairy Guinea Flower)			
730.	5161 <i>Hibbertia quadricolor</i>			
731.	5169 <i>Hibbertia serrata</i> (Serrate Leaved Guinea Flower)			
732.	<i>Hibbertia</i> sp.			
733.	5171 <i>Hibbertia spicata</i>			
734.	11481 <i>Hibbertia spicata</i> subsp. <i>spicata</i>			
735.	5172 <i>Hibbertia stellaris</i> (Orange Stars)			
736.	48381 <i>Hibbertia striata</i>			
737.	5173 <i>Hibbertia subvaginata</i>			
738.	5176 <i>Hibbertia vaginata</i>			
739.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
740.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
741.	<i>Hirudinea</i> sp.			
742.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
743.	<i>Holconia westralia</i>			
744.	6222 <i>Homalosciadium homalocarpum</i>			
745.	449 <i>Hordeum leporinum</i> (Barley Grass)	Y		
746.	450 <i>Hordeum marinum</i>	Y		
747.	3964 <i>Hovea chorizemifolia</i> (Holly-leaved Hovea)			
748.	3966 <i>Hovea pungens</i> (Devil's Pins, Puyenak)			
749.	3968 <i>Hovea trisperma</i> (Common Hovea)			
750.	12859 <i>Hovea trisperma</i> var. <i>trisperma</i>			
751.	12741 <i>Hyalosperma cotula</i>			
752.	5216 <i>Hybanthus calycinus</i> (Wild Violet)			
753.	5221 <i>Hybanthus floribundus</i>			
754.	12007 <i>Hybanthus floribundus</i> subsp. <i>floribundus</i>			
755.	38794 <i>Hydnum repandum</i>			
756.	6223 <i>Hydrocotyle alata</i>			
757.	6226 <i>Hydrocotyle callicarpa</i> (Small Pennywort)			
758.	6229 <i>Hydrocotyle diantha</i>			
759.	6236 <i>Hydrocotyle pilifera</i>			
760.	<i>Hydrodromidae</i> sp.			
761.	<i>Hydrophilidae</i> sp.			
762.	<i>Hydropsychidae</i> sp.			
763.	<i>Hydroptilidae</i> sp.			
764.	5180 <i>Hypericum gramineum</i> (Small St John's Wort)			
765.	5181 <i>Hypericum japonicum</i> (Matted St John's Wort)			
766.	<i>Hyphydrus elegans</i>			
767.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
768.	5825 <i>Hypocalymma robustum</i> (Swan River Myrtle)			
769.	8086 <i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
770.	9352 <i>Hypochaeris radicata</i> (Flat Weed, Cats-ear)	Y		
771.	27787 <i>Hypogymnia subphysodes</i>			
772.	1070 <i>Hypolaena exsulca</i>			
773.	1071 <i>Hypolaena fastigiata</i>			
774.	<i>Hyriidae</i> sp.			
775.	<i>Idiommata blackwalli</i>			
776.	44926 <i>Ileodictyon gracile</i>			
777.	48527 <i>Inocybe invadens</i>			
778.	48550 <i>Inocybe subflavospora</i>			
779.	11 <i>Isoetes drummondii</i> (Quillwort)			
780.	910 <i>Isolepis cernua</i> (Nodding Club-rush)			
781.	20200 <i>Isolepis cernua</i> var. <i>setiformis</i>			
782.	912 <i>Isolepis cyperoides</i>			
783.	14540 <i>Isolepis hystrix</i>	Y		
784.	917 <i>Isolepis marginata</i> (Coarse Club-rush)			
785.	919 <i>Isolepis oldfieldiana</i>			
786.	<i>Isometroides vescus</i>			
787.	<i>Isopeda leishmanni</i>			
788.	2221 <i>Isopogon asper</i>			
789.	2237 <i>Isopogon sphaerocephalus</i> (Drumstick Isopogon)			
790.	7396 <i>Isotoma hypocateriformis</i> (Woodbridge Poison)			
791.	3992 <i>Isotropis cuneifolia</i> (Granny Bonnets)			
792.	1532 <i>Ixia maculata</i> (Yellow Ixia)	Y		
793.	3997 <i>Jacksonia alata</i>			
794.	4012 <i>Jacksonia furcellata</i> (Grey Stinkwood)			

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795.	4018 <i>Jacksonia lehmannii</i>			
796.	4025 <i>Jacksonia restioides</i>			
797.	4029 <i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			
798.	1298 <i>Johnsonia pubescens</i> (Pipe Lily)			
799.	19632 <i>Johnsonia pubescens</i> subsp. <i>pubescens</i>			
800.	1178 <i>Juncus bufonius</i> (Toad Rush)	Y		
801.	1180 <i>Juncus capitatus</i> (Capitate Rush)	Y		
802.	1184 <i>Juncus holoschoenus</i> (Jointleaf Rush)			
803.	11922 <i>Juncus kraussii</i> subsp. <i>australiensis</i>			
804.	1186 <i>Juncus microcephalus</i>	Y		
805.	1188 <i>Juncus pallidus</i> (Pale Rush)			
806.	1189 <i>Juncus pauciflorus</i> (Loose Flower Rush)			
807.	1191 <i>Juncus polyanthemus</i>	Y		
808.	1195 <i>Juncus subsecundus</i> (Finger Rush)			
809.	1196 <i>Juncus usitatus</i> (Common Rush)	Y		
810.	<i>Karaops elleneae</i>			
811.	4037 <i>Kennedia coccinea</i> (Coral Vine)			
812.	4041 <i>Kennedia microphylla</i>			
813.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
814.	4045 <i>Kennedia stirlingii</i> (Bushy Kennedia)			
815.	1221 <i>Kingia australis</i> (Kingia, Pulonok)			
816.	5832 <i>Kunzea ericifolia</i> (Spearwood, Pondil)			
817.	15498 <i>Kunzea glabrescens</i> (Spearwood)			
818.	5835 <i>Kunzea micrantha</i>			
819.	17461 <i>Kunzea micrantha</i> subsp. <i>micrantha</i>			
820.	17785 <i>Kunzea micrantha</i> subsp. <i>petiolata</i>			
821.	5841 <i>Kunzea recurva</i>			
822.	11289 <i>Labichea lanceolata</i> subsp. <i>lanceolata</i>			
823.	3669 <i>Labichea punctata</i> (Lance-leaved Cassia)			
824.	13562 <i>Lachenalia aloides</i>	Y		
825.	20019 <i>Lachnagrostis filiformis</i>			
826.	19955 <i>Lachnagrostis plebeia</i>			
827.	38804 <i>Lactarius eucalypti</i>			
828.	18585 <i>Lagenophora huegelii</i>			
829.	14083 <i>Lambertia multiflora</i> var. <i>darlingensis</i>			
830.	<i>Lampona brevipes</i>			
831.	<i>Lamponusa gleneagle</i>			
832.	<i>Lancetes lanceolatus</i>			
833.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
834.	5033 <i>Lasiopetalum floribundum</i> (Free Flowering Lasiopetalum)			
835.	<i>Latrodectus hasseltii</i>			
836.	38323 <i>Lavandula stoechas</i> subsp. <i>stoechas</i>	Y		
837.	1304 <i>Laxmannia minor</i>			
838.	1307 <i>Laxmannia ramosa</i> (Branching Lily)			
839.	11911 <i>Laxmannia ramosa</i> subsp. <i>ramosa</i>			
840.	11464 <i>Laxmannia sessiliflora</i> subsp. <i>australis</i>			
841.	1309 <i>Laxmannia squarrosa</i>			
842.	7568 <i>Lechenaultia biloba</i> (Blue Leschenaultia)			
843.	7572 <i>Lechenaultia expansa</i>			
844.	7574 <i>Lechenaultia floribunda</i> (Free-flowering Leschenaultia)			
845.	<i>Lectrides parilis</i>			
846.	1075 <i>Lepidobolus preissianus</i>			
847.	18074 <i>Lepidobolus preissianus</i> subsp. <i>preissianus</i>			
848.	<i>Lepidosperma</i> aff. <i>coastale</i> (#134)			Y
849.	<i>Lepidosperma</i> aff. <i>pubisquameum</i> (#166)			
850.	<i>Lepidosperma</i> aff. <i>resinosum</i>			
851.	925 <i>Lepidosperma angustatum</i>			
852.	41620 <i>Lepidosperma asperatum</i>			
853.	929 <i>Lepidosperma carphoides</i> (Black Rapier Sedge)			
854.	930 <i>Lepidosperma costale</i>			
855.	<i>Lepidosperma eastern terete</i> scps (BJK&NG 232)			
856.	932 <i>Lepidosperma effusum</i> (Spreading Sword-sedge)			
857.	936 <i>Lepidosperma leptostachyum</i>			
858.	937 <i>Lepidosperma longitudinale</i> (Pithy Sword-sedge)			
859.	938 <i>Lepidosperma persecans</i>			
860.	940 <i>Lepidosperma pubisquameum</i>			
861.	941 <i>Lepidosperma resinosum</i>			
862.	944 <i>Lepidosperma scabrum</i>			
863.	<i>Lepidosperma</i> sp.			
864.	29141 <i>Lepidosperma</i> sp. <i>Gosnells</i> (A. Markey 1145)			

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865.	29150 <i>Lepidosperma</i> sp. Margaret River (B.J. Lepschi 1841)			
866.	<i>Lepidosperma</i> sp. Mud3			Y
867.	945 <i>Lepidosperma squamatum</i>			
868.	948 <i>Lepidosperma tetraquetrum</i>			
869.	1653 <i>Leporella fimbriata</i> (Hare Orchid)			
870.	1077 <i>Leptocarpus canus</i> (Hoary Twine-rush)			
871.	1078 <i>Leptocarpus coangustatus</i>			
872.	46375 <i>Leptocarpus decipiens</i>			
873.	46380 <i>Leptocarpus kraussii</i>			
874.	46382 <i>Leptocarpus roycei</i>			
875.	<i>Leptoceridae</i> sp.			
876.	2342 <i>Leptomeria cunninghamii</i>			
877.	2355 <i>Leptomeria squarrolosa</i>			
878.	<i>Leptoperla australica</i>			
879.	<i>Leptophlebiidae</i> sp.			
880.	5850 <i>Leptospermum laevigatum</i> (Coast Teatree)	Y		
881.	1085 <i>Lepyrodia glauca</i>			
882.	1088 <i>Lepyrodia macra</i> (Large Scale Rush)			
883.	1090 <i>Lepyrodia muirii</i>			
884.	25131 <i>Lerista distinguenda</i>			
885.	25133 <i>Lerista elegans</i>			
886.	<i>Lethocolea pansa</i>			
887.	6367 <i>Leucopogon capitellatus</i>			
888.	6374 <i>Leucopogon conostephioides</i>			
889.	6400 <i>Leucopogon gracillimus</i>			
890.	6436 <i>Leucopogon propinquus</i>			
891.	6439 <i>Leucopogon pulchellus</i> (Beard-heath)			
892.	28302 <i>Leucopogon</i> sp. Parkerville (A. Meebold 11654)			
893.	6445 <i>Leucopogon squarrosus</i>			
894.	6447 <i>Leucopogon strictus</i>			
895.	6454 <i>Leucopogon verticillatus</i> (Tassel Flower)			
896.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
897.	7677 <i>Levenhookia stipitata</i> (Common Stylewort)			
898.	25005 <i>Lialis burtonis</i>			
899.	<i>Libellulidae</i> sp.			
900.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
901.	<i>Limnesiidae</i> sp.			
902.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
903.	<i>Limnoxenus zelandicus</i>			
904.	59 <i>Lindsaea linearis</i> (Screw Fern)			
905.	4362 <i>Linum marginale</i> (Wild Flax)			
906.	4363 <i>Linum trigynum</i> (French Flax)	Y		
907.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
908.	9289 <i>Lobelia anceps</i> (Angled Lobelia)			
909.	7402 <i>Lobelia gibbosa</i> (Tall Lobelia)			
910.	7403 <i>Lobelia heterophylla</i> (Wing-seeded Lobelia)			
911.	7407 <i>Lobelia rhytidisperma</i> (Wrinkled-seeded Lobelia)			
912.	7408 <i>Lobelia tenuior</i> (Slender Lobelia)			
913.	9356 <i>Logfia gallica</i>	Y		
914.	476 <i>Lolium perenne</i> (Perennial Ryegrass)	Y		
915.	478 <i>Lolium rigidum</i> (Wimmera Ryegrass)	Y		
916.	<i>Lolium</i> sp.			
917.	1222 <i>Lomandra brittanii</i>			
918.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
919.	1228 <i>Lomandra hermaphrodita</i>			
920.	1229 <i>Lomandra integra</i>			
921.	1232 <i>Lomandra micrantha</i> (Small-flower Mat-rush)			
922.	14542 <i>Lomandra micrantha</i> subsp. <i>micrantha</i>			
923.	1234 <i>Lomandra nigricans</i>			
924.	1236 <i>Lomandra odora</i> (Tiered Matrush)			
925.	1239 <i>Lomandra preissii</i>			
926.	1240 <i>Lomandra purpurea</i> (Purple Mat Rush)			
927.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
928.	1244 <i>Lomandra sonderi</i>			
929.	<i>Lomandra</i> sp.			
930.	1245 <i>Lomandra spartea</i>			
931.	1246 <i>Lomandra suaveolens</i>			
932.	<i>Lophoictinia isura</i>			
933.	4059 <i>Lotus angustissimus</i> (Narrowleaf Trefoil)	Y		
934.	<i>Lotus</i> sp. Mud3			Y

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935.	8564 <i>Lotus subbiflorus</i>	Y		
936.	4063 <i>Lotus uliginosus</i> (Greater Lotus)	Y		
937.	1092 <i>Loxocarya cinerea</i>			
938.	4066 <i>Lupinus cosentinii</i>	Y		
939.	4067 <i>Lupinus luteus</i> (Yellow Lupin)	Y		
940.	1198 <i>Luzula meridionalis</i> (Field Woodrush)			
941.	1097 <i>Lyginia barbata</i>			
942.	18049 <i>Lyginia imberbis</i>			
943.	36375 <i>Lysimachia arvensis</i> (Pimpernel)	Y		
944.	36373 <i>Lysimachia minima</i>	Y		
945.	6456 <i>Lysinema ciliatum</i> (Curry Flower)			
946.	6458 <i>Lysinema elegans</i>			
947.	34736 <i>Lysinema pentapetalum</i>			
948.	2839 <i>Macarthuria australis</i>			
949.	<i>Macrogryrus angustatus</i>			
950.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
951.	85 <i>Macrozamia riedlei</i> (Zamia, Djiridji)			
952.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
953.	25650 <i>Malurus elegans</i> (Red-winged Fairy-wren)			
954.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
955.	24551 <i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)			
956.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
957.	24552 <i>Malurus splendens</i> subsp. <i>splendens</i> (Splendid Fairy-wren)			
958.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
959.	17637 <i>Marianthus candidus</i> (White Marianthus)			
960.	17630 <i>Marianthus tenuis</i>			
961.	<i>Maydenoptila baynesi</i>			
962.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
963.	34676 <i>Meionectes brownii</i> (Swamp Raspwort)			
964.	37580 <i>Melaleuca acutifolia</i>			
965.	36296 <i>Melaleuca armillaris</i> subsp. <i>armillaris</i>	Y		
966.	5925 <i>Melaleuca lateriflora</i> (Gorada)			
967.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
968.	20297 <i>Melaleuca osullivanii</i>			
969.	18394 <i>Melaleuca parviceps</i>			
970.	5946 <i>Melaleuca pauciflora</i>			
971.	5952 <i>Melaleuca preissiana</i> (Moonah)			
972.	5958 <i>Melaleuca radula</i> (Graceful Honey-myrtle)			
973.	5959 <i>Melaleuca raphiophylla</i> (Swamp Paperbark)			
974.	5964 <i>Melaleuca seriata</i>			
975.	5978 <i>Melaleuca teretifolia</i> (Banbar)			
976.	5980 <i>Melaleuca thymoides</i>			
977.	5983 <i>Melaleuca trichophylla</i>			
978.	5984 <i>Melaleuca uncinata</i> (Broom Bush, Kwidjard)			
979.	5987 <i>Melaleuca viminea</i> (Mohan)			
980.	13280 <i>Melaleuca viminea</i> subsp. <i>viminea</i>			
981.	14985 <i>Melinis repens</i>	Y		
982.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
983.	25184 <i>Menetia greyii</i>			
984.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
985.	955 <i>Mesomelaena pseudostygia</i>			
986.	956 <i>Mesomelaena stygia</i>			
987.	11473 <i>Mesomelaena stygia</i> subsp. <i>stygia</i>			
988.	957 <i>Mesomelaena tetragona</i> (Semaphore Sedge)			
989.	<i>Microcarbo melanoleucos</i>			
990.	25693 <i>Microeca fascinans</i> (Jacky Winter)			
991.	485 <i>Microlaena stipoides</i> (Weeping Grass)			
992.	11747 <i>Microlaena stipoides</i> var. <i>stipoides</i>			
993.	<i>Micronecta gracilis</i>			
994.	<i>Micronecta robusta</i>			
995.	1658 <i>Microtis atrata</i> (Swamp Mignonette Orchid)			
996.	10954 <i>Microtis media</i> (Tall Mignonette Orchid)			
997.	15419 <i>Microtis media</i> subsp. <i>media</i>			
998.	14344 <i>Millotia tenuifolia</i> var. <i>tenuifolia</i> (Soft Millotia)			
999.	4090 <i>Mirbelia dilatata</i> (Holly-leaved Mirbelia)			
1000.	4091 <i>Mirbelia floribunda</i> (Purple Mirbelia)			
1001.	4100 <i>Mirbelia spinosa</i>			
1002.	7085 <i>Misopates orontium</i> (Lesser Snapdragon)	Y		
1003.	<i>Missulena granulosa</i>			
1004.	<i>Missulena hoggi</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1005.	7410 <i>Monopsis debilis</i>	Y		
1006.	37440 <i>Monopsis debilis</i> var. <i>depressa</i>	Y		
1007.	4662 <i>Monotaxis grandiflora</i> (<i>Diamond of the Desert</i>)			
1008.	19585 <i>Monotaxis grandiflora</i> var. <i>grandiflora</i>			
1009.	4666 <i>Monotaxis occidentalis</i>			
1010.	19179 <i>Moraea flaccida</i> (<i>One-leaf Cape Tulip</i>)	Y		
1011.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (<i>Carpet Python</i>)			
1012.	25191 <i>Morethia lineocellata</i>			
1013.	25192 <i>Morethia obscura</i>			
1014.	24223 <i>Mus musculus</i> (<i>House Mouse</i>)	Y		
1015.	24042 <i>Mustela putorius</i> (<i>European Polecat, Ferret</i>)	Y		
1016.	<i>Myandra bicincta</i>			
1017.	25610 <i>Myiagra inquieta</i> (<i>Restless Flycatcher</i>)			
1018.	<i>Naididae</i> sp.			
1019.	49026 <i>Nandina domestica</i>	Y		Y
1020.	<i>Nannoperca vittata</i>			
1021.	<i>Necterosoma darwini</i>			
1022.	<i>Necterosoma</i> sp.			
1023.	<i>Nematoda</i> sp.			
1024.	<i>Nemertini</i> sp.			
1025.	25426 <i>Neobatrachus pelobatoides</i> (<i>Humming Frog</i>)			
1026.	24738 <i>Neophema elegans</i> (<i>Elegant Parrot</i>)			
1027.	<i>Neosilurus hyrtlii</i>			
1028.	<i>Nephila edulis</i>			
1029.	492 <i>Neurachne alopecuroidea</i> (<i>Foxtail Mulga Grass</i>)			
1030.	<i>Newmanoperla exigua</i>			
1031.	<i>Nidula emodensis</i>			
1032.	<i>Notalina</i> nr. sp. AV14			
1033.	25252 <i>Notechis scutatus</i> (<i>Tiger Snake</i>)			
1034.	<i>Notonectidae</i> sp.			
1035.	<i>Nousia</i> sp. AV16			
1036.	<i>Nunciella aspera</i>			
1037.	2401 <i>Nuytsia floribunda</i> (<i>Christmas Tree, Mudja</i>)			
1038.	25564 <i>Nycticorax caledonicus</i> (<i>Rufous Night Heron</i>)			
1039.	24194 <i>Nyctophilus geoffroyi</i> (<i>Lesser Long-eared Bat</i>)			
1040.	24195 <i>Nyctophilus gouldi</i> (<i>Gould's Long-eared Bat</i>)			
1041.	<i>Occiperipatoidea gilesii</i>			
1042.	24407 <i>Ocyphaps lophotes</i> (<i>Crested Pigeon</i>)			
1043.	<i>Oecetis</i> sp.			
1044.	6137 <i>Oenothera affinis</i> (<i>Longflower Evening Primrose</i>)	Y		
1045.	6140 <i>Oenothera mollissima</i>	Y		
1046.	14292 <i>Oenothera stricta</i> subsp. <i>stricta</i>	Y		
1047.	<i>Offadens soror</i> (ex genus 1 WA sp. 1)			
1048.	2365 <i>Olx benthamiana</i>			
1049.	8133 <i>Olearia elaeophila</i>			
1050.	32716 <i>Olearia lehmanniana</i>			
1051.	8143 <i>Olearia paucidentata</i> (<i>Autumn Scrub Daisy</i>)			
1052.	8149 <i>Olearia rudis</i> (<i>Rough Daisybush</i>)			
1053.	<i>Oligochaeta</i> sp.			
1054.	38816 <i>Omphalotus nidiformis</i>			
1055.	<i>Oniscidae</i> sp.			
1056.	18254 <i>Opercularia apiciflora</i>			
1057.	7346 <i>Opercularia echinocephala</i> (<i>Bristly Headed Stink Weed</i>)			
1058.	7348 <i>Opercularia hispidula</i> (<i>Hispid Stinkweed</i>)			
1059.	18255 <i>Opercularia vaginata</i> (<i>Dog Weed</i>)			
1060.	<i>Opisthopora</i> sp.			
1061.	<i>Oribatida</i> sp.			
1062.	4113 <i>Ornithopus compressus</i> (<i>Yellow Serradella</i>)	Y		
1063.	4114 <i>Ornithopus pinnatus</i> (<i>Slender Serradella</i>)	Y		
1064.	<i>Orthocladinae</i> sp.			
1065.	11749 <i>Orthosanthus laxus</i> var. <i>laxus</i> (<i>Morning Iris</i>)			
1066.	24085 <i>Oryctolagus cuniculus</i> (<i>Rabbit</i>)	Y		
1067.	<i>Ostracoda</i> (unident.)			
1068.	4349 <i>Oxalis corniculata</i> (<i>Yellow Wood Sorrel</i>)	Y		
1069.	30375 <i>Oxalis exilis</i>			
1070.	4352 <i>Oxalis glabra</i>	Y		
1071.	4354 <i>Oxalis incarnata</i>	Y		
1072.	4355 <i>Oxalis perennans</i>			
1073.	4356 <i>Oxalis pes-caprae</i> (<i>Soursob</i>)	Y		
1074.	4358 <i>Oxalis purpurea</i> (<i>Largeflower Wood Sorrel</i>)	Y		

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1075.	<i>Oxyethira</i> sp.			
1076.	<i>Oxyopes rubicundus</i>			
1077.	<i>Ozarchaea westraliensis</i>			
1078.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
1079.	<i>Palaemonidae</i> sp.			
1080.	507 <i>Panicum miliaceum</i> (Millet Panic)	Y		
1081.	27892 <i>Pannoparmelia wilsonii</i>			
1082.	<i>Paracladopelma</i> M1 (SFM)			
1083.	<i>Paralampona marangaroo</i>			
1084.	<i>Paralimnophyes pullulus</i> (V42)			
1085.	<i>Parameliidae</i> sp.			
1086.	<i>Paramerina levidensis</i>			
1087.	3618 <i>Paraserianthes lophantha</i> (Albizia)			
1088.	<i>Parastacidae</i> sp.			
1089.	25253 <i>Parasuta gouldii</i>			
1090.	25255 <i>Parasuta nigriceps</i>			
1091.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
1092.	24626 <i>Pardalotus punctatus</i> subsp. <i>xanthopyge</i> (Yellow-rumped Pardalote)			
1093.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
1094.	7089 <i>Parentucellia latifolia</i> (Common Bartsia)	Y		
1095.	27922 <i>Parmotrema chinense</i>			
1096.	527 <i>Paspalum dilatatum</i>	Y		
1097.	528 <i>Paspalum distichum</i> (Water Couch)	Y		
1098.	1542 <i>Patersonia babianoides</i>			
1099.	1546 <i>Patersonia juncea</i> (Rush Leaved Patersonia)			
1100.	1550 <i>Patersonia occidentalis</i> (Purple Flag, Koma)			
1101.	30476 <i>Patersonia occidentalis</i> var. <i>latifolia</i>			
1102.	1551 <i>Patersonia pygmaea</i> (Pygmy Patersonia)			
1103.	11550 <i>Patersonia umbrosa</i> var. <i>xanthina</i> (Yellow Flags)			
1104.	43760 <i>Pauridia occidentalis</i>			
1105.	<i>Pediana occidentalis</i>			
1106.	4346 <i>Pelargonium littorale</i>			
1107.	11139 <i>Pelargonium x domesticum</i>	Y		
1108.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
1109.	<i>Penemideopsis pusilla</i>			Y
1110.	40424 <i>Pentameris airoides</i> subsp. <i>airoides</i>	Y		
1111.	<i>Pentaneurini</i> genus V20			
1112.	6245 <i>Pentapeltis peltigera</i>			
1113.	<i>Pentastemon securifer</i>			
1114.	6006 <i>Pericalymma ellipticum</i> (Swamp Teatree)			
1115.	16477 <i>Pericalymma ellipticum</i> var. <i>ellipticum</i>			
1116.	16478 <i>Pericalymma ellipticum</i> var. <i>floridum</i>			
1117.	15501 <i>Pericalymma spongiocaulum</i>			
1118.	39058 <i>Perichaena depressa</i>			
1119.	2255 <i>Persoonia angustiflora</i>			
1120.	2262 <i>Persoonia elliptica</i> (Spreading Snottygobble)			
1121.	2267 <i>Persoonia longifolia</i> (Snottygobble)			
1122.	2273 <i>Persoonia saccata</i> (Snottygobble)			
1123.	<i>Pertiidae</i> sp.			
1124.	27947 <i>Pertusaria gibberosa</i>			
1125.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
1126.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
1127.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
1128.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
1129.	2284 <i>Petrophile biloba</i> (Granite Petrophile)			
1130.	20391 <i>Petrophile juncifolia</i>			
1131.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
1132.	2301 <i>Petrophile macrostachya</i>			
1133.	2308 <i>Petrophile seminuda</i>			
1134.	2309 <i>Petrophile serruriae</i>			
1135.	2311 <i>Petrophile squamata</i>			
1136.	2312 <i>Petrophile striata</i>			
1137.	19825 <i>Petrorhagia dubia</i>	Y		
1138.	<i>Peziza</i> sp.			
1139.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
1140.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
1141.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
1142.	547 <i>Phalaris angusta</i>	Y		
1143.	552 <i>Phalaris paradoxa</i> (Paradoxa Grass)	Y		
1144.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			

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1145.	25587 <i>Phaps elegans</i> (Brush Bronzewing)			
1146.	18529 <i>Philotheca spicata</i> (Pepper and Salt)			
1147.	1172 <i>Philydrella drummondii</i>			
1148.	1173 <i>Philydrella pygmaea</i> (Butterfly Flowers)			
1149.	14306 <i>Philydrella pygmaea</i> subsp. <i>pygmaea</i>			
1150.	1478 <i>Phlebocarya ciliata</i>			
1151.	1479 <i>Phlebocarya filifolia</i>			
1152.	554 <i>Phleum pratense</i> (Timothy)	Y		
1153.	<i>Pholiota highlandensis</i>			
1154.	<i>Phreodrilidae</i> sp.			
1155.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
1156.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
1157.	16825 <i>Phyllangium divergens</i>			
1158.	16177 <i>Phyllangium paradoxum</i>			
1159.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
1160.	4 <i>Phylloglossum drummondii</i> (Pigmy Clubmoss)			
1161.	13405 <i>Phyllopodium cordatum</i>	Y		
1162.	4141 <i>Phyllota gracilis</i>			
1163.	<i>Physidae</i> sp.			
1164.	<i>Phytophthora cinnamomi</i>			
1165.	78 <i>Pilularia novae-hollandiae</i> (Austral Pillwort)			
1166.	5232 <i>Pimelea argentea</i> (Silvery Leaved Pimelea)			
1167.	11667 <i>Pimelea brevistyla</i> subsp. <i>brevistyla</i>			
1168.	5251 <i>Pimelea imbricata</i>			
1169.	11404 <i>Pimelea imbricata</i> var. <i>major</i>			
1170.	11402 <i>Pimelea imbricata</i> var. <i>piligera</i>			
1171.	11182 <i>Pimelea lehmanniana</i> subsp. <i>nervosa</i>			
1172.	5266 <i>Pimelea suaveolens</i> (Scented Banjine)			
1173.	12041 <i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>			
1174.	5269 <i>Pimelea sylvestris</i>			
1175.	<i>Pisolithus</i> sp.			
1176.	8165 <i>Pithocarpa pulchella</i> (Beautiful Pithocarpa)			
1177.	<i>Planorbidae</i> sp.			
1178.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
1179.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
1180.	24745 <i>Platycercus icterotis</i> subsp. <i>icterotis</i> (Western Rosella)			
1181.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
1182.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
1183.	24750 <i>Platycercus zonarius</i> subsp. <i>semitorquatus</i> (Twenty-eight Parrot)			
1184.	<i>Platynectes</i> sp.			
1185.	6253 <i>Platysace filiformis</i>			
1186.	6255 <i>Platysace juncea</i>			
1187.	32413 <i>Pleuridium ecklonii</i>			
1188.	38824 <i>Pleurotus australis</i>			
1189.	571 <i>Poa annua</i> (Winter Grass)	Y		
1190.	573 <i>Poa drummondiana</i> (Knotted Poa)			
1191.	577 <i>Poa poliformis</i> (Coastal Poa)			
1192.	17016 <i>Podalyria sericea</i>	Y		
1193.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
1194.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
1195.	8175 <i>Podolepis gracilis</i> (Slender Podolepis)			
1196.	8183 <i>Podotheca chrysantha</i> (Yellow Podotheca)			
1197.	8184 <i>Podotheca gnaphalioides</i> (Golden Long-heads)			
1198.	<i>Poecilopta smaragdinea</i>			
1199.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
1200.	8188 <i>Pogonolepis stricta</i>			
1201.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
1202.	2419 <i>Polygonum aviculare</i> (Wireweed)	Y		
1203.	<i>Polypedilum</i> nr. <i>convexum</i> (SAP)			
1204.	<i>Polypedilum nubifer</i>			
1205.	<i>Polypedilum watsoni</i>			
1206.	582 <i>Polypogon monspeliensis</i> (Annual Beardgrass)	Y		
1207.	583 <i>Polypogon tenellus</i>			
1208.	<i>Polypompholyx tenella</i> scps			
1209.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
1210.	4690 <i>Poranthera huegelii</i>			
1211.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
1212.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
1213.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
1214.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			

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1215.	110 <i>Potamogeton drummondii</i>			
1216.	111 <i>Potamogeton ochreateus</i> (Blunt Pondweed)			
1217.	1669 <i>Prasophyllum cyphochilum</i> (Pouched Leek Orchid)			
1218.	1670 <i>Prasophyllum drummondii</i> (Swamp Leek Orchid)			
1219.	1672 <i>Prasophyllum fimbria</i> (Fringed Leek Orchid)			
1220.	1677 <i>Prasophyllum macrostachyum</i> (Laughing Leek Orchid)			
1221.	1680 <i>Prasophyllum parvifolium</i> (Autumn Leek Orchid)			
1222.	<i>Prionosternum scutatum</i>			
1223.	<i>Procladius paludicola</i>			
1224.	<i>Pseudolampona jarrahdale</i>			
1225.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
1226.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
1227.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
1228.	57 <i>Pteridium esculentum</i> (Bracken)			
1229.	13255 <i>Pterochaeta paniculata</i>			
1230.	24702 <i>Pterodroma brevirostris</i> (Kerguelen Petrel)			
1231.	24173 <i>Pteropus scapulatus</i> (Little Red Flying-fox)			
1232.	<i>Pterostylis</i> aff. <i>nana</i>			
1233.	48675 <i>Pterostylis atrosanguinea</i>			
1234.	1686 <i>Pterostylis barbata</i> (Bird Orchid)			
1235.	10875 <i>Pterostylis concava</i>			
1236.	1693 <i>Pterostylis recurva</i> (Jug Orchid)			
1237.	12217 <i>Pterostylis sanguinea</i>			
1238.	18655 <i>Pterostylis</i> sp. <i>crinkled leaf</i> (G.J. Keighery 13426)			
1239.	1698 <i>Pterostylis vittata</i> (Banded Greenhood)			
1240.	2718 <i>Ptilotus drummondii</i> (Narrowleaf Mulla Mulla)			
1241.	2742 <i>Ptilotus manglesii</i> (Pom Poms, Mulamula)			
1242.	2751 <i>Ptilotus polystachyus</i> (Prince of Wales Feather)			
1243.	32417 <i>Ptychostomum angustifolium</i>			
1244.	<i>Punctularia strigosozonata</i>			
1245.	<i>Purpureicephalus spurius</i>			
1246.	8195 <i>Quinetia urvillei</i>			
1247.	28224 <i>Ramalina inflata</i> subsp. <i>australis</i>			
1248.	<i>Ramaria lorithamnus</i>			
1249.	2938 <i>Ranunculus trilobus</i> (Buttercup)	Y		
1250.	3061 <i>Raphanus raphanistrum</i> (Wild Radish)	Y		
1251.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
1252.	<i>Raveniella cirrata</i>			
1253.	<i>Raveniella peckorum</i>			
1254.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
1255.	6012 <i>Regelia ciliata</i>			
1256.	<i>Rheotanytarsus trivittatus</i>			
1257.	<i>Rheotanytarsus underwoodi</i>			
1258.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
1259.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
1260.	24454 <i>Rhipidura leucophrys</i> subsp. <i>leucophrys</i> (Willie Wagtail)			
1261.	15035 <i>Rhodanthe corymbosa</i>			
1262.	13234 <i>Rhodanthe manglesii</i>			
1263.	<i>Richardsonianidae</i> sp.			
1264.	<i>Riethia</i> v4			
1265.	<i>Riethia</i> v5			
1266.	1556 <i>Romulea rosea</i> (Guildford Grass)	Y		
1267.	11544 <i>Romulea rosea</i> var. <i>australis</i> (Guildford Grass)	Y		
1268.	20506 <i>Rubus anglocandicans</i>	Y		
1269.	3191 <i>Rubus ulmifolius</i> (Blackberry)	Y		
1270.	23990 <i>Rubus ulmifolius</i> var. <i>ulmifolius</i>	Y		
1271.	2429 <i>Rumex acetosella</i> (Sorrel)	Y		
1272.	2430 <i>Rumex brownii</i> (Swamp Dock)	Y		
1273.	2433 <i>Rumex crispus</i> (Curled Dock)	Y		
1274.	2440 <i>Rumex pulcher</i> (Fiddle Dock)	Y		
1275.	38837 <i>Russula flocktoniae</i>			
1276.	48907 <i>Russula purpureoflava</i>			
1277.	40425 <i>Rytidosperma caespitosum</i>			
1278.	40426 <i>Rytidosperma occidentale</i>			
1279.	40430 <i>Rytidosperma pilosum</i>			
1280.	40427 <i>Rytidosperma setaceum</i>			
1281.	6929 <i>Salvia verbenaca</i> (Wild Sage)	Y		
1282.	7602 <i>Scaevola calliptera</i>			
1283.	7613 <i>Scaevola glandulifera</i> (Viscid Hand-flower)			
1284.	7619 <i>Scaevola lanceolata</i> (Long-leaved Scaevola)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1285.	7635 <i>Scaevola pilosa</i> (Hairy Fan-flower)			
1286.	13182 <i>Scaevola repens</i> var. <i>repens</i>			
1287.	17055 <i>Schinus molle</i>	Y		
1288.	6263 <i>Schoenolaena juncea</i>			
1289.	<i>Schoenus</i> aff. <i>brevisetis</i> (Mud2, #135)			
1290.	975 <i>Schoenus bifidus</i>			
1291.	978 <i>Schoenus brevisetis</i>			
1292.	979 <i>Schoenus caespitius</i>			
1293.	982 <i>Schoenus clandestinus</i>			
1294.	984 <i>Schoenus curvifolius</i>			
1295.	991 <i>Schoenus grammatophyllus</i>			
1296.	1002 <i>Schoenus nanus</i> (Tiny Bog Rush)			
1297.	1006 <i>Schoenus odontocarpus</i>			
1298.	17614 <i>Schoenus plumosus</i>			
1299.	1011 <i>Schoenus rigens</i>			
1300.	1013 <i>Schoenus sculptus</i> (Gimlet Bog-rush)			
1301.	<i>Schoenus</i> sp. aff. <i>breviculmis</i> sthct			Y
1302.	18164 <i>Schoenus</i> sp. <i>smooth culms</i> (K.R. Newbey 7823)			
1303.	1016 <i>Schoenus subbarbatus</i> (Bearded Bog-rush)			
1304.	1017 <i>Schoenus subbulbosus</i>			
1305.	1019 <i>Schoenus subflavus</i> (Yellow Bog-rush)			
1306.	1020 <i>Schoenus sublateralis</i>			
1307.	1023 <i>Schoenus tenellus</i>			
1308.	1026 <i>Schoenus unispiculatus</i>			
1309.	17409 <i>Schoenus varicellae</i>			
1310.	6033 <i>Scholtzia involucrata</i> (Spiked Scholtzia)			
1311.	<i>Scirtidae</i> sp.			
1312.	<i>Scolopendra laeta</i>			
1313.	6 <i>Selaginella gracillima</i> (Tiny Clubmoss)			
1314.	20663 <i>Senecio multicaulis</i> subsp. <i>multicaulis</i>			
1315.	25884 <i>Senecio pinnatifolius</i> var. <i>latilobus</i>			
1316.	8217 <i>Senecio quadridentatus</i>			
1317.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
1318.	608 <i>Setaria italica</i> (Italian Millet)	Y		
1319.	613 <i>Setaria verticillata</i> (Whorled Pigeon Grass)	Y		
1320.	2909 <i>Silene gallica</i> (French Catchfly)	Y		
1321.	11803 <i>Silene gallica</i> var. <i>quinquevulnera</i>	Y		
1322.	8224 <i>Siloxerus filifolius</i>			
1323.	8225 <i>Siloxerus humifusus</i> (Procumbent Siloxerus)			
1324.	14583 <i>Siloxerus multiflorus</i>			
1325.	<i>Simaetha thoracica</i>			Y
1326.	<i>Simuliidae</i> sp.			
1327.	30948 <i>Smicronis brevisrostris</i> (Weebill)			
1328.	24108 <i>Sminthopsis crassicaudata</i> (Fat-tailed Dunnart)			
1329.	24111 <i>Sminthopsis gilberti</i> (Gilbert's Dunnart)			
1330.	6988 <i>Solanum americanum</i> (Glossy Nightshade)	Y		
1331.	7020 <i>Solanum linnaeanum</i> (Apple of Sodom)	Y		
1332.	7022 <i>Solanum nigrum</i> (Black Berry Nightshade)	Y		
1333.	8230 <i>Sonchus asper</i> (Rough Sowthistle)	Y		
1334.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
1335.	617 <i>Sorghum halepense</i> (Johnson Grass)	Y		
1336.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
1337.	1558 <i>Sparaxis bulbifera</i>	Y		
1338.	4207 <i>Sphaerolobium medium</i>			
1339.	4211 <i>Sphaerolobium vimineum</i> (Leafless Globe Pea)			
1340.	41623 <i>Sphaeromorphaea australis</i>	Y		
1341.	4716 <i>Stachystemon vermicularis</i>			
1342.	4733 <i>Stackhousia monogyna</i>			
1343.	9070 <i>Stackhousia pubescens</i> (Downy Stackhousia)			
1344.	24645 <i>Stagonopleura oculata</i> (Red-eared Firetail)			
1345.	2918 <i>Stellaria media</i> (Chickweed)	Y		
1346.	39083 <i>Stemonitis fusca</i>			
1347.	39086 <i>Stemonitis smithii</i>			Y
1348.	3080 <i>Stenopetalum robustum</i>			
1349.	25643 <i>Sterna hybrida</i> (Whiskered Tern)			
1350.	<i>Sternopriscus browni</i>			
1351.	<i>Sternopriscus marginatus</i>			
1352.	<i>Sternopriscus minimus</i>			
1353.	<i>Sternopriscus</i> sp.			
1354.	2316 <i>Stirlingia latifolia</i> (Blueboy)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1355.	<i>Stratiomyidae</i> sp.			
1356.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
1357.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
1358.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
1359.	<i>Stropharia semiglobata</i>			
1360.	<i>Stylidium</i> aff. <i>androsaceum</i>			
1361.	7684 <i>Stylidium amoenum</i> (Lovely Triggerplant)			
1362.	30278 <i>Stylidium androsaceum</i>			
1363.	25831 <i>Stylidium araeophyllum</i> (Stilt Walker)			
1364.	7693 <i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)			
1365.	7694 <i>Stylidium bulbiferum</i> (Circus Triggerplant)			
1366.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
1367.	7699 <i>Stylidium carnosum</i> (Fleshy-leaved Triggerplant)			
1368.	7702 <i>Stylidium ciliatum</i> (Golden Triggerplant)			
1369.	7712 <i>Stylidium despectum</i> (Dwarf Triggerplant)			
1370.	7713 <i>Stylidium dichotomum</i> (Pins-and-needles)			
1371.	7717 <i>Stylidium divaricatum</i> (Daddy-long-legs)			
1372.	7718 <i>Stylidium diversifolium</i> (Touch-me-not)			
1373.	7719 <i>Stylidium ecome</i> (Foot Triggerplant)			
1374.	7721 <i>Stylidium emarginatum</i> (Biddy-four-legs)			
1375.	7736 <i>Stylidium hispidum</i> (White Butterfly Triggerplant)			
1376.	7742 <i>Stylidium inundatum</i> (Hundreds and Thousands)			
1377.	7749 <i>Stylidium leptophyllum</i> (Needle-leaved Triggerplant)			
1378.	25829 <i>Stylidium neurophyllum</i> (Coastal Plain Triggerplant)			
1379.	7768 <i>Stylidium obtusatum</i> (Pinafore Triggerplant)			
1380.	7773 <i>Stylidium petiolare</i> (Horn Triggerplant)			
1381.	7774 <i>Stylidium piliferum</i> (Common Butterfly Triggerplant)			
1382.	7782 <i>Stylidium pulchellum</i> (Thumbelina Triggerplant)			
1383.	7783 <i>Stylidium pycnostachyum</i> (Downy Triggerplant)			
1384.	33106 <i>Stylidium recurvum</i>			
1385.	7785 <i>Stylidium repens</i> (Matted Triggerplant)			
1386.	<i>Stylidium roseo-alatum</i>			
1387.	7790 <i>Stylidium roseoalatum</i> (Pink-wing Triggerplant)			
1388.	25806 <i>Stylidium scariosum</i>			
1389.	7798 <i>Stylidium schoenoides</i> (Cow Kicks)			
1390.	<i>Stylidium</i> sp.			
1391.	45594 <i>Stylidium tenue</i> subsp. <i>majusculum</i> (Showy Fountain Triggerplant)			
1392.	23511 <i>Stylidium thesioides</i> (Delicate Triggerplant)			
1393.	7806 <i>Stylidium utricularioides</i> (Pink Fan Triggerplant)			
1394.	1260 <i>Stypandra glauca</i> (Blind Grass)			
1395.	6476 <i>Styphelia tenuiflora</i> (Common Pinheath)			
1396.	38842 <i>Suillus luteus</i>	Y		
1397.	<i>Supunna funerea</i>			
1398.	<i>Supunna picta</i>			
1399.	24259 <i>Sus scrofa</i> (Pig)	Y		
1400.	25902 <i>Symphyotrichum squamatum</i> (Bushy Starwort)	Y		
1401.	2321 <i>Synaphea acutiloba</i> (Granite Synaphea)			
1402.	2323 <i>Synaphea gracillima</i>			
1403.	2324 <i>Synaphea petiolaris</i> (Synaphea)			
1404.	16864 <i>Synaphea petiolaris</i> subsp. <i>petiolaris</i>			
1405.	2325 <i>Synaphea pinnata</i> (Helena Synaphea)			
1406.	29186 <i>Synaphea</i> sp. <i>Udumung</i> (A.S. George 17058)			
1407.	<i>Synothele durokoppin</i>			
1408.	<i>Synothele michaelsoni</i>			
1409.	<i>Synsphyronus mimulus</i>			
1410.	32439 <i>Syntrichia papillosa</i>			
1411.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
1412.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
1413.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
1414.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
1415.	20024 <i>Tagetes erecta</i> (Marigold)	Y		
1416.	<i>Tamopsis darlingtoniana</i>			
1417.	<i>Tandanus bostocki</i>			
1418.	<i>Tanypodinae</i> sp.			
1419.	<i>Tanytarsus fuscithorax/semibarbitarsus</i>			
1420.	<i>Tanytarsus</i> nr <i>K5</i>			
1421.	<i>Tanytarsus palmatus</i>			
1422.	<i>Tanytarsus</i> sp. <i>I</i> (SAP)			
1423.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			

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1424.	<i>Taschorema pallescens</i>			
1425.	<i>Tasmanicosa leuckartii</i>			
1426.	<i>Tasmanocoenis tillyardi</i>			
1427.	20135 <i>Taxandria linearifolia</i>			
1428.	<i>Tetragnatha maeandrata</i>			Y
1429.	<i>Tetragnatha valida</i>			
1430.	1034 <i>Tetralia capillaris</i> (Hair Sedge)			
1431.	1036 <i>Tetralia octandra</i>			
1432.	667 <i>Tetarrhena laevis</i> (Forest Ricegrass)			
1433.	4535 <i>Tetradlea hirsuta</i> (Black Eyed Susan)			
1434.	48342 <i>Tetradlea hirsuta</i> subsp. <i>hirsuta</i>			
1435.	48341 <i>Tetradlea hirsuta</i> subsp. <i>viminea</i>			
1436.	4536 <i>Tetradlea hispida</i>			
1437.	4537 <i>Tetradlea nuda</i>			
1438.	1701 <i>Thelymitra antennifera</i> (Vanilla Orchid)			
1439.	10856 <i>Thelymitra benthamiana</i> (Leopard Orchid)			
1440.	1702 <i>Thelymitra campanulata</i> (Shirt Orchid)			
1441.	1705 <i>Thelymitra crinita</i> (Blue Lady Orchid)			
1442.	1707 <i>Thelymitra flexuosa</i> (Twisted Sun Orchid)			
1443.	11053 <i>Thelymitra macrophylla</i>			
1444.	1715 <i>Thelymitra spiralis</i> (Curlylocks)			
1445.	673 <i>Themeda triandra</i>			
1446.	<i>Thienemanniella</i> sp. (V19) (SAP)			
1447.	5080 <i>Thomasia foliosa</i>			
1448.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
1449.	1318 <i>Thysanotus arbuscula</i>			
1450.	1319 <i>Thysanotus arenarius</i>			
1451.	1328 <i>Thysanotus dichotomus</i> (Branching Fringe Lily)			
1452.	1330 <i>Thysanotus fastigiatus</i>			
1453.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
1454.	<i>Thysanotus manglesianus/patersonii</i> complex			
1455.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
1456.	1343 <i>Thysanotus patersonii</i>			
1457.	1351 <i>Thysanotus sparteus</i>			
1458.	1354 <i>Thysanotus tenellus</i>			
1459.	1357 <i>Thysanotus thyrsoides</i>			
1460.	1358 <i>Thysanotus triandrus</i>			
1461.	25203 <i>Tiliqua occipitalis</i> (Western Bluetongue)			
1462.	25519 <i>Tiliqua rugosa</i>			
1463.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
1464.	<i>Tipulidae</i> sp.			
1465.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
1466.	8248 <i>Tolpis barbata</i> (Yellow Hawkweed)	Y		
1467.	19041 <i>Trachymene coerulea</i> subsp. <i>coerulea</i>			
1468.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
1469.	1481 <i>Tribonanthes australis</i> (Southern Tiurmdin)			
1470.	1482 <i>Tribonanthes brachypetala</i> (Nodding Tiurmdin)			
1471.	1483 <i>Tribonanthes longipetala</i> (Branching Tiurmdin)			
1472.	1485 <i>Tribonanthes violacea</i> (Violet Tiurmdin)			
1473.	39098 <i>Trichia favoginea</i>			
1474.	8251 <i>Trichocline spathulata</i> (Native Gerbera)			
1475.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
1476.	<i>Tricholoma saponaceum</i>			
1477.	25521 <i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
1478.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
1479.	1361 <i>Tricoryne elatior</i> (Yellow Autumn Lily)			
1480.	1362 <i>Tricoryne humilis</i>			
1481.	1363 <i>Tricoryne tenella</i>			
1482.	1038 <i>Tricostularia neesii</i>			
1483.	4289 <i>Trifolium angustifolium</i> (Narrowleaf Clover)	Y		
1484.	17145 <i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Y		
1485.	4291 <i>Trifolium arvense</i> (Hare's Foot Clover)	Y		
1486.	4292 <i>Trifolium campestre</i> (Hop Clover)	Y		
1487.	17763 <i>Trifolium campestre</i> var. <i>campestre</i> (Hop Clover)	Y		
1488.	4293 <i>Trifolium cernuum</i> (Drooping Flower Clover)	Y		
1489.	4295 <i>Trifolium dubium</i> (Suckling Clover)	Y		
1490.	17541 <i>Trifolium incarnatum</i> var. <i>incarnatum</i>	Y		
1491.	4304 <i>Trifolium ornithopodioides</i> (Birdsfoot Fenugreek)	Y		
1492.	4313 <i>Trifolium subterraneum</i> (Subterranean Clover)	Y		
1493.	18587 <i>Triglochin nana</i>			

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1494.	<i>Tripletides australis</i>			
1495.	4737 <i>Tripterococcus brunonis</i> (Winged Stackhousia)			
1496.	1139 <i>Trithuria bibracteata</i>			
1497.	1141 <i>Trithuria submersa</i>			
1498.	1561 <i>Tritonia crocata</i>	Y		
1499.	13479 <i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>			
1500.	33418 <i>Trymalium odoratissimum</i> subsp. <i>odoratissimum</i>			
1501.	<i>Tubaria rufofulva</i>			
1502.	48147 <i>Turnix varius</i> (Painted Button-quail)			
1503.	24852 <i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
1504.	25764 <i>Tyto novaehollandiae</i> (Masked Owl)			
1505.	24983 <i>Underwoodisaurus milii</i> (Barking Gecko)			
1506.	<i>Urodacus novaehollandiae</i>			
1507.	<i>Urodacus planimanus</i>			
1508.	<i>Urodacus woodwardii</i>			
1509.	<i>Uromycladium tepperianum</i>			
1510.	8255 <i>Ursinia anthemoides</i> (Ursinia)	Y		
1511.	38388 <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	Y		
1512.	28227 <i>Usnea scabrida</i> subsp. <i>scabrida</i>			
1513.	7153 <i>Utricularia tenella</i>			
1514.	7157 <i>Utricularia violacea</i> (Violet Bladderwort)			
1515.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
1516.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
1517.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			
1518.	7665 <i>Velleia trinervis</i>			
1519.	8257 <i>Vellereophyton dealbatum</i> (White Cudweed)	Y		
1520.	<i>Venator immansueta</i>			
1521.	7107 <i>Verbascum virgatum</i> (Twiggy Mullein)	Y		
1522.	6070 <i>Verticordia acerosa</i>			
1523.	15431 <i>Verticordia acerosa</i> var. <i>acerosa</i>			
1524.	12388 <i>Verticordia acerosa</i> var. <i>preissii</i>			
1525.	6076 <i>Verticordia densiflora</i> (Compacted Featherflower)			
1526.	12411 <i>Verticordia densiflora</i> var. <i>cespitosa</i>			
1527.	15432 <i>Verticordia densiflora</i> var. <i>densiflora</i>			
1528.	6088 <i>Verticordia huegellii</i> (Variegated Featherflower)			
1529.	12429 <i>Verticordia huegellii</i> var. <i>decumbens</i>			
1530.	15433 <i>Verticordia huegellii</i> var. <i>huegellii</i>			
1531.	12430 <i>Verticordia huegellii</i> var. <i>stylosa</i>			
1532.	6107 <i>Verticordia pennigera</i>			
1533.	6110 <i>Verticordia plumosa</i> (Plumed Featherflower)			
1534.	12449 <i>Verticordia plumosa</i> var. <i>brachyphylla</i>			
1535.	15618 <i>Verticordia plumosa</i> var. <i>plumosa</i>			
1536.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			
1537.	4320 <i>Vicia hirsuta</i> (Hairy Vetch)	Y		
1538.	4322 <i>Vicia sativa</i> (Common Vetch)	Y		
1539.	12070 <i>Vicia sativa</i> subsp. <i>sativa</i>	Y		
1540.	4325 <i>Viminaria juncea</i> (Swishbush, Koweda)			
1541.	6575 <i>Vinca major</i> (Blue Periwinkle)	Y		
1542.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		
1543.	722 <i>Vulpia bromoides</i> (Squirrel Tail Fescue)	Y		
1544.	724 <i>Vulpia myuros</i> (Rat's Tail Fescue)	Y		
1545.	33101 <i>Vulpia myuros</i> forma <i>myuros</i>	Y		
1546.	7384 <i>Wahlenbergia capensis</i> (Cape Bluebell)	Y		
1547.	7386 <i>Wahlenbergia gracilentia</i> (Annual Bluebell)			
1548.	7389 <i>Wahlenbergia preissii</i>			
1549.	17910 <i>Washingtonia filifera</i>	Y		
1550.	13103 <i>Watsonia borbonica</i>	Y		
1551.	1566 <i>Watsonia marginata</i>	Y		
1552.	1567 <i>Watsonia meriana</i> (Bulbil Watsonia)	Y		
1553.	18108 <i>Watsonia meriana</i> var. <i>bulbillifera</i>	Y		
1554.	18118 <i>Watsonia meriana</i> var. <i>meriana</i>	Y		
1555.	<i>Watsonia</i> sp. <i>Mud09</i>			Y
1556.	<i>Wheenyoides cookii</i>			
1557.	12072 <i>Wurmbea dioica</i> subsp. <i>alba</i>			
1558.	<i>Xanthagrion erythronurum</i>			
1559.	1249 <i>Xanthorrhoea acanthostachya</i>			
1560.	1253 <i>Xanthorrhoea gracilis</i> (Graceful Grass Tree, Mimidi)			
1561.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
1562.	6284 <i>Xanthosia candida</i>			
1563.	6285 <i>Xanthosia ciliata</i>			

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1564.	6289 <i>Xanthosia huegelii</i>			
1565.	6293 <i>Xanthosia singuliflora</i>			
1566.	2331 <i>Xylomelum occidentale</i> (Woody Pear, Djandin)			
1567.	15819 <i>Xyris atrovirida</i>			
1568.	1049 <i>Zantedeschia aethiopica</i> (Arum Lily)	Y		
1569.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereeye)			

Conservation Codes

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

APPENDIX 7

MDSP Area Environmental Assessment (Aurora Environmental – June 2019)

MEMORANDUM

TO:	Stuart Griffiths, WPG Landholdings Pty Ltd
FROM:	Paul Zuvela
SUBJECT:	MUNDIJONG/WHITBY DSP AREA ENVIRONMENTAL CONSTRAINTS
DATE:	24/06/2019
DOCUMENT N^o:	WPL2019-002_ENVA_001_at_V2

Dear Stuart,

Please find following a summary of the current environmental conditions within the Mundijong District Structure Plan (DSP) area (the site), particularly areas B, C, D, F, G and Development Investigation Areas (DIAs) 2 and 3 shown in Plate 1. Environmental constraints as mapped in the 2018 DSP are depicted in Plate 2.

PLATE 1: THE SITE

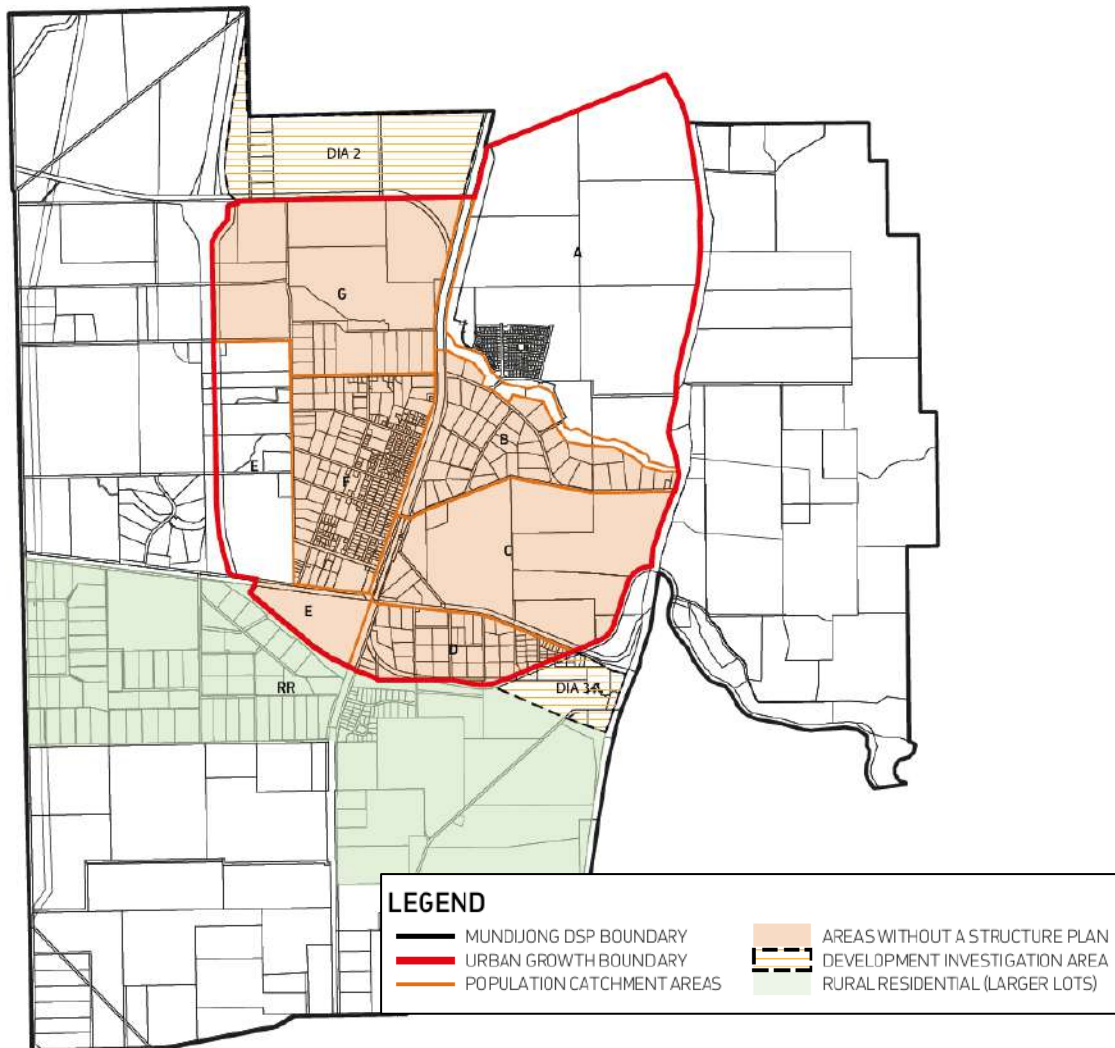
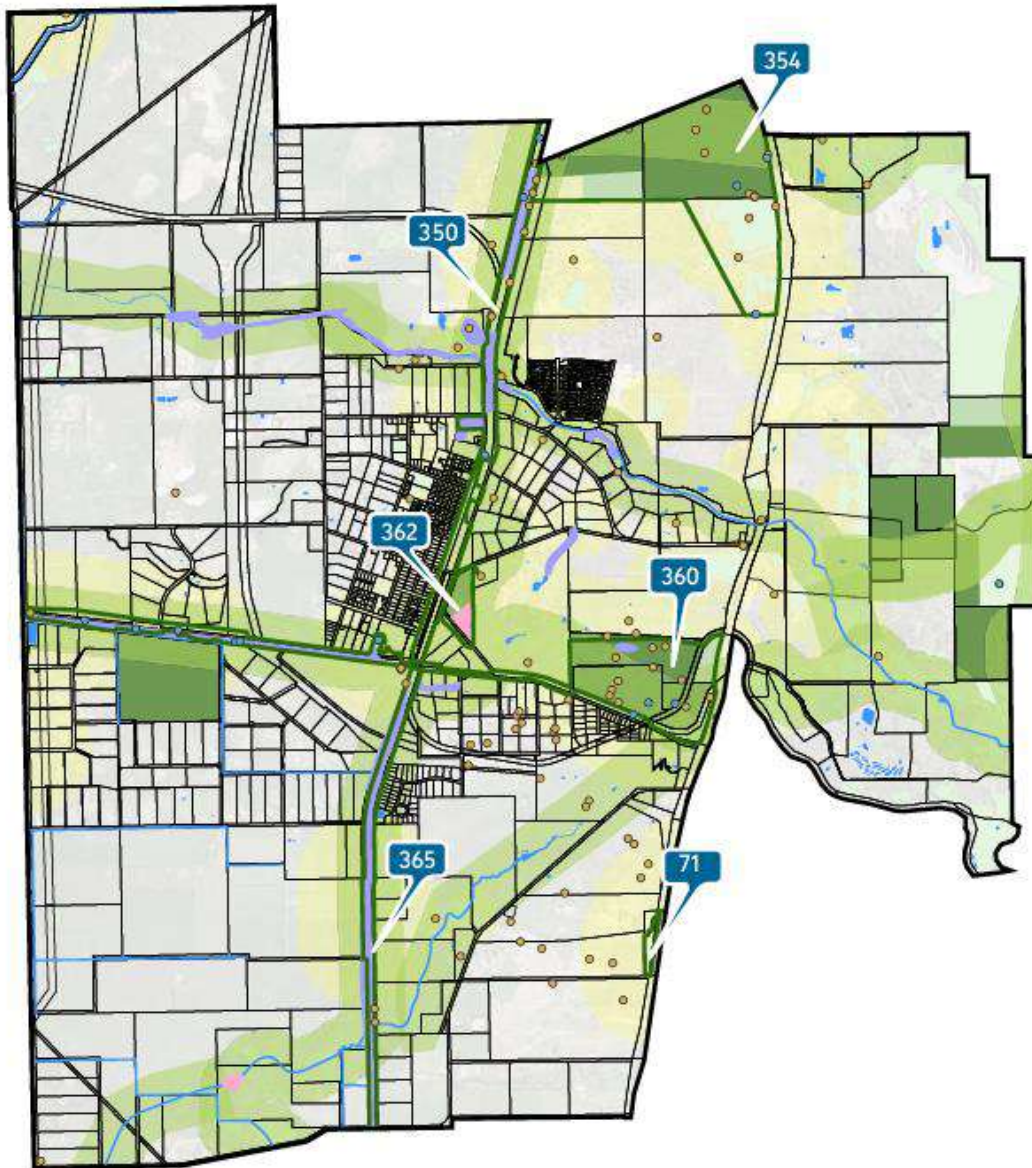


PLATE 2: ENVIRONMENTAL CONSTRAINTS MAPPED IN THE 2018 DSP



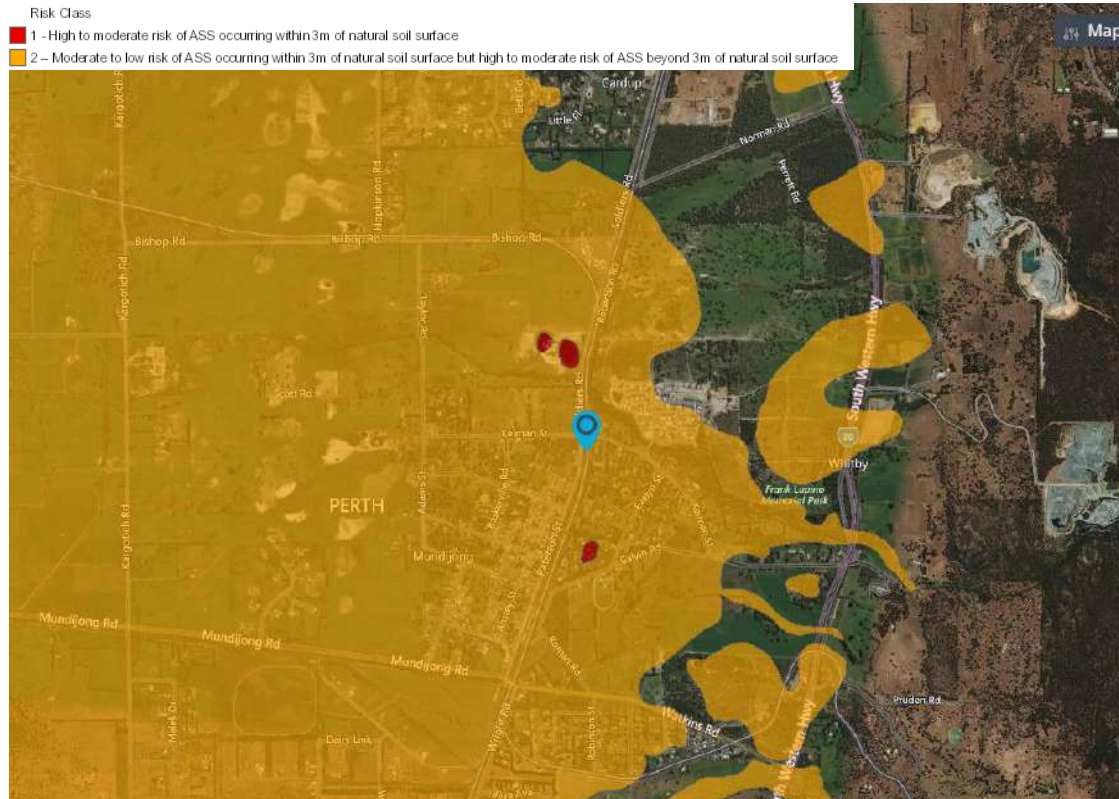
TOPOGRAPHY, SOILS AND ACID SULPHATE SOILS

- Ground elevations at the site slope from the western boundary to the northwest point of the site from approximately 25 mAHD to 75 mAHD, reaching a high point of 96 mAHD along the eastern boundary (South-Western Highway).
- The Mundijong/Whitby Cell consists of three soil types: Forrestfield, Pinjarra and Bassendean.
- In isolated pockets, the alluvial soils are overlain by windblown sand typical of the Bassendean System. These areas are prone to wind erosion, but only minor areas of the remainder of the flats are susceptible to either wind or water erosion.
- As shown in Plate 3 a large portion of the site is mapped as *moderate to low risk of ASS within 3m of the natural surface but high to moderate risk of ASS beyond 3m of the natural soil surface* (DWER, 2019b).
- The findings of the Preliminary ASS investigation by Cardno (2007) suggest that ASS are not present within the shallow (to 3.0 m BGS) soil profiles.

MEMORANDUM

- Overall Cardno (2007) concluded that should deep excavation works or dewatering be proposed, further studies should be undertaken to assess the potential for ASS deeper within the soil profile prior to commencement of such activities.
- The high risk regions for the development of ASS are restricted to 3 small areas (wetlands west of Soldiers Road, the wetland east of Robertson Road and north of Evelyn Street adjacent to Manjedal Brook).

PLATE 3: ACID SULFATE SOILS RISK MAPPING



Recommendations

- Should deep excavations (e.g. deeper than 3.0m of the natural soil surface) or dewatering be required for subdivision and future development, further ASS investigations may be required.

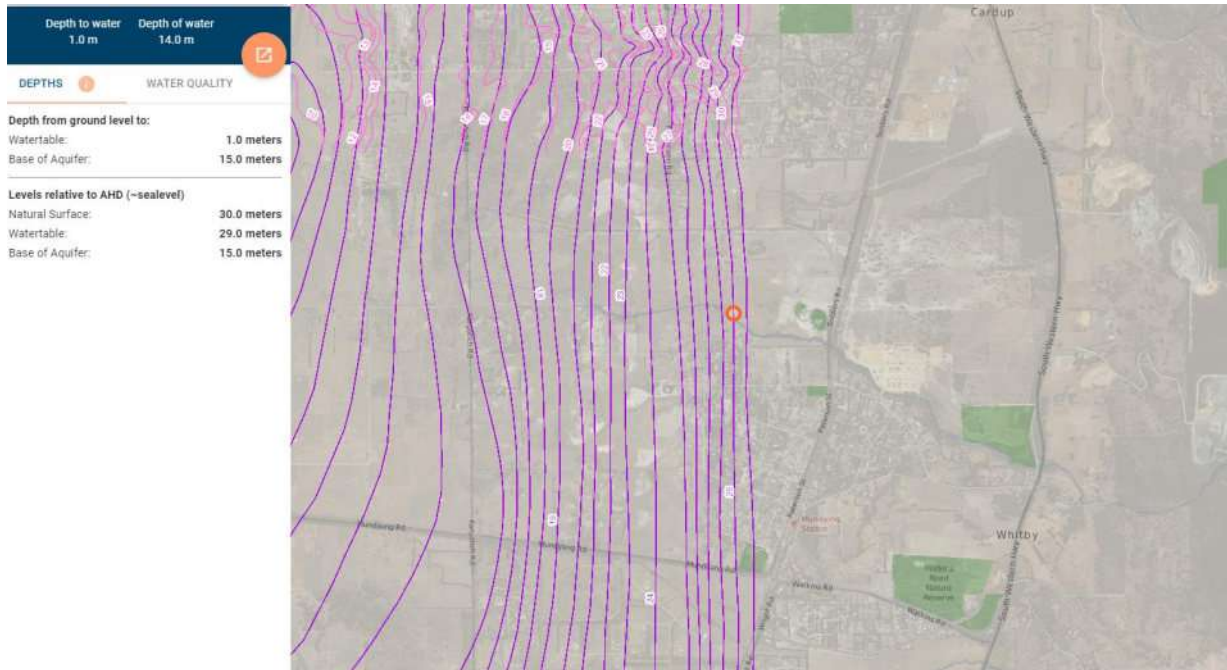
GROUNDWATER

- The Perth Groundwater Map (DoW, 2019) shows groundwater beneath the western portion of the site at 1-2 m below the ground surface, with groundwater flowing in a westerly direction. There is no data in the Perth Groundwater Map for the eastern side.
- The groundwater under the western side of the site is mapped as 'brackish' (TDS 1000 - 1500 mg/L).
- Cardno (2007) measured groundwater levels in the north east section of the DSP area, with levels varying from approximately 20 mBGS in the vicinity of the eastern boundary (central eastern to south-eastern) of the DSP area decreasing to less than 5 mBGS (and in some instances less than 2m) along the central region adjacent to Soldiers Road.
- Department of Water records of ground water level measurements since 1978 show a significant decline groundwater levels.

MEMORANDUM

- A search of the Water Register shows there are more than 400 registered bore licenses for the area, with a majority registered for domestic use with an allocation of up to 1500kL/annum. The majority of these are licensed for the Leederville aquifer (around 300) and the Superficial Swan aquifer (around 80).

PLATE 4: GROUNDWATER LEVELS (PERTH GROUNDWATER MAP, 2019)



Recommendations

- Further assessment of groundwater levels and water quality may be required as an input into water management planning.
- Groundwater availability for irrigation purposes should be further investigated and where there is availability, an application should be submitted to secure water resources early in the planning process.

SURFACE HYDROLOGY

- Several Conservation Category wetlands (CCWs) are mapped within the DSP area (Plate 5).
- Two CCWs (UFI 15446 and 15445) (Plate 5) are associated with Manjedal Brook, which is a perennial stream that flows through the site in a westerly direction (Plate 6).
- Manjedal Brook discharges to the Oaklands Main Drain, which in turn discharges to Birrega Drain approximately 600 m north of Mundijong Road (DoW, 2015).

MEMORANDUM

PLATE 5: GEOMORPHIC WETLANDS MAPPING

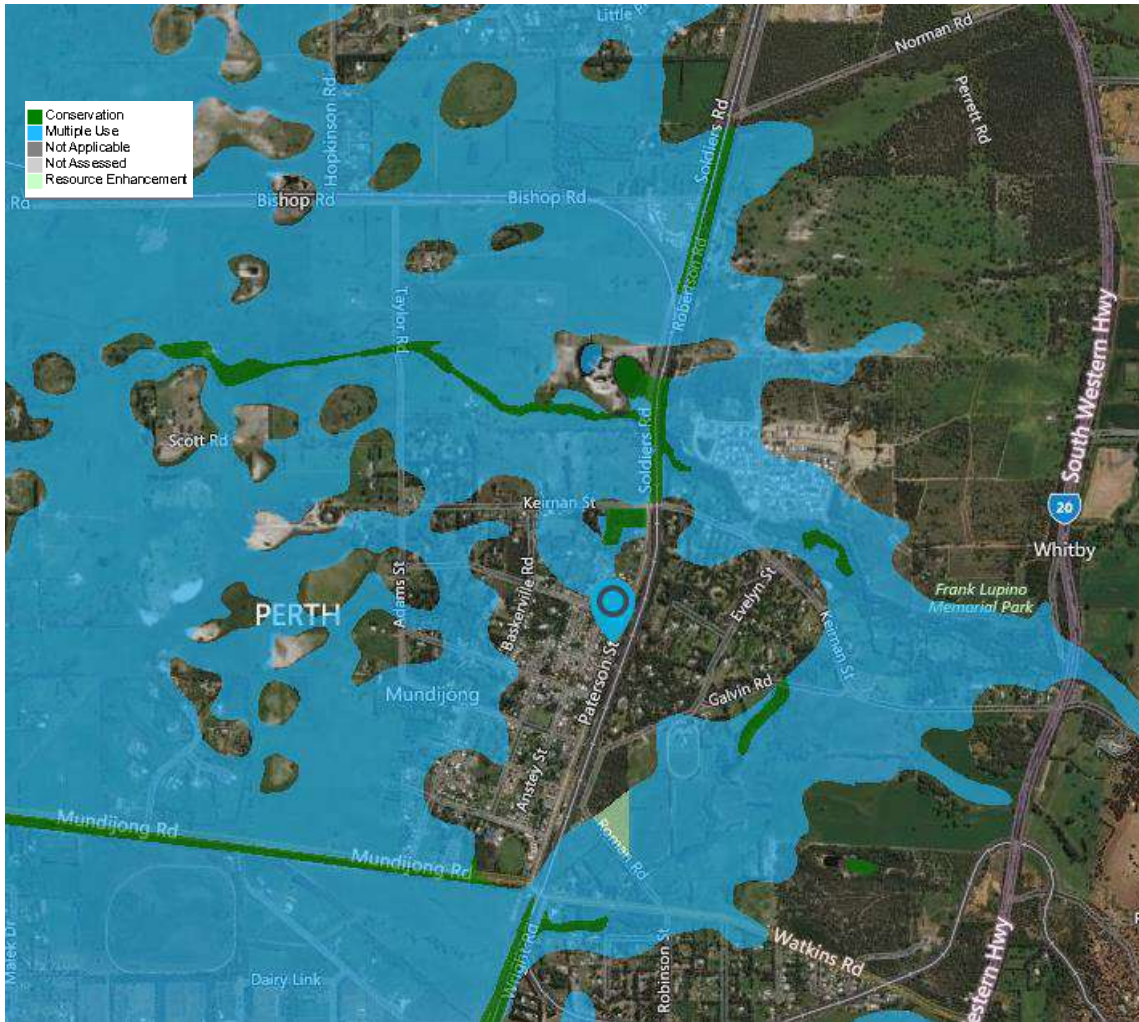
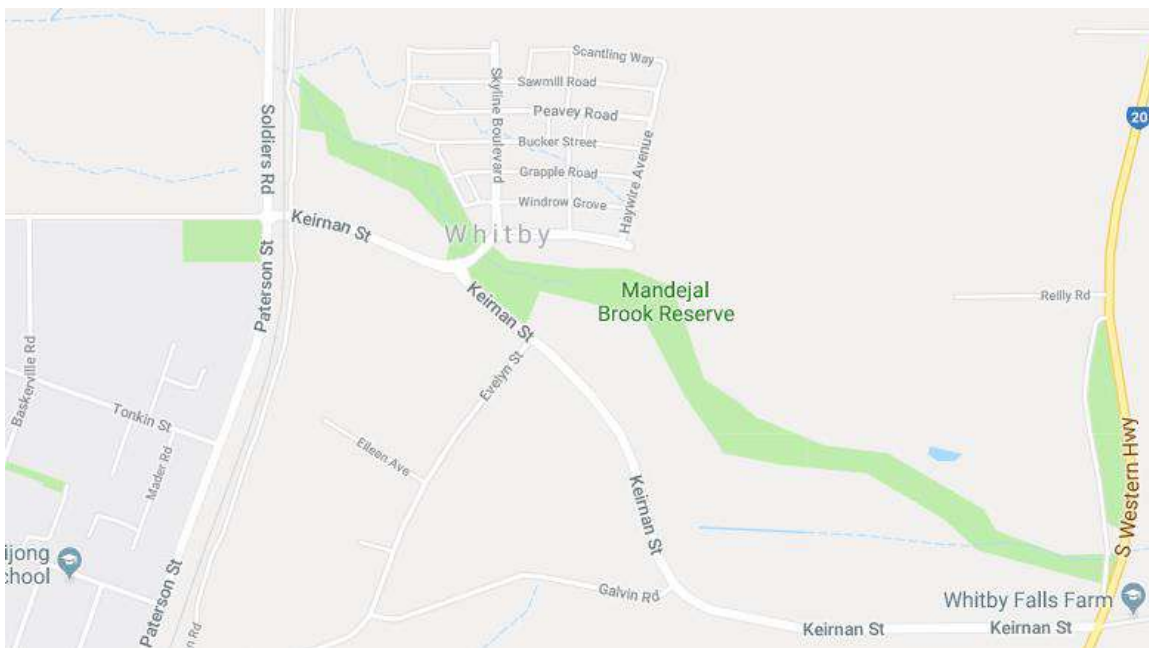


PLATE 6: MANJEDAL BROOK RESERVE



MEMORANDUM

FLOOD RISK

- The 1% AEP floodplain mapping for the DSP area is shown in Plate 7 and indicates the areas that are subject to flooding in a 100 year event.
- Mapping in Plate 8 reveals no areas of floodway within the DSP area.
- A flood study completed by the Department of Water (DoW) in 2015 covers the DSP area. The study shows the escarpment catchments in the Birrega study area are small, relative to the catchment area located on the Swan Coastal Plain. As such, flooding from tributaries within the Darling Scarp (e.g. Cardup Brook, Manjedal Brook and Beenyup Brook) is considered to be relatively minor.
- Detailed floodplain mapping was prepared for the 100 year ARI event, using a combination of the maximum modelled flood levels for all duration events, including levee failure scenarios (DoW, 2015). Plate 9 provides an overview of the floodplain mapping for the 100 year event.

PLATE 7: 1 in 100 AEP FLOODPLAIN (NATIONAL MAP, 2019)



MEMORANDUM

PLATE 8: FPM 1 IN 100 AEP FLOODWAY AND FLOOD FRINGE AREA (NATIONAL MAP, 2019)

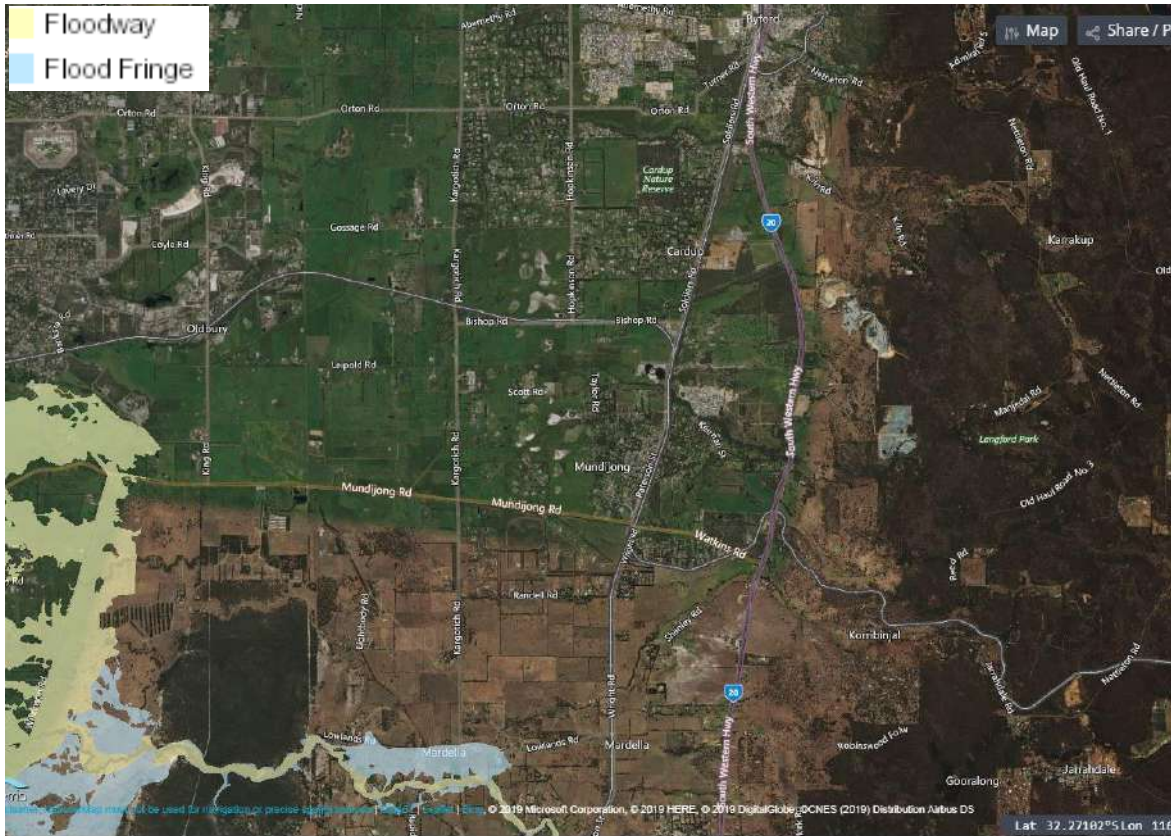
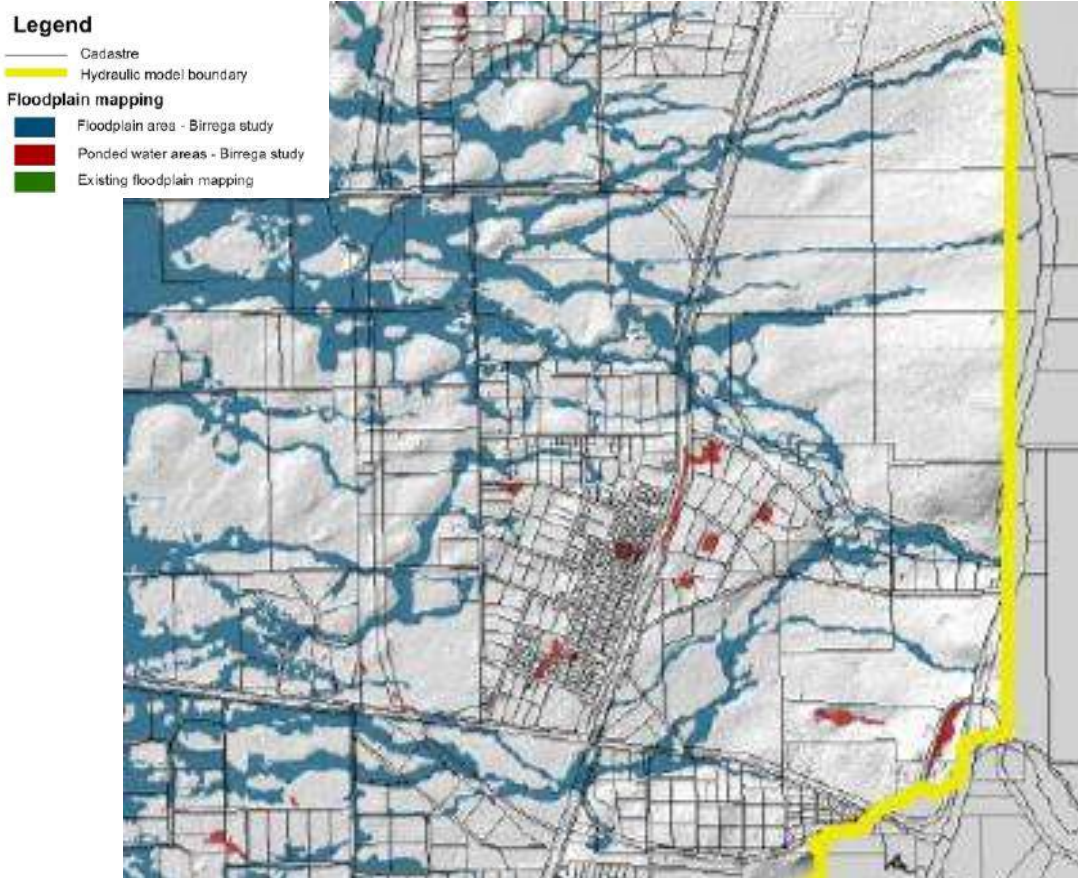


PLATE 9: DETAILED 100 YEAR ARI FLOODPLAIN MAPPING AND PONDED AREAS (DOW, 2015)



MEMORANDUM

Regulator Advice

Department of Biodiversity Conservation and Attractions (DBCA) and the Department of Water and Environmental Regulation (DWER) were consulted in relation to buffers to CCWs and Manjedal Brook. Their advice is summarised below:

- A 50m buffer should be applied to CCWs/Manjedal Brook.
- In accordance with the *Decision Process for Stormwater Management in Western Australia* (DWER, 2017), stormwater management infrastructure (including pipes, constructed drains, flood detention areas and vegetated swales) should be located outside of the buffer to CCWs and resource enhancement wetlands.
- Drainage infrastructure such as bioretention areas to manage the small events (first 15mm) should be outside of the CCW, its buffer and waterway foreshore area. Larger events such as the 1% and 5% AEP may overtop this bioretention area and discharge via vegetated overland flow paths into the wetlands, buffer and foreshore.
- DWER advised that for areas not mapped as CCW but associated with Manjedal Brook, the expectation is that the foreshore area (buffer) is to:
 - include any areas of floodway
 - include all/most of the riparian vegetation and any Bush Forever site area
 - extend a minimum of 30m from the top of the waterway bank (on each side)

EPA Advice for development in the Mundijong Area

EPA Advice on West Mundijong Industrial Precinct (Notice of Environmental Assessment - MRS Amendment 1298-41)

The EPA expects that the area mapped as a CCW (Manjedal Brook) be managed and protected by a minimum buffer of 50 metres. This buffer should be included as an ecological linkage at the structure planning stage.

Recommendations

- Water management planning consistent with the Better Urban Water Management Guidelines will be required (e.g. DWMS, LWMS and UWMPs at relevant planning stages), ensuring sufficient separation to groundwater levels, finished levels are above flood levels and appropriate stormwater and groundwater controls are integrated within the development.
- No development shall occur within CCWs or their buffers.
- Importation of fill and/or subsurface drainage infrastructure (or similar) will be required for development in areas of high groundwater levels, to ensure sufficient separation of built structures and the estimate average annual maximum groundwater level (AAMGL).
- A Foreshore Management Plan is likely to be required (by the developer) for areas future development adjacent to Manjedal Brook.
- Access to CCWs wetlands should be controlled via the use of fencing and provision of paths.
- Where development is proposed near a retained wetland a Wetland Management Plan is likely to be required.

MEMORANDUM

SURROUNDING LAND USES AND CONTAMINATION

The land uses surrounding the DSP area are summarised in Table 7.

TABLE 7: SURROUNDING LAND USES

LOCATION ¹	LANDUSE
North	The northern boundary of the DSP area is Norman/Bishop Road. Beyond this boundary is approximately 500 m of remnant bush and a recent plantation timber allotment to the north east. Further north is the PERMApole Timber Treatment Plant. To the northeast is Cardup Metro Brickworks and the Byford Rifle Range.
East	Immediately east of the DSP area is South-Western Highway. Beyond the Highway are several industrial commercial properties which were assessed as part of this PSI, including South Cardup Landfill, Henley Park Motorcross Track and the decommissioned mine.
South	South of Mundijong/Watkins Road, the area is predominantly residential and comprises rural allotments (including a Dairy, Poultry and Horse Racing Track). Towards the eastern end of Watkins Road is a significant area of remnant vegetation (adjacently south of Jarrahdale Road).
West	Beyond the western boundary of the DSP area the land is predominantly rural properties. The general topography for the area slopes from east to west and as such west of the Cell is a large palusplain wetland. The DEC wetland base named this wetland as the Mundijong Wetland.

- A Preliminary Site Investigation (PSI) of potentially contaminated sites within the DSP area was undertaken by SMEC (2009). SMEC compiled a list of 14 potentially contaminated sites, based on the *Mundijong Whitby District Structure Plan Environmental Scoping Paper* (Land Insights, 2006) and other sites identified through consultation with the Shire of Serpentine-Jarrahdale.
- The results of the PSI identified five (5) potentially contaminating activities warranting further investigation, (Table 8). The locations of these sites are shown on Plate 11. The remaining sites are not expected to require further investigation given the low risk of contamination, subject to there being no additional potentially contaminating activities undertaken since the original assessment.
- There are no registered contaminated sites (registered on the DWER Contaminated Sites database) within the DSP area or in close proximity. Plate 10 shows there are 3 contaminated sites within a 10 km radius.

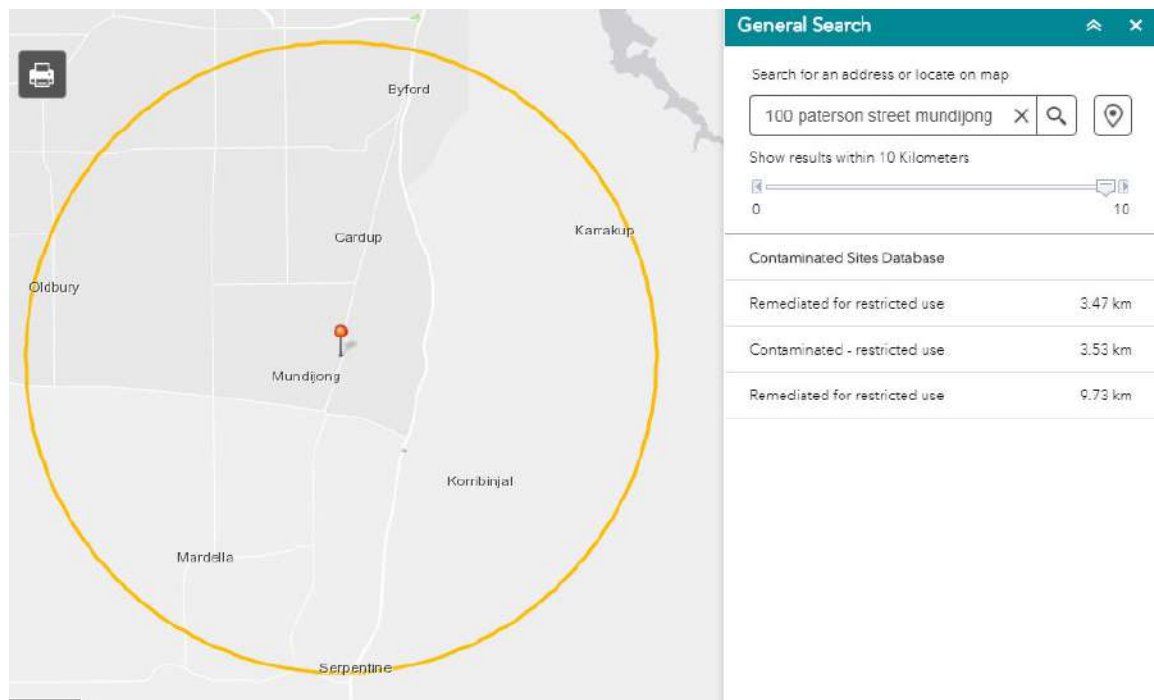
¹ With respect to the DSP area.

MEMORANDUM

TABLE 8: POTENTIALLY CONTAMINATED SITES

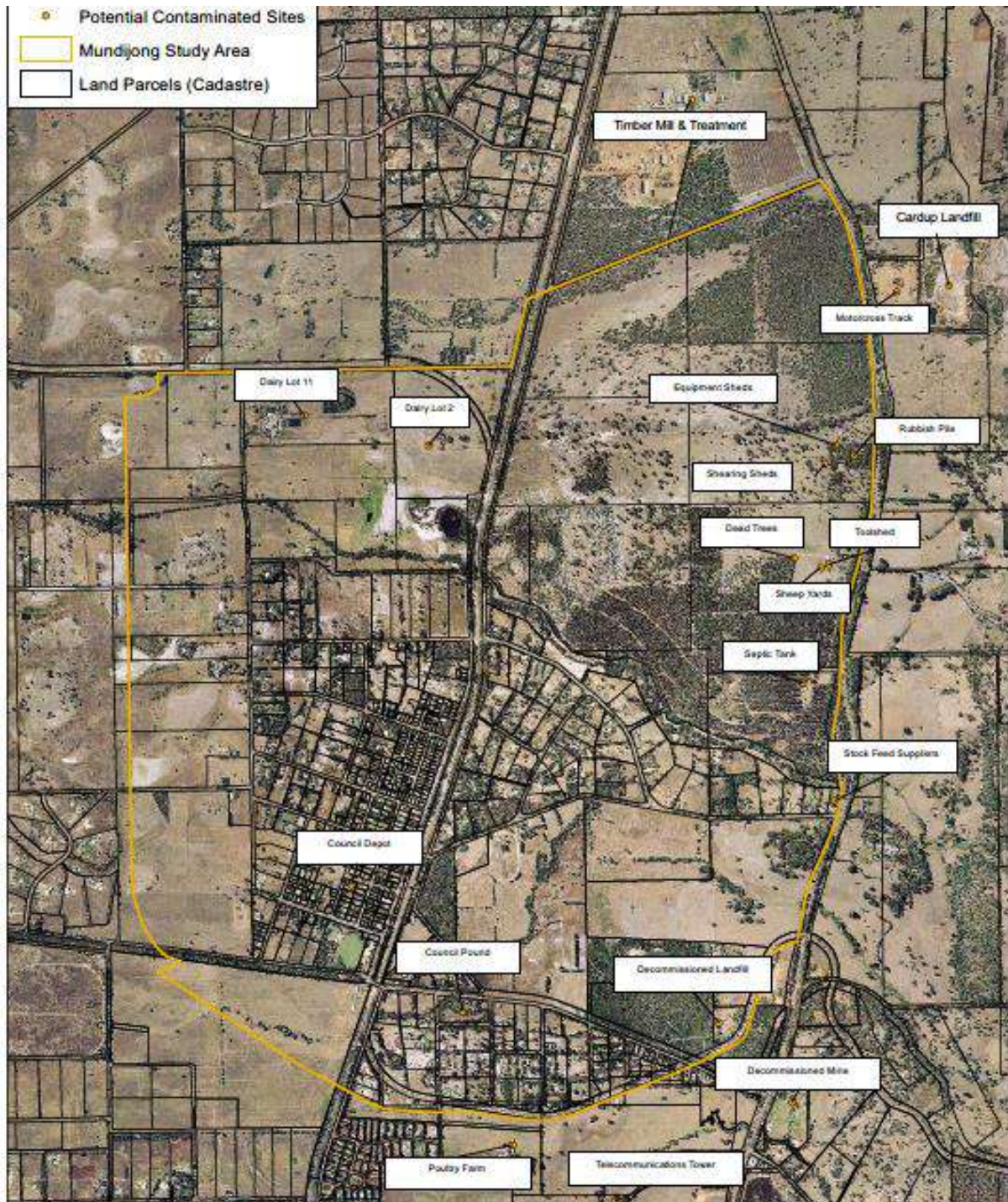
LOCATION	RECOMMENDATION	POSSIBLE DEVELOPMENT RESTRICTIONS
Council Depot	Further investigations required, should changing land use be proposed.	Expected to pose constraints on development due to contamination potential.
Decommissioned Landfill	Further investigations required, should changing land use be proposed.	Expected to pose constraints on development due to contamination potential.
Timber Mill and Treatment	Further investigations required should, changing land use be proposed for Bush Forever Site 350, 354.	Maintain EPA buffer (EPA, 2005b) between sensitive receptors (residential lots) and Timber Mill.
Stockfeeds	Further investigations recommended for storage sheds.	May pose constraints on development depending on detailed investigations of areas with high risk of contamination.
Decommissioned Mine	Further investigations are recommended down gradient of the mine.	High likelihood of constraints on development due to contamination potential.
Garden & Hire Business	Conduct a DSI. Undertake remediation activities as required following further investigation.	Not expected to pose any constraints for the DSP area.

PLATE 10: CONTAMINATED SITES DATABASE SEARCH RESULTS



MEMORANDUM

PLATE 11: POTENTIALLY CONTAMINATED SITES (SMEC, 2009)



MEMORANDUM

Recommendations

- For each of the five (5) sites identified as possibly contaminated and requiring further investigation, the following will need to be undertaken:
 - Undertake a DSI according to DWER Guidelines; and
 - Should contamination be identified, a Site Remediation and Validation Report will be required in compliance with DWER guidelines, noting that an accredited Contaminated Sites Auditor will need to be appointed.

FLORA AND VEGETATION

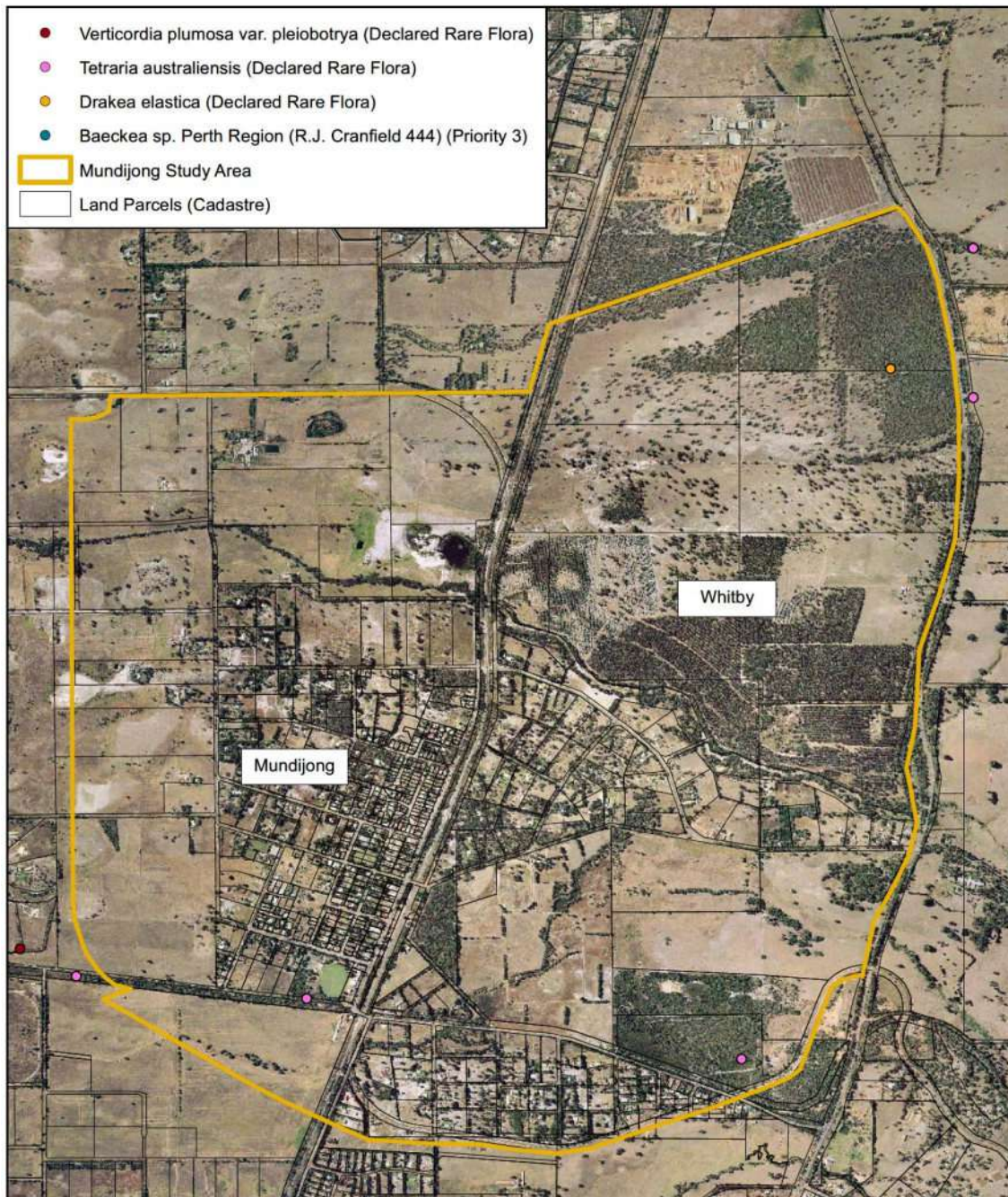
- The DSP area contains approximately 189ha of remnant native vegetation that belong to the Forrestfield and Guildford complexes.
- These complexes are considered to be significant as there is currently less than 10% of their original extent remaining on the Swan Coastal Plain.
- Bush Forever sites 350, 354, 360, 362 and 365 are located within the DSP area (Plates 14 and 15).
- SMEC (2009) identified three species of threatened Flora and one Priority Flora within the DSP area – these are located in the Mundijong Road Reserve and in Bush Forever sites 350 and 354 (Plate 12).
- DBCA mapped Threatened and Priority Flora are shown in Plate 13.
- Remnant vegetation includes five state listed Threatened Ecological Communities (TECs), two (marked with asterisk*) of which are also protected under the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act) (SMEC, 2009):
 - 2 Southern wet shrublands
 - 3a *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils*
 - 3b *Corymbia calophylla* – *E. marginata* woodlands on sandy clay soils
 - 3c *Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands*
 - 20b Eastern *Banksia attenuata* and/or *E. marginata* woodlands
- The majority of the remnant vegetation and all TECs in the DSP area are restricted to Bush Forever sites – particularly Sites 350, 354, 360 and 362. BF Site 350 contains 3 TECs, BF Site 354 contains 2 TECs. Plate 13 shows SMEC's (2009) TEC mapping, buffers and Bush Forever Sites.
- SMEC nominated 500m buffers to the area of TEC. The basis for this buffer is not known, however, it is Aurora Environmental's experience that a 50m buffer is generally applied. Further investigation of the basis for the SMEC buffers should be undertaken.
- Current DBCA mapping of TECs in the DSP area are shown in Plate 16.
- Table 9 lists the Commonwealth TECs identified in the Protected Matters Search Report as occurring within a 2km buffer of the site. At least two of these TECs appear to be in the DSP area.
- The Clay Plans of the Swan Coastal Plain TEC (listed as likely to occur within the area in Table 9) was not identified in the Environmental Study by SMEC (2009) as it was not listed federally as a TEC until 2012. The SMEC study did identify FCT 8 Herb rich shrublands in clay pans which is now listed as a TEC by the DBCA and forms part of the federally listed TEC.

MEMORANDUM

TABLE 9 : COMMONWEALTH THREATENED ECOLOGICAL COMMUNITIES WITHIN 2KM OF THE SITE

TEC	EPBC Act	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
<i>Corymbia calophylla</i> – <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain	Endangered	Identified in the DSP area in SMEC (2009)
<i>Corymbia calophylla</i> – <i>Xanthorrhoea preisii</i> woodlands and shrublands of the Swan Coastal Plain	Endangered	Identified in the DSP area in SMEC (2009)

PLATE 12: THREATENED AND PRIORITY FLORA (SMEC, 2009)



MEMORANDUM

PLATE 13: DBCA MAPPED THREATENED AND PRIORITY FLORA SPECIES (2019)

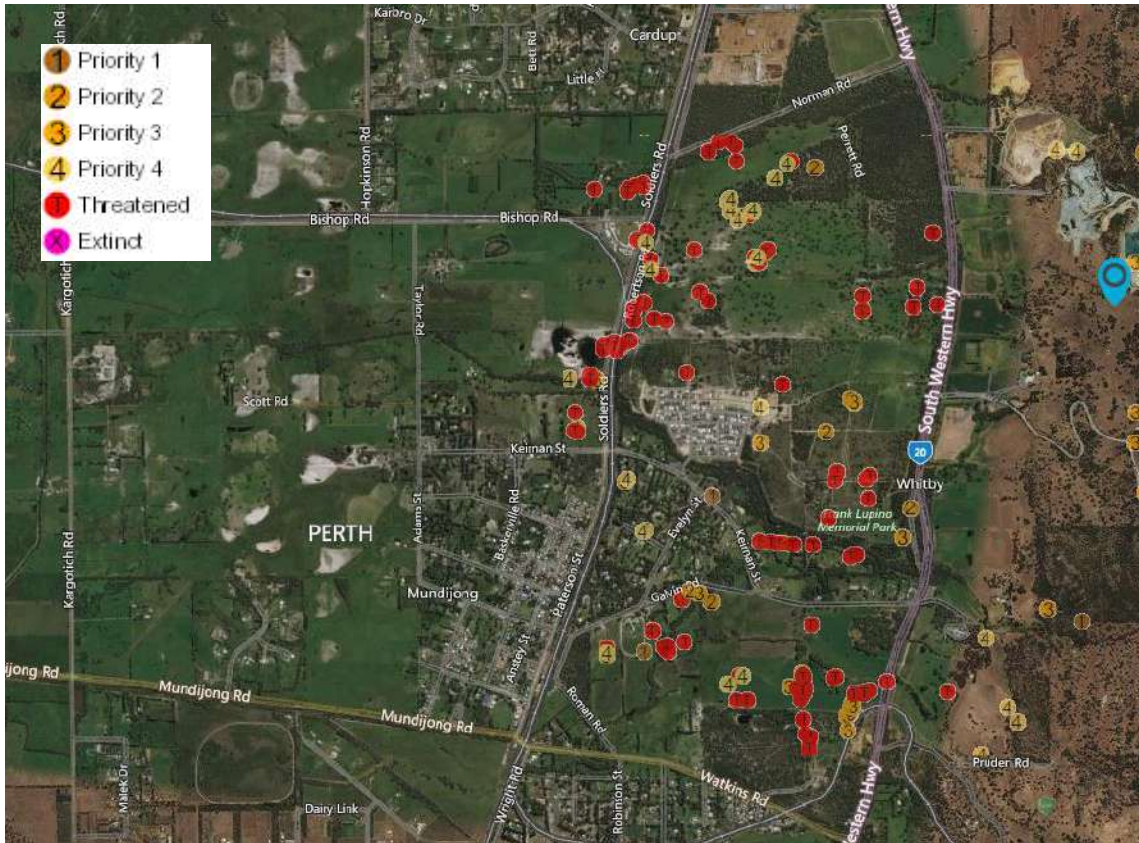
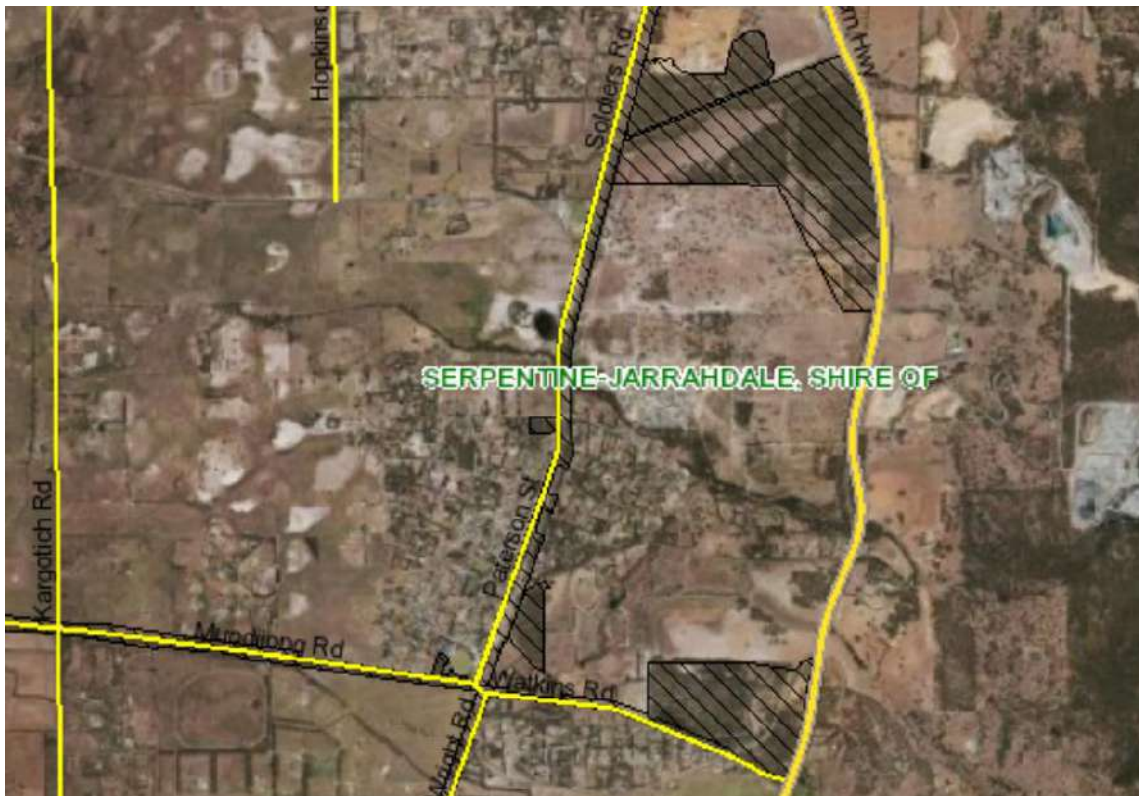
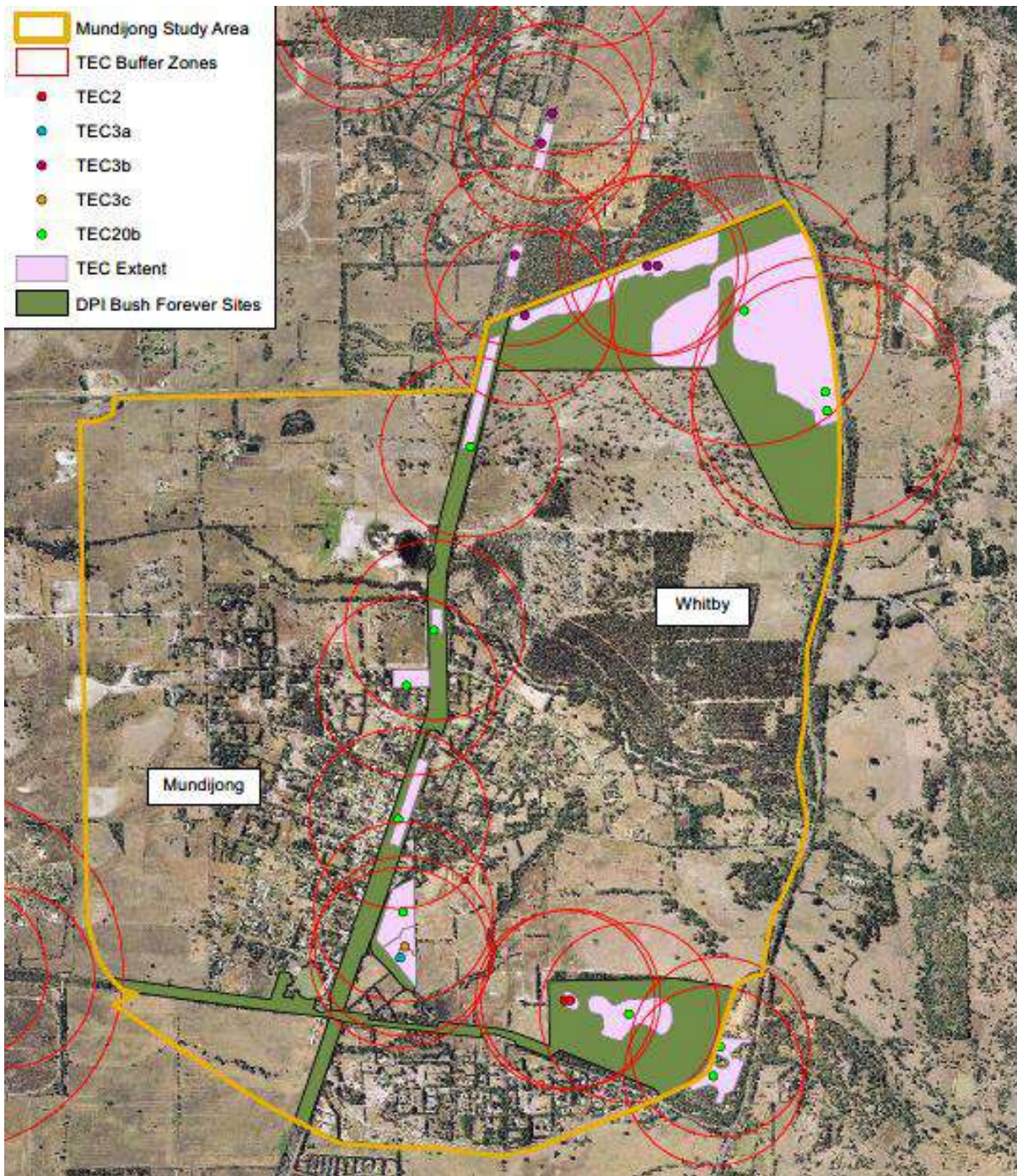


PLATE 14: BUSH FOREVER SITES (LANDGATE, 2019)



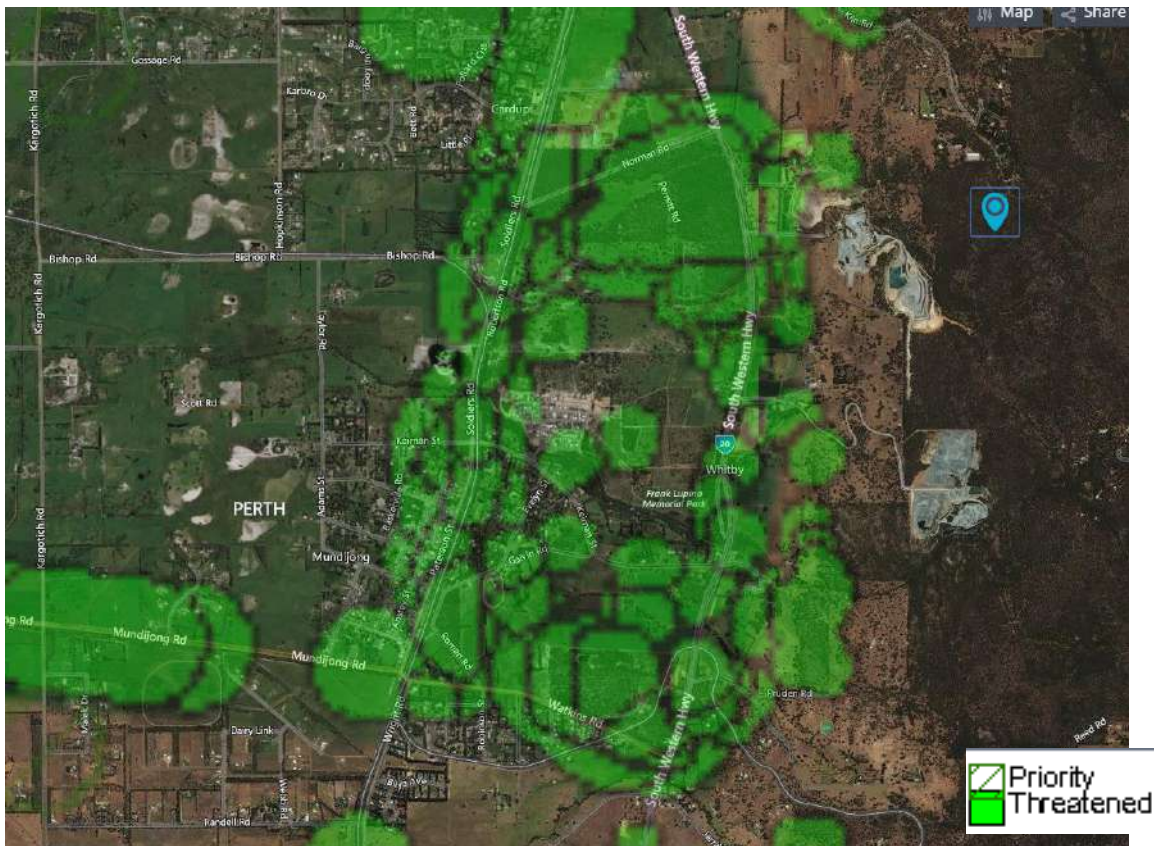
MEMORANDUM

PLATE 15: TECs, BUFFERS AND BUSH FOREVER SITES (SMEC, 2009)



MEMORANDUM

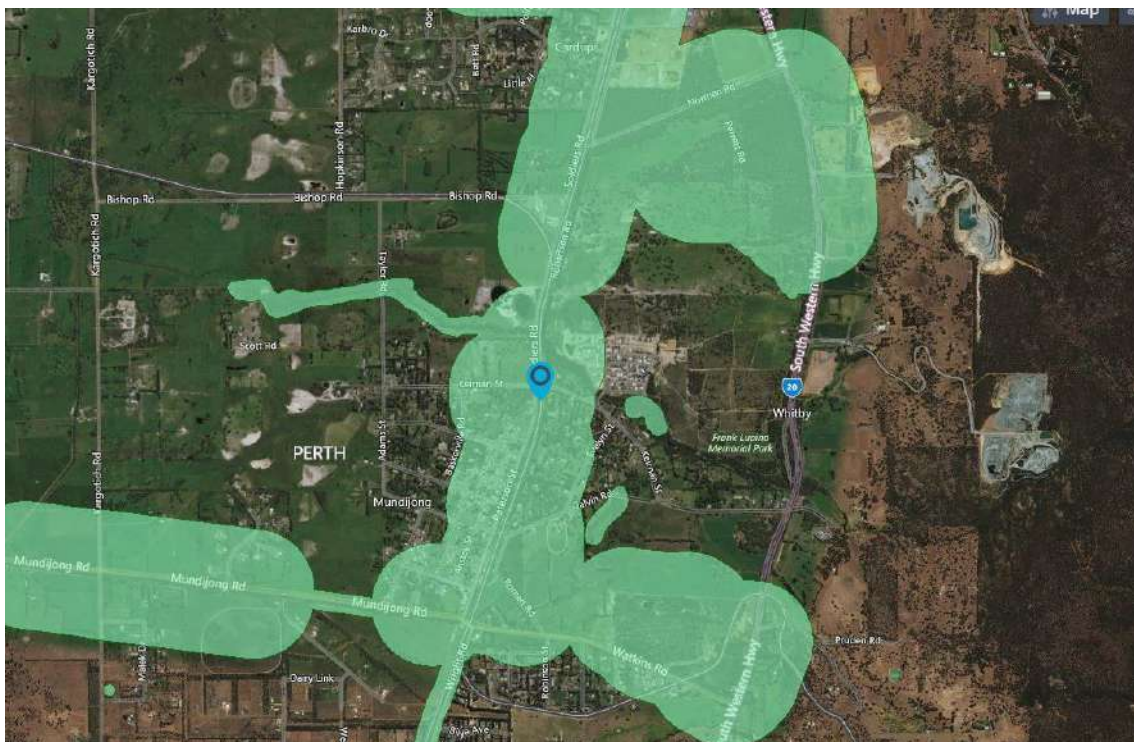
PLATE 16: STATE ENDORSED THREATENED ECOLOGICAL COMMUNITIES (DBCA, 2019)



ENVIRONMENTALLY SENSITIVE AREAS (ESA)

- ESAs within the DSP area are associated with threatened flora, CCWs and TECs (Plate 17).

PLATE 17: ENVIRONMENTALLY SENSITIVE AREAS



MEMORANDUM

EPA Advice for development in the Mundijong Area

EPA Advice on West Mundijong Industrial Precinct

The EPA is aware that the amendment area contains the Guildford vegetation complex which is mapped as having less than 10% remaining on the Swan Coastal Plain. This vegetation should be protected and included as an ecological linkage at the structure planning stage.

Recommendations

- Where native vegetation is to be cleared, detailed flora and vegetation surveys should be undertaken at the LSP stage to identify areas of significant flora and vegetation for retention.
- Buffers (generally 50 m) to areas of retained vegetation are likely. However, the basis for the 500m buffers specified by SMEC should be further investigated.
- Buffers will often be required to be revegetated if it is cleared or contains degraded vegetation.
- If development is planned near a TEC, ground truthing is required to confirm the TEC boundary.

FAUNA

- The most significant fauna habitat within the DSP area is associated with the Bush Forever Sites.
- Four native mammal and two introduced mammal species, six amphibians, 12 reptiles and 24 birds have been recorded at sites within the DSP area (SMEC, 2009).
- Carnaby’s Cockatoo are listed as Critically Endangered under the EPBC Act and are known to feed, breed and roost in the Mundijong area, however no DBCA confirmed Carnaby’s Cockatoo breeding areas or roost sites are mapped (in the available online databases) within the DSP area.
- Several roost sites are present to the south of the DSP area as identified during the 2018 Great Cocky Count (Bird Life Australia) and are shown on Plate 18.
- The DSP area is mapped as potential breeding habitat for Carnaby’s Cockatoo and potential feeding habitat is associated with the Bush Forever sites.
- There are also areas of potential Quenda habitat within the DSP area, shown on Plate 19. The Quenda is a Priority 4 fauna species.
- Plate 20 shows DBCA records of threatened and priority fauna species from the DSP area.

Table 10 lists the Commonwealth Threatened Species identified in the Protected Matters Search Report as species or species habitat known or likely to occur within 2km of the site.

TABLE 10 : COMMONWEALTH THREATENED FAUNA SPECIES

Species	EPBC Act	Type of Presence
Forest Red-tailed Black-Cockatoo	Vulnerable	Species or species habitat known to occur within area.
Baudin's Cockatoo	Endangered	Roosting known to occur within area.
Carnaby's Cockatoo	Endangered	Species or species habitat known to occur within area.
Malleefowl	Vulnerable	Considered unlikely given the fragmented and small size of patches of remnant vegetation.
Woylie	Endangered	Considered unlikely given the fragmented and small size of patches of remnant vegetation.
Chuditch	Vulnerable	Considered unlikely given the fragmented and small size of patches of remnant vegetation.
Quokka	Vulnerable	Considered unlikely given the fragmented and small size of patches of remnant vegetation.

MEMORANDUM

PLATE 18: COCKY COUNT ROOSTS (2018)

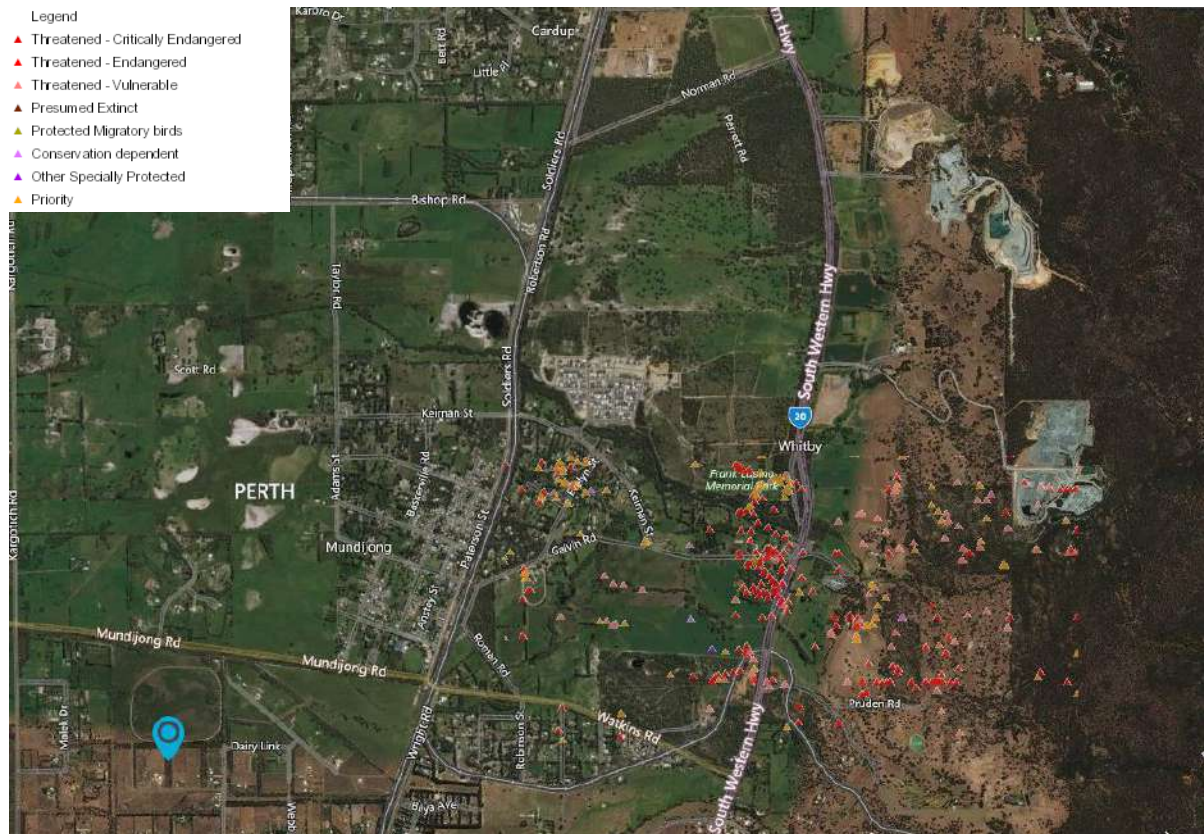


PLATE 19: POTENTIAL QUENDA HABITAT



MEMORANDUM

PLATE 20: THREATENED AND PRIORITY FAUNA SPECIES



Recommendations

- Where native vegetation is to be cleared, field investigations for Threatened Fauna should be undertaken in accordance with EPA *Guidance Statement No. 56 – Terrestrial fauna surveys for environmental impact assessment in Western Australia* (June 2004).
- Fauna Management Plans may be required when clearing areas of remnant vegetation.
- The requirement for an EPBC referral should be evaluated once potential clearing impacts are known.

BUSHFIRE RISK

- Plate 21 shows the majority of the DSP area (shaded pink) has been identified as bushfire prone by the Fire and Emergency Services Commissioner.
- Additional planning and building requirements may apply to new proposals within bush fire prone areas. A further assessment of bushfire risk may also be required.

MEMORANDUM

PLATE 21: BUSH FIRE PRONE AREAS (DFES, 2019)



Recommendations

- Bushfire Hazard Assessment and application of Bushfire Management Plans to address bushfire risk is required by SPP 3.7: Planning in Bushfire Prone Areas and the Guidelines for Planning in Bushfire Prone Areas.

ODOUR & NOISE

Plate 22 shows the potential odour and noise emitting land uses (and generic buffer distances) within and adjacent to the DSP area.

Those land uses that have been identified by SMEC (2009) as potentially impacting future development in the DSP area are listed in Table 11.

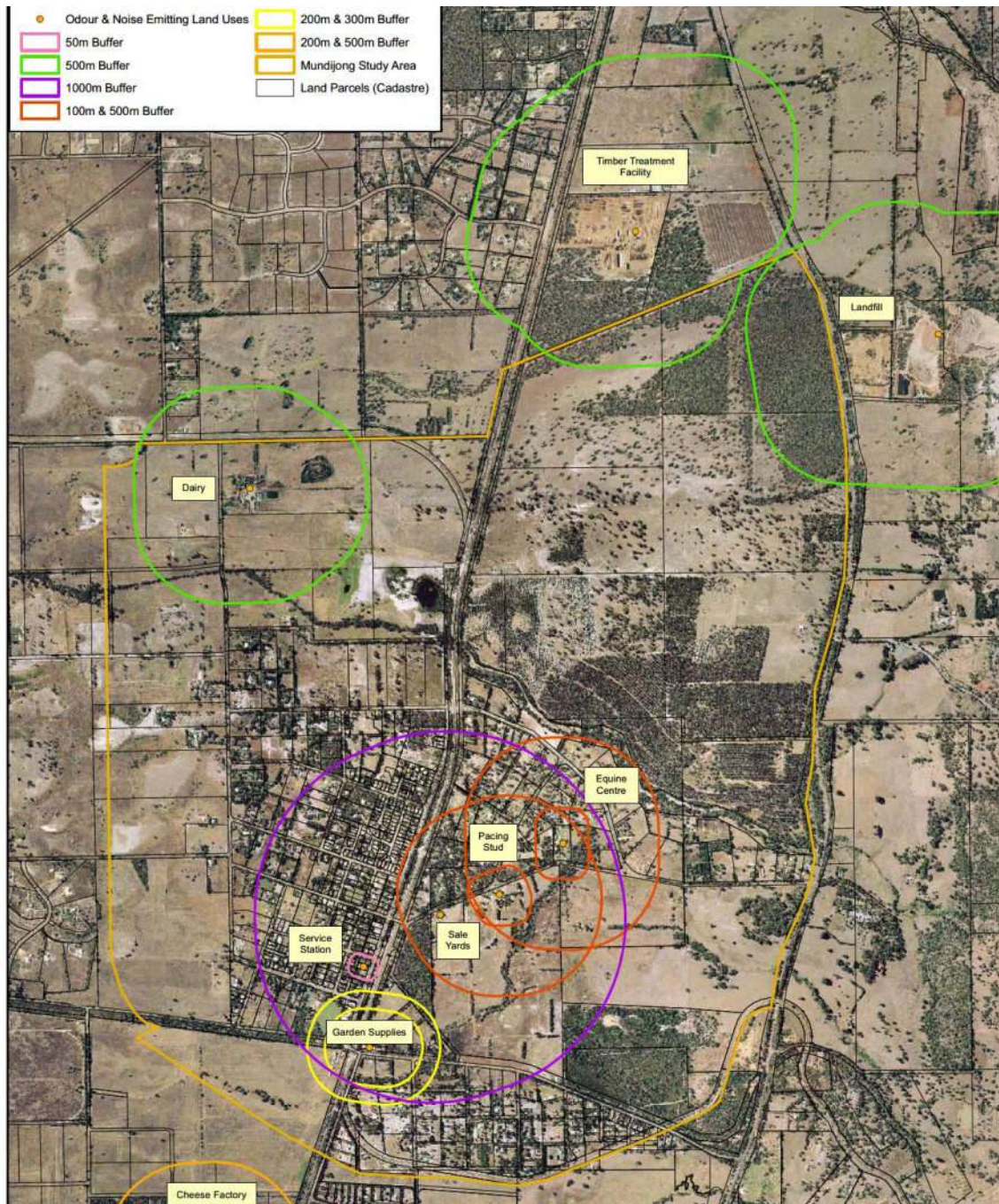
TABLE 11: NOISE AND/OR ODOUR EMITTING SITES

Site Use	Location	Impacts on the DSP area
Dairy	52 Taylor Road	Odour & noise - While this area has been rezoned as Urban Development, until the dairy is closed no odour sensitive properties should be constructed within the buffer zone.
Service Station	20 Paterson Street	Odour - There is presently only one property within the 50m buffer zone. No other properties should be constructed within this zone.
Sale Yards (Cattle, sheep etc)	Cnr Evelyn & Roman Roads	Odour & noise - As long as the sale yards remain in operation no odour sensitive properties should be constructed within the 1000m buffer zone.
Hedley Park Motocrosse	Cnr Shale Road and South Western Hwy	Noise - Any changes to the site's operating hours or the clearing of nearby vegetation may result in noise from this site becoming a significant issue.

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Garden Hire	Lot 410 Watkins Road	Odour and Noise - Depending on the types of chemicals stored on site there may be a restriction required on the development of sensitive properties within the 200m buffer zone.
Horse Stud & Training Track	Evelyn Road	Odour and Noise - As long as the stud remains in operation no odour sensitive properties should be constructed within the 100m buffer zone. New properties requiring the addition/inclusion of stables will need to submit a Land Management Plan to the Shire.
Horse Agistment Facility	Galvin Road	Odour and Noise - As long as the stud remains in operation no odour sensitive properties should be constructed within the 100m buffer zone. New properties requiring the addition/inclusion of stables will need to submit a Land Management Plan to the Shire.

PLATE 22: ODOUR AND NOISE EMITTING LAND USES



MEMORANDUM

Recommendations

- Confirm whether the land uses identified above remain in operation.
- Where the generic buffer distance is met and the proposed facility is designed for “best practice” emission control, then no further assessment of odour is required; and
- Where a proposal for a sensitive land use development is within the generic buffer zone of existing odour source a more detailed assessment of the level of management in place at the nearby source will be required.
- Noise issues associated with the South Western Highway and the north-south railway should be addresses at the Local Structure Planning Stage.
- Traffic noise impacts associated with new/upgraded road and rail infrastructure should be assessed.

ABORIGINAL HERITAGE

- A search of the Aboriginal Heritage Inquiry System (AHIS) reveals four registered sites along the western boundary of the search area (Plate 23). The details of these four sites are listed in Table 12. Registered sites have been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*.
- SMEC (2009) reported 12 Aboriginal heritage sites within the DSP study area however the current (June 2019) AHIS search results did not include 8 of those sites.

PLATE 23: ABORIGINAL HERITAGE INQUIRY SYSTEM SEARCH

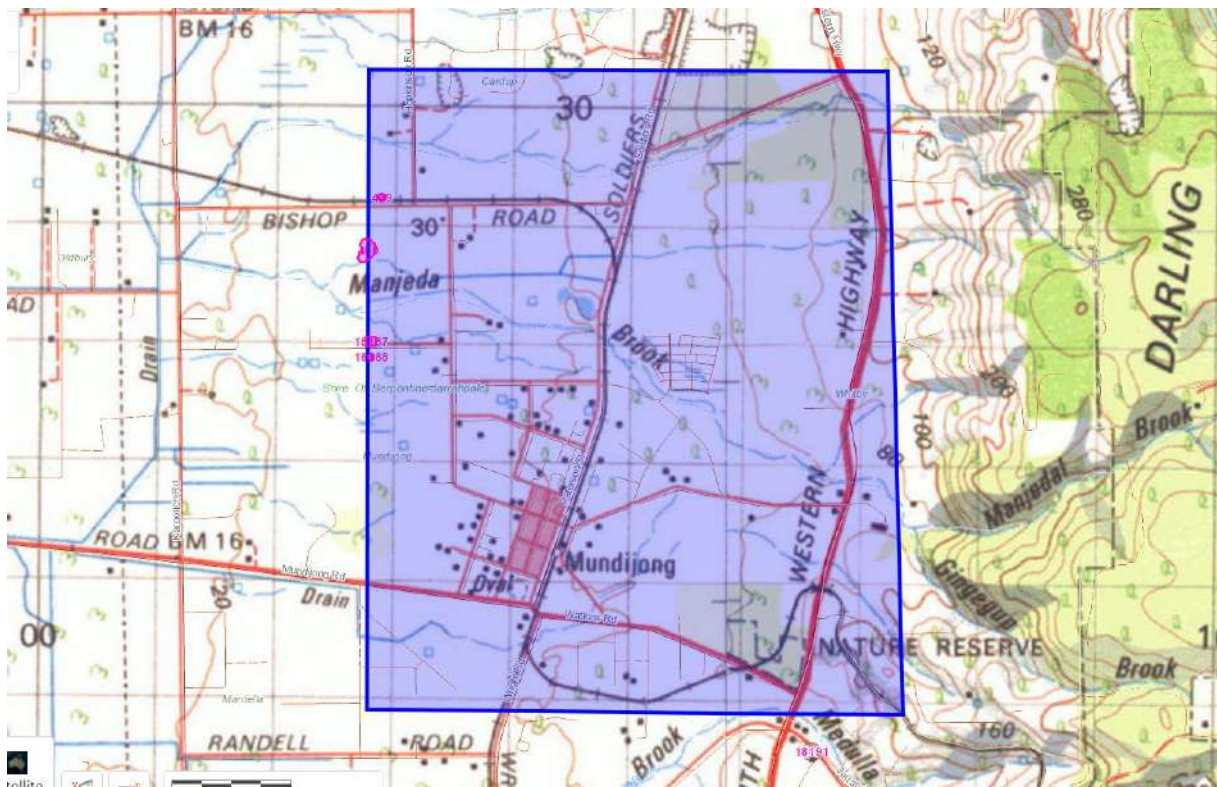


TABLE 12: REGISTERED ABORIGINAL SITES

SITE ID	SITE NAME	SITE TYPE
449	South-East Corridor 02	Artefacts / Scatter
450	South-East Corridor 03	Artefacts / Scatter
18187	Tonkin Highway – Mundijong Road Scatter #11	Artefacts / Scatter
18188	Tonkin Highway – Mundijong Road Scatter #12	Artefacts / Scatter

Recommendations

- Localised heritage factors should be avoided where possible. Where disturbance is not possible, a Section 18 clearance will be required.

REFERENCES

AHIS (2019) Aboriginal Heritage Enquiry System <https://maps.daa.wa.gov.au/AHIS/>

Australian Government (2019) National Map <https://nationalmap.gov.au/>

Cardno BSD (2007) Preliminary Acid Sulfate Soil Assessment for Lots 22 to 27, 29 and 45 South West Hwy and Lots 302 and 399 Reilly Road, Whitby.

DoW, Department of Water (2019) Perth Groundwater Map
<https://maps.water.wa.gov.au/#/webmap/gwm>

DoW, Department of Water (2015) Birrega and Oaklands flood modelling and drainage study.

Landgate (2019) Map Viewer Plus <https://maps.landgate.wa.gov.au/maps-landgate/registered/>

SMEC (2009) Environmental Study for the Mundijong/Whitby District Structure Plan.

DISCLAIMER

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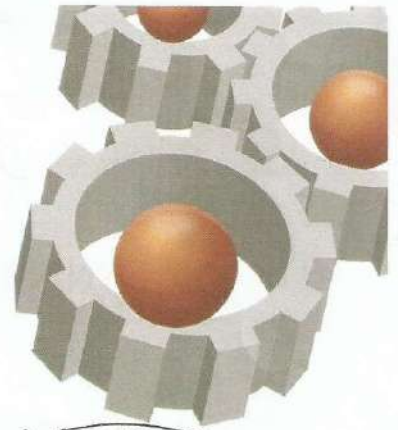
An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed and signed off by senior members of the consultancy team prior to issue to the client.

APPENDIX 8

Subject Site Land Owners Letters of Support



DYNAMIC PLANNING
AND DEVELOPMENTS



Name: Joan Willis
~~Patricia Cabassi~~ & Patricia Cabassi ~~Patassi~~

Property Address: 365 Leibold Rd, Oldbury WA 6121

Support or Object to the Amendment: Support.

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 19/10/18.**

Contact Details

Phone: 9275-4433

Email: admin@dynamicplanning.net.au

Yours faithfully,

Neil Teo - Director

| Suite 15/29 Collier Road Morley WA 6062 | P.O. Box 688 Inglewood WA 6932 | (08) 9275 4433 | (08) 9275 4455

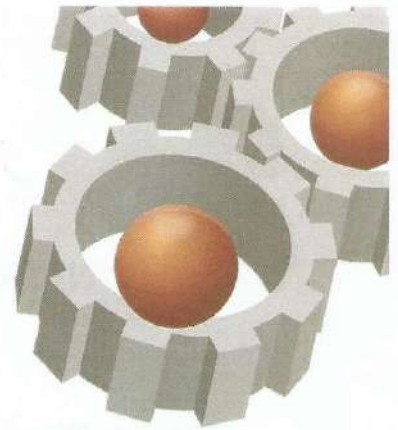
DYNAMIC CREATIVE PROACTIVE INNOVATIVE PASSIONATE

admin@dynamicplanning.net.au

www.dynamicplanning.net.au



DYNAMIC PLANNING
AND DEVELOPMENTS



Cabassi

Name: Michael & Patricia Cabassi

Property Address: 389 Leipold Rd, Oldbury WA 6121

Support or Object to the Amendment: Support.

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 19/10/18.**

Contact Details

Phone: 9275-4433

Email: admin@dynamicplanning.net.au

Yours faithfully,

Neil Teo - Director

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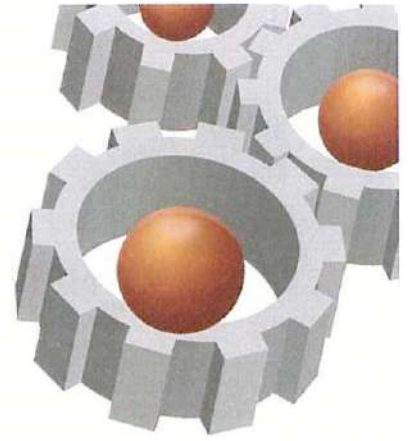
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admin@dynamicplanning.net.au

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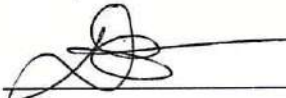


DYNAMIC PLANNING
AND DEVELOPMENTS



Name: Eric Dianne Bronowithi

Property Address: 447 Leopold RD ChDBury

Support of Objecting to the Amendment: 

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 19/10/18.**

Contact Details

Phone: 9275-4433

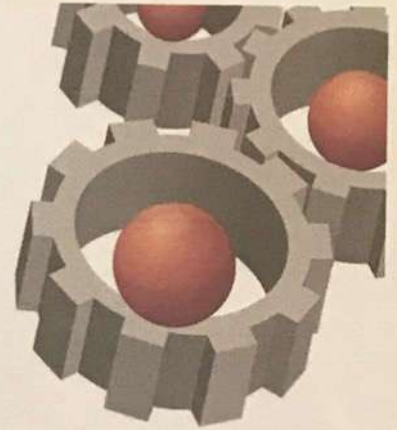
Email: admin@dynamicplanning.net.au

Yours faithfully,

Neil Teo - Director



DYNAMIC PLANNING
AND DEVELOPMENTS



Name: WOUTER GERRITS

Property Address: 457 LEIPOLD RD, OLOBURY

Support or Object to the Amendment: SUPPORT

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 10/04/19.**

Contact Details

Phone: 9275-4433

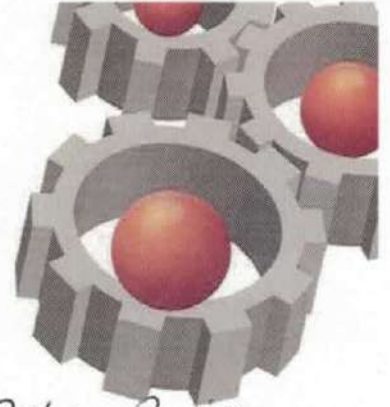
Email: admin@dynamicplanning.net.au

Yours faithfully,

Neil Teo - Director



DYNAMIC PLANNING
AND DEVELOPMENTS



Name: GP Treuco Nominees Pty Ltd - Peter Panizza

Property Address: Lot 2, 467 Leipold Road, Oldbury

Support or Object to the Amendment: SUPPORT

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 19/10/18.**

Contact Details

Phone: 9275-4433

Email: admin@dynamicplanning.net.au

Yours faithfully,

Neil Teo - Director

| Suite 15/29 Collier Road Morley WA 6062 | P.O. Box 688 Inglewood WA 6932 | (08) 9275 4433 | (08) 9275 4455

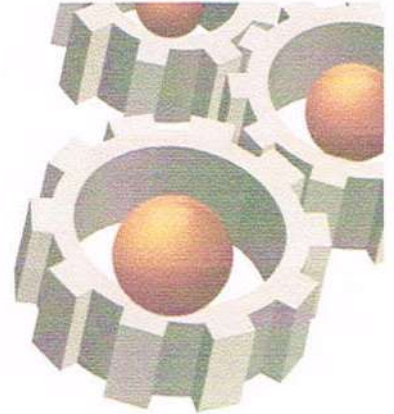
DYNAMIC CREATIVE PROACTIVE INNOVATIVE PASSIONATE

admin@dynamicplanning.net.au

www.dynamicplanning.net.au



DYNAMIC PLANNING
AND DEVELOPMENTS



Name: BDJ 234 Pty Ltd.

Property Address: 729 King Road ~~1111~~ Oldbury

Support or Object to the Amendment: Support.

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 19/10/18.**

Contact Details

Phone: 9275-4433

Email: admin@dynamicplanning.net.au

Yours faithfully,

Neil Teo - Director

Shanne Mondy
(Director)

| Suite 15/29 Collier Road Morley WA 6062 | P.O. Box 688 Inglewood WA 6932 | (08) 9275 4433 f (08) 9275 4455

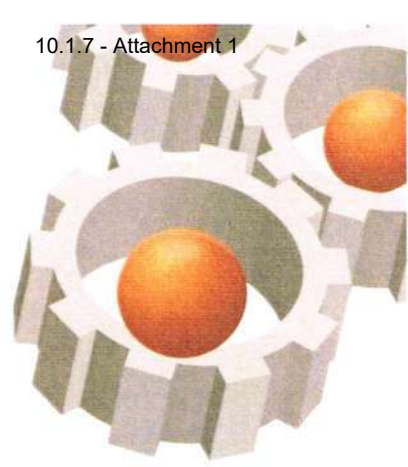
DYNAMIC CREATIVE PROACTIVE INNOVATIVE PASSIONATE

admin@dynamicplanning.net.au

www.dynamicplanning.net.au



DYNAMIC PLANNING
AND DEVELOPMENTS



Name: VERLON COCKEN

Property Address: 1077 MANDREIDGE RD OLDBURY

Support or Object to the Amendment: SUPPORT N J BOCKELL

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 23/10/18.**

Contact Details

Phone: 9275-4433

Email: admin@dynamicplanning.net.au

Yours faithfully,

Neil Teo - Director



DYNAMIC PLANNING
AND DEVELOPMENTS



Name: GRAHAM FORWARD, AUTHORIZED DIRECTOR

Property Address: 725, 726, 727 MUNOIJONG RD., OLDHAM.

Support or Object to the Amendment: SUPPORT.

As noted in our previous letter, we would be happy to discuss the proposed amendment with any concerned landowners prior to the completion of the above form if desired. **We also ask that any submissions regarding the proposed amendment are received by the 19/10/18.**

Contact Details

Phone: 9275-4433

Email: admin@dynamicplanning.net.au

G. Forward
16.10.18

Yours faithfully,

Neil Teo - Director

9 May 2019

Watson Property Group
c/- Dynamic Planning and Developments
PO Box 688
INGLEWOOD WA 6932

Dear Sir/Madam,

OLDBURY METROPOLITAN REGION SCHEME AMENDMENT

I am the registered proprietor of Lots 51 and 56 Kargotich Road and Lots 53 and 54 Gangemi Road, Oldbury.

Further to your correspondence, I confirm I support the rezoning of the land bounded by Kargotich Road, Mundijong Road, King Road and Leipold Road, Oldbury from Rural to Urban under the Metropolitan Region Scheme.

My intention is to develop my landholdings for light industry and service commercial land uses which are compatible with the general industrial land uses proposed in the adjoining West Mundijong Industrial Area. In this respect, I would support the extension of the West Mundijong District Structure Plan to include my landholdings.

Kind regards,

Nino Gangemi

**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 3.2

LK Advisory's Submission – Draft Mundijong District Structure Plan and Draft Mundijong Urban Development Contribution Plan (20 August 2020)



L K A D V I S O R Y

Urban & Regional Planning | Strategy | Policy | Governance | Performance

Your Ref: 530

20 August 2020

Mr Neil Teo
Director
Dynamic Planning and Developments Pty Ltd
PO Box 688
INGLEWOOD WA 6932

By email: neil.teo@dynamicplanning.net.au

Dear Neil,

Review of Draft Mundijong District Structure Plan & Draft Mundijong Urban Development Contribution Plan (Amendment No. 209 to Shire of Serpentine Jarrahdale Town Planning Scheme No. 2)

LK Advisory has been engaged by WPG Landholdings Pty Ltd (WPG) to independently review the:

- Draft Mundijong District Structure Plan (DSP) (Shire of Serpentine Jarrahdale Ref: PA18/779); and
- Draft Mundijong Urban Development Contribution Plan (DCP) associated with Amendment No. 209 to the Shire's Town Planning Scheme No. 2 (Shire Ref: PA18/780).

The purpose of our review has been to determine the value and impact of extending the Draft DSP and DCP to incorporate the land bounded by Mundijong, King, Leipold and Kargotich Roads, Oldbury, which was the subject of your submission (dated 6 December 2019) on the Shire's Draft Local Planning Strategy (LPS) and Local Planning Scheme No. 3 (LPS 3). For ease of reference, this area is later described in this advice as the proposed West Mundijong Urban Precinct (WMUP).

We acknowledge and accept that this advice will inform or accompany a submission to the Shire on the Draft Mundijong DSP and DCP, on behalf of WPG.

Our opinions and advice on the Draft Mundijong DSP and DCP are set out below for your and the Shire's consideration:

1. Draft Mundijong DSP (Shire Ref: PA18/779)

1.1 The Draft Mundijong DSP has a lengthy and complicated history, which can best be illustrated by the following timeline of events:

- 2011 – WAPC approval of the Mundijong Whitby DSP, comprising the urban portion of the new Draft Mundijong DSP (i.e. east of the West Mundijong Industrial Area).
- 2013 – Draft West Mundijong Industrial Area DSP adopted for advertising by Council (March). This structure plan has remained in draft form and has never been finally adopted.
- 2017 – MRS Amendment gazetted to rezone the West Mundijong Industrial Area.
- 2018 – Town Planning Scheme Amendment and DCP gazetted for the West Mundijong Industrial Area ('DCA 2') (February).
- 2018 – Council (in May) endorsed for advertising the Draft Mundijong Local Development Strategy for the entire Mundijong locality. The Local Development Strategy comprised a Draft Mundijong DSP incorporating the 2011 Mundijong Whitby DSP and the 2013 Draft West Mundijong Industrial Area DSP, together with more detailed Concept and Precinct Plans.

2018 – Council (on 17 December) adopted for advertising a revised Draft Mundijong DSP, Amendment No. 209 to Town Planning Scheme No. 2 (TPS 2) and the associated Draft Mundijong Urban and West Mundijong Industrial Area Development Contribution Plans. This is the Council decision which has been acted upon to initiate the recent advertising of the Draft Mundijong DSP, Scheme Amendment No. 209, and the related Urban and Industrial DCPs.

- 1.2 In its recent advertising material regarding the Draft Mundijong DSP, the Shire states that:
- a. Provision 1 of Development Area 1 and Provision 1 of Development Area 2 of the Shire's TPS 2 require a single DSP to be adopted to guide subdivision and development for the whole of Development Areas 1 and 2.
 - b. The Draft DSP is not being prepared or determined under the 'deemed provisions' of the Scheme. Rather, it is being considered in accordance with the specific Development Area provisions of TPS 2.
 - c. The Draft DSP is an informing, relevant and strategic document to guide the exercise of discretion for Structure Plans and Local Development Plans which fall under the auspices of the 'deemed provisions' of the Scheme.

On the first point above, while it is true that Provision 1 of Development Areas 1 and 2 requires a single DSP to be prepared covering both areas, Provision 4 of Development Area 1 (Mundijong) also requires a structure plan for the area to comply with Part 4, Regulation 16 of the 'deemed provisions'.

Regarding point b. above, it is unclear why the Shire would state the Draft DSP is not being prepared or determined under the 'deemed provisions' because – firstly, the Draft DSP was instigated by and is now being advertised in accordance with Council's December 2018 resolution (OCM148/12/18), which explicitly refers to:

- Schedule 2, Part 4, Clause 17 of the *Planning and Development (Local Planning Schemes) Regulations 2015* (the 'deemed provisions');
- The Draft DSP's compliance with clause 16(1) of the 'deemed provisions'; and
- Advertising of the Draft DSP in accordance with clause 18 of the 'deemed provisions'.

It is clear from Council's enabling resolution that the Draft DSP was indeed intended to be prepared and determined under the 'deemed provisions'. Therefore, if the Shire is relying on that 17 December 2018 resolution as the basis for advertising the Draft DSP then it can only do so in accordance with the 'deemed provisions', because that is precisely what Council's resolution required.

If the Shire no longer intends to prepare or determine the Draft DSP in accordance with the 'deemed provisions' then it could only do so under a new Council resolution that does not reference or require compliance with the 'deemed provisions'. From a governance and compliance viewpoint, doing so may void the current DSP advertising process, thus requiring the DSP to be advertised *de novo*.

In relation to point c. above, the Draft DSP will itself need to fall under the auspices of the 'deemed provisions' if it is being advertised and determined in accordance with Council's resolution from 17 December 2018.

- 1.3 Section 3.2.1 of the Draft Mundijong DSP identifies an estimated yield of 17,592 dwellings for Residential Precincts A – G. By contrast, the Draft Mundijong 'Traditional Infrastructure' DCP (incorporated in Amendment No. 209 to TPS 2) forecasts a lesser yield of (only) 16,746 dwellings for Precincts A – G; while the Draft 'Community Infrastructure' DCP (incorporated in Amendment No. 207 to TPS 2) forecasts an even lower yield again of 16,382 dwellings for those precincts.

The estimated residential population resulting from these three different forecast dwelling yields is 50,840; 48,395; and 47,343, respectively, based on the Draft DSP's residential occupancy rate of 2.89 persons per household.

Estimated dwelling yield and population forecasts for the areas designated in the Draft DSP as Rural Small Holdings and Development Investigation Areas (DIAs) 2 and 3 have deliberately not been included in the above figures, as the dwelling and population yields for both are either nominal (for

the Rural Small Holdings) or premature to reliably calculate (in the case of DIAs 2 and 3) in the absence of any detailed planning.

- 1.4 The dwelling yield inconsistencies described in 1.3 above are magnified when compared against the detailed constraints assessment contained in your submission on the Shire's Draft LPS and LPS 3. That assessment concluded that Precincts A – G would (only) yield around 13,056 dwellings with a resultant population of 37,731 persons – approximately 4,536 fewer lots and 13,109 fewer residents than stated in the Draft DSP.
- 1.5 It is critical that the Shire reconciles the variance in estimated dwelling yields described in 1.3 and 1.4 above, as inconsistent or inaccurate dwelling yield estimates between the Draft Mundijong DSP, Draft 'Traditional Infrastructure' DCP and Draft 'Community Infrastructure' DCP will distort the district population forecasts, DCP contribution amounts, DCP cost apportionment and DCP income calculations.
- 1.6 If the proposed WMUP were incorporated in the Draft DSP as Precinct M, in accordance with your submission on the Shire's Draft LPS and LPS 3, then it would add capacity for up to 6,500 additional dwellings and 18,784 residents.
- 1.7 The planning arguments in support of Precinct M were comprehensively addressed in your LPS/LPS 3 submission and therefore do not need to be repeated in this advice. However, in the context of the Draft DSP and the related 'Traditional Infrastructure' and 'Community Infrastructure' DCPs, it is worth noting the following benefits of including Precinct M as a residential expansion area in the Draft DSP:
 - a. The addition of Precinct M would assist in resolving the identified dwelling yield inconsistencies;
 - b. The addition of Precinct M would address any anticipated dwelling or population shortfalls inherent in the current Draft DSP and DCPs;
 - c. Based on the comprehensive assessment included in your previous submission to the Shire, Precinct M is more developable, serviceable, accessible, coordinated, commercially viable, and less constrained than other DSP areas proposed for urbanisation.
 - d. Precinct M would provide a much-needed contingency to achieve urbanisation of the greater Mundijong area if development within Precincts A – G does not proceed or does not proceed at the rate or density envisaged by the DSP or DCPs. In our opinion and experience, this is a very real possibility, given the:
 - Multiple, disparate land ownership throughout the Precincts where most of the urban development is proposed.
 - The absence of any Local Structure Planning for Precincts B, C, D, part E, F and G, which comprise approximately 60% of the total land area of Precincts A – G and approximately 70% of the anticipated dwelling yield.
 - The immense challenges, costs, time delays and complications associated with preparing and adopting Local Structure Plans for most of the DSP's proposed urban area. The only way this could practically be achieved is through pre-funding by the Shire and recovery of costs via local, Precinct-level DCPs, in addition to the district and Shire-wide DCPs. This added cost burden would impose a further barrier to development of that land, which in turn could jeopardise the urban structure upon which the entire DSP is premised; and
 - Substantial environmental, servicing and infrastructure constraints affecting much of the existing DSP area.
- 1.8 We note the WMUP shares the same Rural zoning under the Metropolitan Region Scheme and the Shire's TPS 2 as DIAs 2 and 3. On this basis, as an interim and alternative approach to including the WMUP in the Draft DSP as a new residential Precinct M, the land could instead be designated as a new DIA 4 under the Draft DSP. This would provide WPG with an opportunity and incentive to carry out more detailed planning to prove-up the development potential of that area, without prejudicing the zoning or land use outcomes that could arise from that work. In our view, this represents an appropriate and balanced way forward for the Draft DSP.

2. Draft Mundijong Urban DCP & Amendment No. 209 to TPS 2 (Shire Ref: PA18/780)

- 2.1 The Draft Mundijong Urban DCP proposed by Amendment No. 209 to TPS 2 is a 'Traditional Infrastructure' DCP with a 20-year operating life. This DCP must be read in conjunction with the 'Community Infrastructure' DCP proposed by Amendment No. 207 to TPS 2, which Council adopted for final approval at its meeting on 18 May 2020 (OCM110/05/20). The combination of shared costs from both DCPs represents the true impact of development contributions on land within the Mundijong Draft DSP.
- 2.2 The 'Traditional Infrastructure' DCP proposed by Amendment No. 209 identifies \$218.65 million worth of infrastructure costs to be shared among Precincts A – G of the Draft DSP, equating to a development contribution rate of \$13,057 per lot (or dwelling), based on a total yield of 16,746 lots/dwellings.
- 2.3 The 'Community Infrastructure' DCP proposed by Amendment No. 207 identifies \$120 million worth of community infrastructure costs to be delivered over a 30-year operating period. These community infrastructure costs are proposed to be apportioned as follows – approximately 56.4% (\$67.47 million) is to be funded from development within the Draft Mundijong DSP; 24.8% is to be funded from development within the Draft Byford DSP; 16.7% is to be funded by the Shire; with the balance 2.1% to be funded by development across the remainder of the Shire.
- 2.4 Therefore, the combined value of infrastructure to be funded from the Draft Mundijong DSP (and almost exclusively from Precincts A – G) under both DCPs is \$286.12 million.
- 2.5 At its May 2020 meeting, Council resolved to remove (to pursue as a separate Scheme Amendment) infrastructure items M03 (Kiernan Park Recreation Centre Extension) and S02 (Kiernan Park Outdoor Aquatic Centre (Stage 6)) from the Draft 'Community Infrastructure' DCP, which have a combined total cost of \$29.37 million. According to the Officer Report to Council, this resulted in the contribution rate for land within the Draft Mundijong DSP dropping from \$5,200 per lot (dwelling) to \$3,450 per lot (dwelling). However, this is only considered to be a temporary reduction, given the stated intent to still include these items in the 'Community Infrastructure' DCP via a subsequent Scheme Amendment.
- 2.6 As a consequence of the above, the development contribution rate applicable for land within Precincts A – G of the Draft Mundijong DSP is expected to range from \$16,507 per lot (dwelling) to \$18,257 per lot, depending on the future inclusion, cost and apportionment of community infrastructure items M03 and S02. This has the potential to adversely affect the commercial viability of development within the DSP area, as the proposed contribution rate is likely to represent around 10% of the estimated average sale price for lots created in the Draft DSP area, based on a prevailing average lot price of approximately \$185,000 for a 450m² lot in Whitby.

Furthermore, this contribution rate is presented in static terms, and does not account for any:

- cost escalation
- reduction in the value of money over time
- delays in the progress of development and payment of contributions
- risk of lot yields not being achieved within the life of the DCP

- 2.7 From our assessment and experience, we have identified the following critical issues in the two DCPs relating to the Draft Mundijong DSP –

- a. Neither the 'Traditional Infrastructure' DCP Report nor the text to be inserted as Development Contribution Area 10C in Appendix 10 of TPS 2 (pursuant to Amendment No. 209) specify the timing or priority of infrastructure items, other than identifying (in Section 4.1 of the DCP Report) the Town Centre Distributor and Grade Separation as the sole priority infrastructure item.

Stipulation of infrastructure timing and priority is a mandatory essential requirement of *Draft State Planning Policy No. 3.6 (SPP 3.6) – Infrastructure Contributions* and is needed to provide certainty and confidence to developers and future residents alike that the infrastructure items which contributions are being collected for will actually be delivered in a predictable order and timing committed to by Council.

- b. As stated in 1.3 earlier in this advice, there are inconsistencies between the dwelling yield and population forecasts stated in the Draft Mundijong DSP (17,592 dwellings), Draft Mundijong 'Traditional Infrastructure' DCP (16,746 dwellings), and Draft 'Community Infrastructure' DCP (16,382 dwellings). Based on a development contribution rate of \$16,507 per lot (dwelling) this equates to varying development contribution incomes of \$290.39 million, \$276.42 million, and \$270.41 million, respectively.

This is significant considering the combined value of infrastructure to be funded from the Draft Mundijong DSP (almost entirely from Precincts A – G) is \$286.12 million. Hence, the yield forecast of 16,746 dwellings contained in the Draft Mundijong 'Traditional Infrastructure' DCP is likely to result in a substantial \$10 million funding shortfall. This shortfall increases to more than \$15 million if the estimated yield from the Draft 'Community Infrastructure' DCP is applied.

However, the future DCP funding shortfall becomes even more severe if the revised yield calculation (of 13,056 dwellings) included in your submission on the Shire's Draft LPS and LPS 3 is applied, resulting in a colossal \$70 million funding deficit.

- c. The Draft Mundijong 'Traditional Infrastructure' DCP does not include any income or expenditure projections to demonstrate infrastructure project funding or cashflow. As a result, the DCP assumes that all required infrastructure items will be delivered within the DCP's 20-year lifespan. To do so, any one or more of the following scenarios would need to occur –

Scenario 1: The Shire would need to pre-fund most of the infrastructure at an enormous expense.

Scenario 2: Some infrastructure items would need to be removed from the 20-year operating period of the DCP for funding and delivery in a separate, subsequent DCP.

Scenario 3: All development contributions would need to be collected within the 20-year operating period.

For Scenario 3 to occur, the DCP's forecast yield of 16,746 lots would need to be delivered at an average rate of 837 lots per annum for the next 20 years. This is rather unrealistic when considering the pattern and pace of historical development in the Shire, as outlined below.

In reviewing the Shire's Annual Budgets and Financial Reports from 2014/15 to 2019/20, we note that the total number of rateable properties in all Residential GRV categories (Improved, Vacant and Minimum) across the whole Shire increased from 5,591 (year ended 30 June 2015) to 8,303 (year ended 30 June 2020) – an additional 2,712 properties, equating to an average annual increase of 542 rateable residential properties per annum. Hence, to match the DCP's ambitious average annual development rate, the production of residential lots within the Draft Mundijong DSP alone would need to be some 55% greater than the average annual residential lot production across the whole Shire for the past five years – and this would need to be sustained over the next 20 consecutive years.

To overcome this growth rate challenge, several important and interdependent issues must be resolved, as follows:

- The District and Neighbourhood Centres proposed in the Draft DSP need to be physically created and visible to new buyers, as the amenities are essential attractors for buyers in a competitive local and district property market.
- Comprehensive local structure planning will need to be completed for most of the Draft DSP area, before subdivision or development can occur and before any contribution will be paid from those areas.
- The inherent challenges posed by multiple and uncoordinated land ownership throughout most of the Draft DCP area will need to be overcome, as history and experience have

demonstrated that little or no development will occur in those areas until and unless those challenges are successfully resolved;

- There must be early and coordinated delivery of critical district-level infrastructure as a stimulus for accelerated supply of residential lots/dwellings in the greater Mundijong area;
- There must be a marked increase in demand for the residential product mix proposed by the Draft DSP/DCP and it must be commercially feasible for the development sector to supply new product to meet or exceed that demand;
- Additional developable land must be made available in the greater Mundijong area to compensate for the reduction in dwelling yield forecast in your LPS/LPS3 submission;
- The overall land base from which contributions are collected must increase to improve the feasibility of delivering on the infrastructure aspirations contained in the two aforementioned DCPs;
- The additional contributing land referred to in the preceding point must be sufficiently large, de-constrained, accessible and appealing to the market, to encourage new development early in the DCPs life. This in turn will generate payment of requisite development contributions which can then be directed to the early delivery of critical district-level infrastructure.

In our opinion, inclusion of the proposed WMUP in the Draft DSP and DCPs would significantly contribute to resolving the above issues, for the reasons already covered in this advice and outlined in your earlier submission on the Shire's Draft LPS/LPS3.

- d. Appendix 4 of the Draft 'Community Infrastructure' DCP Report identifies the following expected population growth within the Mundijong DCP area (referred to as DCA 4 in Amendment No. 207 to TPS 2):

Table 1 – Expected Population Growth in the Mundijong DCP Area

2016	2021	2026	2031	2036	2041	2046	2051
1,979	3,680	6,398	12,380	20,961	28,007	37,421	50,000

Based on the Draft Mundijong DSP's residential occupancy rate of 2.89 persons per household, this translates to the following lot/dwelling projections for the Draft DSP area:

Table 2 – Expected Lot/Dwelling Growth in the Mundijong DCP Area

2016	2021	2026	2031	2036	2041	2046	2051
684	1,273	2,213	4,283	7,252	9,691	12,948	17,301
Increase from previous period	589	940	2,070	2,969	2,439	3,257	4,353

This clearly illustrates that full build-out of the Draft Mundijong DSP area is not likely to occur until 2051. Despite this, the Draft 'Traditional Infrastructure' DCP would expire around 2041, assuming the DCP is gazetted in 2021.

- 2.8 If the proposed WMUP were incorporated in the Draft DSP as either Precinct M or DIA 4 then the 6,500 additional lots proposed in that Precinct could (subject to passing all relevant need and nexus tests and in accordance with Draft SPP 3.6) contribute a notional \$2,500/lot for local infrastructure or up to \$3,500/lot where district infrastructure is also involved. This would generate additional development contribution income ranging from \$16.25 million to \$22.75 million, thereby increasing the funding pool for delivery of traditional and community infrastructure items, whilst reducing the development contribution rate for all properties in the DSP.

- 2.9 The absence of a detailed timing and priority schedule for traditional (in particular) and community infrastructure items under the Draft Mundijong DCPs will invariably give rise to the same paradox afflicting most DCPs of this size, scale and 20+ year time horizon, whereby new lots first need to be created to generate development contributions that will eventually fund the new infrastructure, but the new infrastructure first needs to be delivered to incentivise and cater for the subsequent creation of new lots.

Adding the proposed WMUP to the Draft Mundijong DSP area will assist in resolving this dilemma, as your LPS/LPS 3 submission revealed the area is comparatively less constrained and easier to develop than much of the land contained in Precincts A – G. Therefore, the WMUP could serve as an important source of both development contributions and rate revenue to assist in managing pre-funded infrastructure items and DCP cashflow.

- 2.10 While it is acknowledged that future rates income is not a determining factor in planning decisions, it deserves to be noted that –
- a. The Minimum Residential GRV rate adopted by Council in its 2020/21 Budget is \$1,276 per rateable property, while the average Residential GRV rate equates to \$1,764 per rateable property.
 - b. The estimated yield of 6,500 dwellings (i.e. rateable properties) from the proposed WMUP translates into an estimated *annual* rates revenue for the Shire (at full build-out) ranging from \$8.29 million – \$11.46 million.
 - c. This potential rate revenue from the proposed WMUP is (only) approximately \$2 million less than the Shire's total forecast Residential rates revenue of \$13.52 million in its 2020/21 Budget.

We would urge the Shire to give detailed consideration to the matters raised in this advice if there is to be any prospect of achieving the infrastructure goals, development aspirations and population targets proposed for the broader Mundijong urban area and the Shire as a whole.

I would welcome the opportunity to discuss any aspect of this advice with you or the Shire.

Please do not hesitate to contact me on 0439 044 967 or len@lkadvisory.com.au if you have any queries whatsoever regarding this matter.

Yours sincerely,



LEN KOSOVA
Managing Director

**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

APPENDIX 4

Mundijong West Landowners Group – Member & Support Register

The Mundijong West Landowners Group

C/O Watson Property Group - Unit 6 / 110 Erindale Road, Balcatta WA 3021

The undersigned represent all landowners within the proposed *West Mundijong Urban Precinct (WMUP)* bounded by Mundijong, Gangemi, Leipold and King Roads, Oldbury.

I/We hereby confirm that I/we are members of *The Mundijong West Landowners Group* and reaffirm our strong individual and combined group support for the proposal to rezone the *West Mundijong Urban Precinct* from Rural to Urban.

Mundijong West Landowners Group - Member & Support Register					
Lot No.	Street No.	Road	Registered Owner	Authorised Representative	Signed
275	1087	Mundijong Road	Vernon Cockell	Vernon Cockell	<i>Vernon Cockell</i>
725	-	Mundijong Road	Dr Graham Forward and Forrest Family Investments	Dr Graham Forward	<i>Graham Forward</i>
726	-				
727	771				
724	729	Leipold Road	BDJ 234 Pty Ltd	Ben Panizza	<i>Ben Panizza</i>
800	447	Leipold Road	Eric & Dianne Broadwith	Eric Broadwith	<i>Eric Broadwith</i>
2	467	Leipold Road	Wouter Gerryts	Wouter Gerryts	<i>Wouter Gerryts</i>
801	441	Leipold Road			
264	409	Leipold Road	Ferdinando Cicolari	John Cicolari	<i>John Cicolari</i>
265	-				
123	389	Leipold Road	Michael & Patricia Cabassi	Michael & Patricia Cabassi	<i>Cabassi</i>
2	365				
1	331	Leipold Road	Rene & Patricia des Bouvrie	Rene & Patricia des Bouvrie	<i>Rene & Patricia des Bouvrie</i>
272	-	Mundijong Road	WPG Landholdings Pty Ltd	Stuart Griffiths (Group Facilitator)	<i>Stuart Griffiths</i>
273	-				
274	-	Mundijong Road	WPG Landholdings No. 3 Pty Ltd		

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C/O Watson Property Group - Unit 6 / 110 Erindale Road, Balcatta WA 6021
info@watsonpropertygroup.com*



**WEST MUNDIJONG URBAN PRECINCT
PROPOSED MRS AMENDMENT**

ADDENDUM 1

Response to Pre-Referral Comments

Explanatory Note: The following matrix details the outcomes of the pre-referral process and consists of the referral agencies comments and the proponent's and their consultants responses to the comments. In one instance the proponent has included an amended report to address some of the matters raised by the subject referring agency being DFES. For clarity, the original report has been retained within the MRS Submission and the revised report is now included as Attachment 1 to this Addendum as follows:

1. Amended Bushfire Hazard Level Assessment Report by Lushfire & Planning for The Department of Fire & Emergency Services (DFES).





Referral Comments	Response
<p><u>Department of Biodiversity, Conservation and Attractions</u></p> <p>Bush Forever Site 360 adjoins the southern boundary of the proposed amendment area. The Bush Forever site contains,</p> <ul style="list-style-type: none"> • a Conservation Category Wetland (UFI 14817), • an occurrence of the Threatened Ecological Community (TEC) Floristic Community Type 8 (FCT8) <i>Herb rich shrublands in claypans</i>, which is listed as Critically Endangered in Western Australia under the <i>Biodiversity Conservation Act 2016</i> (BC Act) and Federally under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> (EPBC Act), and • a population of the threatened species <i>Lepidosperma rostratum</i>, which is listed as Endangered under the State BC Act and the Federal EPBC Act. <p>The TEC and threatened flora population are located on the southern side of Mundijong Road. Neither the Amendment Report or the Aurora Environmental Assessment Report - May 2022 (EAR) consider potential hydrological impacts on the FCT8 TEC occurrence and the threatened <i>L. rostratum</i> population located within the Bushforever Site 360.</p> <p>The EAR, which involved a desk top assessment and a brief site inspection, outlined that,</p> <ul style="list-style-type: none"> • An assessment and application to reclassify a portion of the CCW is being considered. The assessment will involve mapping the vegetation types and condition, potential presence of threatened flora or ecological communities and collection of site photos. This information would be compiled and submitted to the DBCA for review and assessment as a formal request to modify the Geomorphic Wetlands of the Swan Coastal Plain dataset. Until the issue of the CCW has been assessed, the area will need to be retained with a 50 m buffer. 	<p>DBCA's expectations around the further detailed planning that will occur should the MRS amendment be approved are acknowledged and we can confirm that future detailed Local Structure Planning (LSP) for the site will include a Local Water Management Strategy that demonstrates the proposed development of the site will not impact the SCP8 TEC, the threatened <i>L. rostratum</i>, or the CCW wetland area within Bush Forever Site 360, and also consider buffer requirements.</p> <p>Further environmental analysis at the LSP phase will also demonstrate that any requirements pertaining to the black cockatoo habitat are appropriately addressed.</p>

- The only native vegetation remaining on the site comprises scattered paddock trees of Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) and Swamp Sheoak (*Casuarina obesa*)
- The vegetation at the site was assessed as Completely Degraded.

The EAR recommended that the following matter should be considered in future planning and development stages,

- Provide a buffer of 50m to the mapped conservation category wetland (CCW) along Mundijong Road, which is also a Bush Forever Site, and prepare a management plan for the treatment of the buffer/interface with the proposed development at the site. The buffer should be reflected in the structure plans and the management plan could be prepared at local structure plan stage or as a condition of subdivision. An investigation to reclassify this portion of the CCW is currently being considered as the area is degraded and not commensurate with CCW values

The Structure Plan, Local Water Management Strategy and Urban Water Management Plans will need to demonstrate that the proposed development of the site will not impact the SCP8 TEC, the threatened *L. rostratum*, or the CCW wetland area within Bush Forever Site 360, and also consider buffer requirements.

It is DBCA's expectation that the Department of Water and Environmental Regulation and the Shire of Serpentine-Jarrahdale will consider whether the Local Water Management Strategy and Urban Water Management Plans adequately provide for the maintenance of the pre-development hydrology of the Conservation Category wetland, and ensures that the SCP 8 TEC and population of the threatened flora species *L. rostratum* are not impacted by changes to groundwater and surface hydrology.

It is DBCA's expectation that the detailed planning for the site will identify and seek to retain black cockatoo habitat, and that the proponent will consider requirements for referral of the proposal to the Commonwealth Department of Agriculture Water and Environment under the *Environmental Protection and Biodiversity Conservation Act 1999*

Department of Fire and Emergency Services

1. Policy Measure 6.3 a) (i) Results of a Bushfire Hazard Level (BHL) assessment.

Issue	Assessment	Action
BHL Assessment	A BHL Assessment should be provided in accordance with the methodology set out in Appendix 2 of the Guidelines. The BMP has not provided a pre-development BHL, prepared in accordance with the Guidelines.	Modification required. The BHL should be modified in accordance with methodology set out in Appendix 2 of the Guidelines.

2. Policy Measure 6.3 c) Compliance with the Bushfire Protection Criteria

Issue	Assessment	Action
Location	A1.1 – not demonstrated. The pre-development BHL Assessment has not been provided. DFES notes the proposed mitigation measures depicted in Figure 9 of the BMP. However, in accordance with the Guidelines, the BMP should be amended to reflect the Moderate BHL of the site.	Modification required. Decision maker to be satisfied compliance with Element 1 can be achieved.
Vehicular Access	A3.1, A3.2b, A3.3, A3.4a & A3.4b – not demonstrated The BMP has not addressed the relevant Vehicular Access requirements associated with the proposed MRS amendment. DFES notes the BMP (Table 4) has provided an assessment of the Bushfire Protection Criteria (BPC) at subsequent stages of	Modification to the BMP is required. Decision maker to be satisfied compliance with Element

Lushfire has provided the below mentioned response in relation to the DFES advice.

1. The existing vegetation is shown in Figure 7 confirming that virtually all of the site has grassland with a moderate bushfire hazard level. The key consideration under Clause 6.2(b) of SPP3.7 is to show that a strategic planning proposal has or will, on completion, have a moderate BHL. This is demonstrated in Figure 9.

A BHL assessment for the undeveloped site can be provided but it provides no additional justification for the amendment.

2. A1.1 – response as per above.

A3.1, A3.2b, A3.3, A3.4a & A3.4b – as indicated in Table 4, the existing site has multiple access routes in different directions at both the district and local level. These existing external roads comply with specifications in Table 6 of the Bushfire Protection Criteria, noting that Mundijong Road is classified as a district distributor.

A revised BHL Assessment is attached as Attachment 1 of this addendum.



	<p>planning. However the BMP should be amended to accurately reflect compliance with the relevant BPC associated with the MRS amendment.</p>	<p>3 can be achieved.</p>	
<p><u>Recommendation – supported subject to modifications</u></p> <p>At the scheme amendment stage, consideration should be given to the intensification of land use and how this relates to identified bushfire hazards at this location. The scheme amendment and BMP have adequately identified issues arising from the bushfire hazard level assessment and considered how compliance with the bushfire protection criteria can be achieved at subsequent planning stages.</p> <p>However minor modifications to the BMP are necessary to ensure it accurately identifies bushfire risk and necessary mitigation measures. These modifications are detailed in the table(s) above. As these modifications are considered minor in nature and will not affect the scheme amendment, these can be undertaken without further referral to DFES.</p>			
<p><u>Department of Mines, Industry Regulation and Safety</u></p> <p>The Department of Mines, Industry Regulation and Safety (DMIRS) has determined that this proposal raises no significant issues with respect to mineral and petroleum resources, geothermal energy, and basic raw materials</p>			<p>No response required.</p>
<p><u>Department of Education</u></p> <p>The Department notes that the West Mundijong Urban Precinct (WMUP) is not contemplated for urban development under any planning framework documents and sits outside the Shire of Serpentine Jarrahdale’s draft Mundijong District Structure Plan (DSP) area. Accordingly, careful consideration is to be given to ensure that the proposed MRS Amendment would not compromise the orderly and proper planning of the broader locality which may impact on, amongst other things, the public school planning.</p> <p>From a school demand perspective, it is expected that at least 4 public primary school and 1 public secondary school sites would be provided as part of future</p>			<p>The appropriateness of the proposed ‘Urban’ cell of land, despite not being recognised in any planning framework documents has been discussed at length within the submitted MRS Amendment Report.</p> <p>The Department of Education will be a key referral body as part of the future LSP process where the school demand and provision will be examined in detail.</p>



structure planning to support the delivery of 6,500 dwellings within the WMUP in accordance with the WAPC's draft Operational Policy 2.4 – Planning for School Sites (OP 2.4). In addition, noting the site constraints which may exist within the WMUP, the public school sites should be of the prescribed size, regular in shape and unencumbered to the following extent as per the OP 2.4 and Liveable Neighbourhoods:

- not require significant clearing of native vegetation, threatened fauna habitat and/or need any State or Australian Government environmental approvals or offsets, or intend/propose for significant areas of vegetation to be retained;
- being on level ground with no extensive site earthworks required;
- not impacted by any environmental or physical buffers or easements;
- achieves a low bushfire hazard level post development;
- provision of adequate and safe access for evacuation in the event of bushfire; and
- provision of at least three road frontages with sufficient road width to accommodate for safe and convenient on-street embayment car bays and public bus bays, and Safe Active Streets.

Accordingly, the Department requests to be included in the preparation of future structure plan to ensure that there is adequate and suitably located public school sites within the WMUP

Department of Health

1. Water Supply and Wastewater Disposal

The DOH has no objection to the proposal subject to all proposed developments being connected to reticulated deep sewerage as stated in the submitted supporting documents.

It is noted that currently the existing wastewater service connection is a significant distance away and it may be several years before it becomes economically viable to connect. This proposal along with other proposals in the district needs to also address the additional loadings or volumes that will be placed onto the existing infrastructure. As wastewater volumes increase the management of

The Department of Health does not object to the proposed amendment on the basis that reticulated deep sewerage will be provided. It is intended for reticulated deep sewerage to be provided and how this will occur has been articulated in the Infrastructure and Servicing Assessment completed by Porter Consulting Engineers.

The MRS Amendment has considered SPP2.5 in detail in section 5.3 of the MRS Amendment report. It has also considered surrounding uses that are likely to impact upon urban development within the WMUP, specifically the Peel Feedlot, West Mundijong Industrial Area, King Road Brewing Co. and the Waste Materials Stockpile, Sorting and Recycling. Appropriate buffers to land uses likely to impact the future 'Urban' development can be considered at the future structure planning stages.



wastewater treatment needs to be upgraded to accommodate higher volumes and peak loading events. The applicant should provide details of any infrastructure upgrades and management practises to the DOH prior to the development commencement

2. Separation of Agricultural and Residential Land Use

Due consideration has not been given to aspects of State Planning Policy 2.5 (SPP 2.5) regarding protection of agricultural land use and application of buffer and separation distance requirements between sensitive uses (urban/residential) and existing agricultural uses.

The DOH requests that the Metropolitan Region Scheme Amendment is revised to adequately consider the requirements of SPP 2.5, and particularly in regard to Section 5.12.1. No buffer/separation area has been identified in the current plan and DOH strongly recommends it is considered at this stage of planning in order to ensure that the planning scheme meets the required objectives with regard to the area of land available for development

3. Medical Entomology

The subject land is in a region that occasionally experiences significant problems with nuisance and disease carrying mosquitoes. These mosquitoes can disperse several kilometres from breeding sites and are known carriers of Ross River (RRV) and Barmah Forest (BFV) viruses. Human cases of RRV and BFV diseases occur annually in this general locality.

The subject land is also within 3km of mosquito dispersal distance from mosquito breeding sites. Mosquitoes will disperse from these sites to the subject land under favourable environmental conditions. There may also be seasonal freshwater mosquito breeding habitat within proximity to the subject land. Additionally, there is the potential for mosquitoes to breed in on-site infrastructure and constructed water bodies if they are poorly designed.

A Mosquito Management Plan can be provided as part of the future LSP phase.



<p>Prior to development, the DOH recommend a mosquito management plan (MMP) be developed and approved by both the DOH and the Local Government in which the proposal is based to ensure the risk to the community of exposure to nuisance and/or disease carrying mosquitoes is considered. This MMP is to be approved by the Local Government and DOH prior to any subdivision.</p> <p>The DOH has provided guides and templates for the development of suitable MMP's to assist land developers meet these requirements. Please see: Mosquitomanagement (health.wa.gov.au) for additional support.</p>	
<p><u>Department of Transport</u></p> <p>The Department of Transport (DoT) has review the submitted document. DoT support the proposed amendment and provide the following comments for consideration:</p> <ul style="list-style-type: none"> • The cycling provision within the precinct should consider the Long-Term Cycle Network (https://www.transport.wa.gov.au/activetransport/long-term-cycle-network.asp) and be designated in accordance with the WA Cycle Network Hierarchy (www.transport.wa.gov.au/mediaFiles/activetransport/AT_P_WA_CycleNetwork_Hierarchy.pdf). • The precinct need to have adequate and safe pedestrian and cycling infrastructure that accommodates people of all ages and abilities. Please refer to the recently released Shared and Separated Path Guidelines for details on appropriate planning and design treatments, available at: https://www.transport.wa.gov.au/mediaFiles/activetransport/AT_CYC_P_Shared_and_separated_paths.pdf. • Future on-street cycling lanes within the precinct should be protected from the traffic lane by positioning them between the verge and on-street parking bays, ensuring adequate clearance from car 'dooring'. • The Department is keen to provide transport comment at the next planning stage 	<p>Support of the Department of Transport is acknowledged and the comments will be considered as part of subsequent planning stages.</p>



Department of Water and Environmental Regulation

The Department has reviewed the information provided and wishes to advise that it does not support the proposal due to the departure from the *South Metropolitan Peel SubRegional Planning Framework* (WAPC, 2018), *State Planning Policy 2.5 – Rural Planning* (WAPC, 2016) and *Guidance Statement No 3 – Separation Distances Between Industrial and Sensitive Land Uses* (EPA, 2005).

The *South Metropolitan Peel Sub-Regional Planning Framework* (WAPC, 2018) (Framework) identified the site as rural and did not identify this site to accommodate longterm projected population growth for future urban land use. The Framework sets out to retain the land for rural and agricultural purposes, and identified other areas within and around the town for achieving a more consolidated urban form close to existing servicing.

Through the implementation of the *State Planning Policy 2.5 – Rural Planning* (WAPC, 2016) (SPP 2.5), the WAPC will seek to protect rural land including “comprehensively planning for the introduction of sensitive land uses that may compromise existing, future and potential primary production on rural land”. In contemplating any rezoning from rural to urban applications, the decision maker is to “ensure that the sensitive zone does not overlap with any buffer determined to be necessary as a result of introducing the new zone, and the area within the buffer should retain its rural zoning until such time as the buffer is no longer required”. Urban development is a sensitive land use and in this location, is within a buffer to intensive animal land uses which is further discussed below.

The subject site is located directly adjacent to two premises that are licenced under Part V of the *Environmental Protection Act 1986*, being a cattle feedlot (licence [L7839/1998/7](#)) and a livestock holding pen (licence [L5200/1988/11](#)). *Guidance Statement No 3 – Separation Distances Between Industrial and Sensitive Land Uses* (EPA, 2005) (GS No 3) provides advice on the use of generic separation distances (buffers) between industrial and sensitive land uses (including urban) to avoid conflicts between incompatible land uses. The impacts to urban land use from existing activities that may cause unacceptable

Reasons for departing from the *South Metropolitan Peel Sub-Regional Planning Framework* have been addressed in detail within the submitted MRS Amendment Report.

Again, SPP2.5 was addressed in detail as part of the MRS Amendment Report which also discussed the *Guidance Statement No 3 – Separation Distances Between Industrial and Sensitive Land Uses* and the buffer distances recommended by this policy. It is commented that the generic buffer distances quoted by DWER are generic in nature and can be varied in appropriate circumstances. Further detailed planning around the potential of these land uses to impact upon residential development can be completed at subsequent planning stages where buffers can be established based on a detailed analysis as opposed to generic buffer distances being applied.

impacts on amenity includes emissions (including noise, dust and odour) and infrastructure.

To avoid or minimise the potential for land use conflict, the recommended generic separation distances between industry and sensitive land uses are:

- 1000-2000m for a sheep animal feedlots and
- At least 1000m for saleyards or holding pens.

The site subject to this request is located 350m north of the sheep animal feedlot premises and directly across the road to the holding yard premises. Therefore, the proposed sensitive land use would be within two buffers and is likely to be adversely impacted upon with emissions from these premises. In addition, the subject site is located 1000m west of land that is zoned Industrial in the Metropolitan Region Scheme. Industrial land uses that may be located within this zone, will require a buffer distance of greater than 1000m. As described above, the site may be located within a buffer that may cause impacts to amenity.

Decision making authorities are encouraged to consider the above policies and GS No 3 prior to the scheme amendment stage to prevent any land use conflicts. This is reflected in the Framework whereby the subject site is identified to remain as rural. As such, the Department would not support the amendment to the Metropolitan Region Scheme due to the inconsistency with the Framework, SPP 2.5 and GS No 3.

Main Roads Western Australia

The following key comments are provided:

- It is noted that the subject area not identified in Perth and Peel @3.5M Planning Frameworks as 'Urban Expansion' nor identified as a future Planning Investigation Area.
- There subject area does not have any existing or planned key public transport routes. While it may be serviced by a local bus service this would result in a large urban area relying almost entirely on private vehicle access
- The proposal is not consistent with a number of principles in the Perth and Peel @3.5M Planning Frameworks including:

KCTT has provided a response to the MRWA comments below:

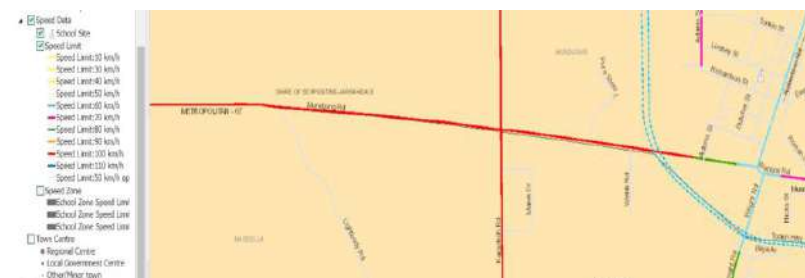
- This is a planning matter that has been addressed in detail within the MRS Amendment Report.
- As described in the report, the potential local bus service would connect to Mundijong and Byford Train Stations and potentially to the west to Wellard. This provides further transport opportunities that are not dependent on private vehicles. While the PTA indicated they do not have any plans for expansion of the public transport through the area, should this area be rezoned to urban, PTA would review current planning.

- limit the identification of new greenfield area
- facilitate increasing the number of people close to where they work
- integrate land use and public transport to contribute to maintaining air quality
- Mundijong Road is shown as a Primary Distributor and Primary Freight route in Perth and Peel @3.5M Planning Frameworks and the Transport @ 3.5M Plan.
- Mundijong Road has been identified as a future State Road under the care and control of Main Roads WA (refer “Future Roads Project” link - [future-roads-projectmetropolitan.docx \(live.com\)](#)).
- The Transport Impact Assessment provided with the submission suggests downgrading and reducing the speed limit along Mundijong Road to 60-70 kph but this would not be appropriate or supported by Main Roads.

Main Roads has undertaken a high level review of the KCTT Transport Impact Assessment included with the submission and comments on these are below. In summary this assessment cannot be relied upon to make any decision on the proposal as it is flawed and does not represent transport issues that are likely to arise.

- This is a planning matter that has been addressed in detail within the MRS Amendment Report.
- Noted.
- Noted.
- Noted, however there are a number of examples throughout the Perth Metro Area where speed limits are lower, passing through an urban area or townsite even for Primary Distributors.
 - Stirling Highway – 60km/h
 - Canning Highway – 60km/h
 - South Western Highway – 60-110km/h
 - Armadale Road – 60/80km/h
 - Anketell Road – 80-90km/h

The speed along Mundijong Road in the vicinity of Mundijong Townsite is reduced from 100km/h to 80km/h and then to 60km/h. Further to this, although the official MRWA map does not show it yet, the speed was reduced on Mundijong Road in approach to Kargotich Road intersection. Current speed limit in this zone (sign posted) is 80km/h.



MRWA Transport Impact Assessment Comments



1. Page 12 - Question the validity of the statement "Although the safety record is quite poor at present, this will be improved through the urbanisation of the area.". This is likely incorrect as urbanisation will increase traffic volumes in the area resulting in an increase in number of crashes.
2. P12 - "Designing and constructing urban roads of appropriate geometric standards and reducing the speed limit will improve the road safety on Mundijong Road in particular." This seems predicated on reducing the speed limit on Mundijong Road, but this would not be appropriate or supported by Main Roads given the future role and function of Mundijong Road as a major east-west freight link.
3. Page 16 - Section on active transport does not mention the long term cycle network. The L TCN shows a secondary route between the existing Gangemi Road and King Road. This is not shown in the TIA.
4. Page 16 - The East-West distance of the site is approximately 5km. People generally don't walk that far, especially if they have groceries or other bulky goods. Expecting a high uptake of active transport (particularly walking) while understood is ambitious at best.
5. Page 19 - Tables need to distinguish between trip generation (dwellings) and trip attraction (neighbourhood centres, schools)
6. Page 19 - There are no high schools proposed for the site. These trips will be external to the site. This is not mentioned.
7. Page 19 - The basis for the 80% local traffic assumption is not provided and therefore cannot be verified. Need to provide further justification.
8. Page 19 - The trip attraction rate of 80% for the neighbourhood centre is likely to be over-estimated. There is a lack of planned surrounding amenity (large sporting complex, niche stores, etc), which will result in trips which are strictly not groceries being external to the site, decreasing the trip attraction rate.
9. Page 19 - The assumption that most employees of the West Mundijong Industrial Area are from the surrounding area is unfounded. This assumption is not supported in the data from the ABS census 2016.
10. Page 20, 2.11 - Table is assumed and no justification is given for the breakdown.

1. Increase in traffic volumes is likely to increase the number of crash incidents, however it is likely to decrease the crash density (number of crashes per MKVT) and crash severity.

Crash record on Mundijong Road for the study period (2017-2021) clearly shows patterns typical of high-speed rural roads. Casualty crashes occurred mostly at the intersections, inclusive of a fatality crash. Vast majority of these crashes are right-angle crashes, which may imply that sight distances are insufficient for the legal speed limit. The intersection with the most incidents (Mundijong Rd/Kargotich Rd) did not have a single incident since the roundabout and speed reduction were implemented. Furthermore, 58% of midblock crashes on Mundijong Road are single-vehicle crashes (run off road, hit an object, hit an animal etc). These type of crashes are not commonly encountered on roads constructed to the urban standard, where road geometry is appropriate for the speed limit.

With increased traffic volumes, drivers become more alert and aware of other vehicles. Low volumes of traffic on a rural, high-speed road create a fertile environment for reckless driving. The urbanisation of the area does not mean just more vehicles on the road, but also adjusting the road environment and/or speed limit to create coherent driving conditions. Creating tighter kerb radii at intersections, narrower streets, appropriate sight distances and overall a sense of urban form would improve current safety issues.

If MRWA is adamant not to Mundijong Road speed reduction, despite clear evidence that the reduction of speed limit, adjustment of geometry and sight distances will improve safety record, speed limits should be reduced at King Road and Kargotich Road. Moreover, direct property access to Mundijong Road should be avoided, particularly for residential properties.

2. As above.



- | | |
|---|--|
| <ol style="list-style-type: none"> 11. Page 21 - High schools not mentioned. 12. Page 22, 2.13 - Traffic distribution is assumed with no scientific backing or rigor. Need to provide justification or reasoning. 13. Page 22 - No justification provided for the 3% annual growth rate. 14. Page 22 - No commentary on redistribution of traffic due to the opening on Tonkin Highway Extension in 2025. 15. Page 24 - Mundijong Road is not within the subject area so not sure why it has been included. 16. Page 25 - suggests reducing speed limit to 60-70 kph. This is not appropriate or supported by Main Roads. | <ol style="list-style-type: none"> 3. Noted. The Principal shared path along Mundijong Road was considered in Mundijong District Plan.

Internal pedestrian and cycle network will be refined in the next stages of planning when internal layouts of key roads are known. 4. The preliminary information for the precinct land uses include a number of public-purpose facilities, sport amenities, schools and POS areas. Given that the estimated yield is approximately 6,000 dwellings, 4 primary schools and several local or neighbourhood centres, next planning stage will see these land uses distributed to create appropriate catchments. Strategically placed land uses throughout the precinct combined with a well-established pedestrian and cycle network can significantly increase the percentage of active transport. 5. Noted - the distinction will be made clearer in the next iteration of the report. The distinction was, naturally, accounted for in the modelling. 6. Noted - to be amended in the next iteration of the report, if the information on proposed high-schools is available. The closest high schools in the vicinity are: <ul style="list-style-type: none"> • Court Grammar School 6.2km to the north east • Byford Secondary College 12.3km to the north east • Gilmore College 16.5km to the north west • Baldivis Secondary College 18.1km to the south west 7. The precinct is expected to have a large array of land uses that would reduce the need for external trips. As this is a very early stage in the planning process with the currently available information on the land uses, KCTT believe that the assumption provided is adequate.

WAPC Guidelines state: " For example, a smaller structure plan that is predominantly residential would have a very high |
|---|--|



proportion of external trips. A larger structure plan with a wide range of land uses and facilities, for example, schools, medical facilities, shops, employment and recreation, as well as residential, would have a high proportion of internal trips. It is not possible within these guidelines to provide firm guidance on what proportions to use for internal/external trips, as each structure plan will be different. The transport assessor should therefore use professional judgement when determining an appropriate internal/external split backed up with supporting information, data, surveys etc. where available. "

Furthermore, "local" traffic means traffic drawn within the subject area. If all of the schools in the area are public schools, they will have a direct catchments, which are likely to be within the subject site for the most part. The assumption will be revised if the actual catchments are available in the next planning phase.

8. We disagree with this comment. As mentioned above, there will be more than 6,000 dwellings in the area. It is reasonable to assume that a neighbourhood centre will derive 80% of it's trade from within the area. Based on our previous experiences, neighbourhood centres have a catchment of approximately 1km (depending on size and mix of commercial land use), and this experience corresponds to SPP 4.2 directions. Grocery shopping makes up most of the shopping trips, and new public open spaces (adjacent to a school or not) will likely become home to new sporting clubs.
9. The assumption is based on Workers' Place of Residence for the Shire of Serpentine Jarrahdale.

Workers' place of residence 2021 Residents' place of work 2021

Shire of Serpentine Jarrahdale

Workers' place of residence

Of the 6,352 people who work in the Shire of Serpentine Jarrahdale, 3,362 or 52.9% also lived in the area.

10. Trip purpose table is naturally assumed as the development doesn't exist; therefore, it is impossible to conduct a household survey. We have used this table for planning purposes for more than a decade. It could be argued that rise in WFH practices would have an impact, however this impact has not been quantified yet in any of the standard traffic generation rates.
11. Noted - to be amended in the next iteration of the report, if the information is available.
12. As explained in the report, traffic distribution takes into consideration the current residents' place of employment for the Shire of Serpentine Jarrahdale as per profile.id. During the timeframe for the development of the subject site, future Tonkin Highway Extension, Draft Mundijong District Structure Plan and other planned development projects in the area are expected to be completed.

The traffic distribution will be reviewed to account for the newest census data (2021) in the next iteration.

13. 3% per annum is a typical growth rate used for planning purposes in greenfield developments. We used the typical rate because we



	<p>did not have access to the ROM24 model. If the ROM24 model is made available, we will adjust the rate to suit.</p> <p>14. Tonkin Highway Extension has been taken into consideration.</p> <p>15. Mundijong Road abuts the subject site, and provides key access to the site, therefore, it must be included in the analysis. It is noted that MRWA will determine the ultimate cross-section for Mundijong Road.</p> <p>16. As above</p>
<p><u>Public Transport Authority</u></p> <p>The PTA has reviewed the Proposed Metropolitan Region Scheme Amendment report for the West Mundijong Urban Precinct, and have no preliminary comments.</p>	<p>Noted – no response required.</p>
<p><u>Shire of Serpentine Jarrahdale</u></p> <p>1. Requests the WAPC (as a regional planning authority) to undertake a subregional structure planning exercise for the area bound by Kargotich Road, Mundijong Road, King Road and all freight rail line, with the intent that this subregional structure plan inform the suite of MRS amendments required to achieve the most effective planning outcome for this precinct. This subregional structure plan should include stakeholder and community engagement, and address the following matters</p> <ul style="list-style-type: none"> a) Road infrastructure coordination (specifically to request that Mundijong Road be recognised as a State Government Main Roads road, and be reserved as a Primary Regional Road under the MRS given its linkage between north south highways of Kwinana Freeway, future Tonkin Highway, South West Highway and Albany Highway). b) Potable water and sewer infrastructure coordination (specifically to request that Water Corporation provide direction on the timing and delivery of the necessary urban 	<p>Whilst the Shire’s response and request is acknowledged, they have not provided their position on the proposed MRS amendment. The information and work that the Shire has requested the WAPC undertake can occur separately to the proposed MRS amendment and should not prohibit or prevent its assessment.</p>



<p>water and sewer infrastructure given the pressure for development taking place within Mundijong).</p> <ul style="list-style-type: none"> c) Intermodal infrastructure coordination (specifically to request Westport actively consider how an expanded West Mundijong Industrial Area which interfaces with the current and ultimate freight rail servicing a new port and freight links, is a strategic opportunity). d) Regional planning clarification (specifically to request that the WAPC consider removing the current Cardup Planning Investigation Area which impacts on the Cardup Equestrian Area, which erodes an important rural residential precinct between the urban localities of Byford and Mundijong). e) Industrial area expansion (specifically to request that the WAPC consider the southeast subregional opportunities associated with a connected and expanded West Mundijong Industrial Area). f) Activity centre classification (specifically to request the Mundijong District Centre be considered for reclassification as a strategic regional centre). <p>2. Considers its position on the Proposed Metropolitan Region Scheme Amendment – West Mundijong Urban Precinct once Part (1) is completed by the WAPC.</p>	
<p><u>Water Corporation</u></p> <p>The proposal is inconsistent with the <i>South Metropolitan Peel Sub-Regional Planning Framework</i>.</p> <p>The subject land is remote from existing Water Corporation serviced areas and is not covered by Water Corporation long term infrastructure planning</p>	<p>Porter Consulting Engineers have provided the below response to the comments received from the Water Corporation:</p> <p>Porter Consulting Engineers prepared an Infrastructure and Servicing Assessment (ISA) for the Mundijong West Precinct. The ISA was included in submission to the WAPC for a proposed MRS Amendment to include Mundijong West within the Sub Regional Planning Framework Area.</p> <p>As part of the preparation of the ISA, Porter Consulting Engineers wrote to the various service authorities requesting infrastructure servicing advice for Mundijong West. As the site is outside of current planning area, no or limited future infrastructure planning was available.</p> <p>As part of the ISA, Porter Consulting Engineers considered the</p>



	<p>infrastructure planning received from the authorities for the areas adjoining the site and prepared servicing concepts on how Mundijong West could be incorporated into this planning, consistent with current design standards. A Concept Sewer Servicing Plan was tabled in Appendix 1 of the ISA and a Concept Water Servicing Plan was tabled in Appendix 2.</p> <p>The Water Corporation have responded to the WAPC regarding the request for preliminary comment on the proposed MRS Amendment. Their response was Mundijong West is not covered by any Water Corporation long term infrastructure planning as the site is outside of the Sub Regional Planning Framework. We understand the Water Corporation will not prepare any infrastructure planning until the WAPC have included the land in an adopted strategy.</p> <p>Based on our review, we are of the opinion there are opportunities to incorporate Mundijong West into the current infrastructure planning as demonstrated on our Concept Sewer and Water Servicing Plans.</p>
<p><u>Westport</u></p> <p>Westport is the State Government's long-term program to investigate, plan and build a future port in Kwinana with integrated road and rail transport networks. The Westport project will improve the overall efficiency of trade for import and export industries as well as resulting in transformational changes to the Perth and Peel Region.</p> <p>It is the largest port and supply chain project in Australia and is likely unprecedented for the State Government in terms of the overall scale, complexity and importance for the State's future economic growth.</p> <p>The current Westport planning program (Stage 3) will result in advice being provided to the State Government about when and how a new Kwinana port and logistics network should be developed. A business case will recommend to Government the high-level designs and best time and way to transition from the Inner Harbour in Fremantle to the Outer Harbour in Kwinana.</p> <p>The Westport Office recently completed the Landside Logistics Opportunities</p>	<p>Prior to the request for pre-lodgement advice with the WAPC, considerable planning had occurred on behalf of WPG Landholdings Pty Ltd (WPG) and the Mundijong West Landowners Group relating to the subject land (Figure 1) which is referred to as the 'West Mundijong Urban Precinct (WMUP)'. A summary of the planning history has been provided below for context:</p> <ul style="list-style-type: none"> • A submission was lodged on the Shire of Serpentine Jarrahdale Draft Local Planning Strategy and Local Planning Scheme No. 3 in December of 2019. • A formal submission was lodged on the Draft Mundijong District Structure Plan and Draft Mundijong Urban Development Contribution Plan in August of 2020. • In considering the Draft Mundijong District Structure Plan and Draft Mundijong Urban Development Contribution Plan at their November 2020 Council Meeting, the Shire of Serpentine Jarrahdale acknowledged the planning merits of the WMUP. • A meeting was held with the WAPC Chairman in January of 2021 to discuss progressing planning for the WMUP. The project team was encouraged to lodge a submission when Perth and Peel @ 3.5



Study (LLOS), which has investigated potential freight and logistics requirements to support the future Outer Harbour across the Westport Program's 50-year planning horizon.

Two of the three LLOS shortlisted options identify different potential freight and logistics system requirements in the broader Oakford/Oldbury and Mundijong localities. These preliminary and conceptual outputs from the LLOS will be considered further as part of the Westport Program's Supply Chain Integrated Design (SCID) project, which is scheduled to commence in October 2022 and run through until the end of 2023.

The outputs from the SCID project will inform the development of the Westport business case, which is scheduled to be presented to the State Government in mid-2024 for its consideration.

The Westport Program's interests in the broader Oakford/Oldbury and Mundijong area remain under active consideration and are yet to be determined. The proposed West Mundijong Urban Precinct falls within the Westport Program's current area of interest.

Given the significance of Westport to the State's future economic growth, it is critical that the outcomes associated with Westport's current investigations are understood to inform consideration of potential land use requirements in the Oakford/Oldbury and Mundijong localities.

On this basis, the Westport Office does not support the proposed rezoning, as its progression in the short-term may be prejudicial to Westport's planning for the long-term freight and logistics requirements needed to support the efficient and effective operation of the future Outer Harbour.

million was to be reviewed in 2021. This review was ultimately deferred indefinitely by the State Government.

- A written deputation was provided to the Statutory Planning Committee on the 25 June 2021 when they considered the Shire's Draft Local Planning Strategy and Local Planning Scheme No. 3 for adoption.
- A detailed MRS Amendment submission was prepared and lodged with the WAPC in May of 2022 which included comprehensive supporting reports demonstrating the suitability of the land for 'Urban' development. These studies included:
 - Land Capability Assessment – May 2022.
 - Traffic Impact Assessment – May 2022.
 - Economic Impact Assessment – May 2022.
 - Infrastructure and Engineering Assessment – May 2022.
 - District Water Management Strategy – May 2022.
 - Environment Assessment Report – May 2022.
 - Bushfire Hazard Level Assessment – May 2022.
- Pre-lodgement referral responses on the proposed MRS amendment were received in August/September of 2022. Critical to the progression of the MRS amendment was the Westport referral response which essentially required the amendment to be placed on hold until such time as they resolved its land use planning and determined their spatial land requirements.

Based on the considerable work done to date and the need for 'Urban' land within the Mundijong area, as noted in our MRS Amendment report, simply sterilising land until such time as Westport resolve what their land requirements are is considered to be inappropriate. It may be that Westport's land requirements don't include the subject land but they have been unable to confirm this despite considerable efforts by the project team to obtain the *Landside Logistics Opportunities Study*, including a Freedom of Information request.

As a result we consider that the amendment request should be progressed despite Westport's referral response.



Attachment 1
Revised BHL Assessment



Bushfire Management Plan (Bushfire Hazard Level Assessment)

Land bounded by Mundijong Road, Kargotich Road,
Leipold Road and King Road, Oldbury



Ref 20 - 050

Ver E

May 2023

LUSHFIRE & PLANNING

3 Paterson Rd

Pinjarra WA 6208

0418 954 873

ABN 74 232 678 543



Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference:	Land bounded by Mundijong, Kargotich, Leipold and King Roads		
Suburb:	Oldbury	State:	WA
		P/code:	6121
Local government area:	Serpentine Jarrahdale		
Description of the planning proposal:	Planning Scheme Amendment		
BMP Plan / Reference Number:	20-050	Version:	E
		Date of Issue:	3/05/2023
Client / Business Name:	WPG Landholdings No 3 Pty Ltd		

Reason for referral to DFES

	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Is the proposal any of the following special development types (see SPP 3.7 for definitions)?

Unavoidable development (in BAL-40 or BAL-FZ)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Strategic planning proposal (including rezoning applications)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Minor development (in BAL-40 or BAL-FZ)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
High risk land-use	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Vulnerable land-use	<input type="checkbox"/>	<input checked="" type="checkbox"/>

If the development is a special development as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

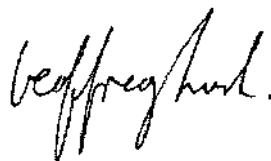
Note: The decision maker (e.g. the local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name	Accreditation Level	Accreditation No.	Accreditation Expiry
Geoffrey Lush	Level 2	BPAD 27682	28/02/2024
Company	Contact No.		
Lush Fire & Planning	0418 954 873		

I declare that the information provided in this bushfire management plan is to the best of my knowledge true and correct.

Signature of Practitioner



Date

3/05/2023

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury Summary

This bushfire management plan is prepared for land bounded by Mundijong, King, Leipold and Gangemi Roads, Oldbury (the Study Area). The study area has an area of 859 hectares and is located 3kms west of the Mundijong townsite and 7kms south west of Byford.

Contained within the study area for this report is the proposed West Mundijong Urban Precinct (the subject land), which is proposed to be developed for urban purposes. In order to achieve this, it will be necessary to modify the existing planning framework including the Metropolitan Region Scheme and Shire of Serpentine Jarrahdale Local Planning Strategy and Scheme. Given the strategic nature of this report and the size of the subject land, the bushfire assessment is in the form of a strategic Bushfire Hazard Level assessment.

The study area contains twenty-two (22) freehold lots, while the subject land contains sixteen (16) freehold lots and a drainage reserve. The subject land is generally rectangular in shape being approximately 3,260m by 2,100m. The area is currently used for broad acre farming being primarily for cattle grazing and equine establishments. It is characterised by large open paddocks with scattered trees, with dwellings located around the periphery.

There is scattered vegetation on the site and adjacent road reserves. Bush Forever Site 360 extends along Mundijong Road. The site has an elevation of between 10m AHD in the north western corner rising to 16m on the eastern boundary. Over the length of the site this is a gradient of less than 1%.

In order to develop the land for urban purposes it will be necessary to first amend the Metropolitan Region Scheme and the Shire's Local Planning Scheme, followed by further detailed planning through structure planning, subdivision applications, and development applications.

The land situated between Gangemi Road and Kargotich Road falls outside the MRS Amendment area for the proposed West Mundijong Urban Precinct. This land has nevertheless been assessed as part of this bushfire management plan because it abuts the subject land and may in future accommodate other uses which are compatible with the 1km buffer to the West Mundijong industrial area.

The western portion of the subject land, being 647 hectares situated west of Gangemi Road would be developed as medium density residential development. This would have an R20 zoning an average lot size of 450m² with associated open space, recreational areas and facilities, and neighbourhood amenities.

The environmental assessment has noted that there are no intact areas of native vegetation within the study area. The site is mapped as a Multiple Use wetland with an area of Conservation Category Wetland along Mundijong Road. Bush Forever Site 360 traverses the southern boundary of the study area. A 50m buffer is required to the conservation category wetland along Mundijong Road.

The Bushfire Hazard Level assessment identifies the vegetation with an extreme hazard rating. Within the subject land these have a combined area of approximately 35 hectares which is 4% of the total site area. All of the external boundary roads also have roadside vegetation with an extreme hazard level.

It is expected that 95% of the developed site will have either a moderate or low bushfire hazard level when developed. Large portions of the site will have a low hazard level and consequently, subdivision and development of that area would not be subject to State Planning Policy SPP3.7 Planning in Bushfire Prone Areas or the Bushfire Protection Criteria.

Bushfires occur regularly within the locality and pose a threat to life and property. The surrounding land is a mixture of urban, rural residential, and rural land uses. The rural land uses are typically large properties used for broad acre grazing with grassland being the predominant vegetation. The primary bushfire hazard is from a fast moving grass fire which can still have the potential to be a destructive fire threatening life and property. In response to this, the site has excellent district access to the subject land from multiple directions on district distributor roads.

The most significant local issue is the management of the interface with the proposed 50m wide revegetation buffer adjacent to Mundijong Road conservation category wetland, Bush Forever Site.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury Summary

This report demonstrates that the hazard level on the subject land will be reduced and permanently altered by the site being developed. The developed site is expected to generally have a low hazard level.

The Bushfire Protection Criteria in the Guidelines can be achieved now or in subsequent planning stages and the proposal complies with the objectives of State Planning Policy 3.7.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

Document Control

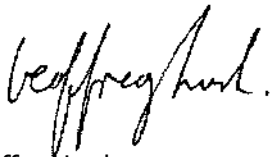
Street No	Lot No	Plan	Street Name		
	Various		Mundijong, Kargotich, Leipold and King Roads		
Locality	Oldbury	State	WA	Postcode	6121
Local Government Area	Serpentine Jarrahdale				
Project Description	Scheme Amendment				
Prepared for	WPG Landholdings No 3 Pty Ltd				

Ref No	Revision	Date	Purpose
20-028	E	03/05/2023	DFES Comments

Name	Geoffrey Lush	Company	Lushfire & Planning
BPAD	Level 2 Practitioner	Accreditation No Expiry	27682 February 2024

Disclaimer

The measures contained in this report do not guarantee that a building will not be damaged in a bushfire. The ultimate level of protection will be dependent upon the design and construction of the dwelling and the level of fire preparedness and maintenance under taken by the landowner. The severity of a bushfire will depend upon the vegetation fuel loadings; the prevailing weather conditions and the implementation of appropriate fire management measures.



Geoffrey Lush
3 May 2023
geoffrey@lushfire.com.au



Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

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Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

1.0 Proposal Details

1.1 Introduction

This bushfire management plan is a strategic hazard assessment prepared for land bounded by Mundijong, King, Leipold and Kargotich Roads, Oldbury. The study area for this bushfire management plan comprises the proposed West Mundijong Urban Precinct and land outside of that precinct, between Gangemi and Kargotich Roads. In total, the study area is 859 hectares in area and is located 3kms west of the Mundijong townsite and 7kms south west of Byford townsite as shown Figure 1. The study area is bounded by Kargotich, Leipold, King and Mundijong Roads.

In order to develop the land for urban purposes it will be necessary to first amend the Metropolitan Region Scheme and the Shire's Local Planning Scheme, followed by further detailed planning through structure planning, subdivision applications, and development applications.

The objectives of this report are to:

- a) Demonstrate how the bushfire hazard level will be managed. This can be by avoiding development in areas with an extreme hazard level, or where unavoidable reducing this to a moderate or low hazard level. This will enable the decision-maker to ensure that appropriate bushfire risk management measures are maintained for the life of the development.
- b) To identify any bushfire management issues and any spatial impact of such issues; which should be considered; in the preparation of any modification to the Local Planning Strategy, Scheme amendment, local structure plan; subdivision and development.
- c) Demonstrate that development will comply with State Planning Policy SPP3.7 Planning in Bushfire Prone Areas; the associated Guidelines and Bushfire Protection Criteria now and/or in subsequent planning stages.

Appendix 5 of the Guidelines for Planning Bushfire Prone Areas contains a checklist for the preparation of Bushfire Management Plans. In relation to the bushfire assessment results it provides the option of either a Bushfire Attack Level (BAL) Contour Map or a Bushfire Hazard Level assessment as shown in Table 1 below. The BAL Contour Map is usually prepared when the subdivision layout is known.

Given the strategic nature of this report and the size of the subject land, the bushfire assessment is in the form of a Bushfire Hazard Level assessment.

Table 1 Bushfire Management Plan Checklist

SECTIONS	Local Planning Strategies	Scheme and Amendments	Structure Plans	Subdivision	Development Approval
3.0	Bushfire assessment results				
3.2	Assessment outputs				
	BHL assessment	Yes	Yes	Yes	
		or	or		
	BAL contour map	Yes	Yes	Yes	
				or	
	BAL assessment			Yes	Yes



LEGEND

- STUDY AREA —
- SUBJECT LAND —

**FIGURE 1
LOCATION**



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



geoffrey@lushfire.com.au
0418 954873

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

1.2 Existing Conditions

The study area for this plan contains twenty-two (22) freehold lots and several reserves. It is rectangular in shape being approximately 4,250m by 2,100m. The proposed West Mundijong Urban Precinct is contained within the study area and comprises the landholdings west of Gangemi Road, to King Road, and north of Mundijong Road, to Leipold Road. The existing conditions are shown in Figure 2 and the cadastral information documented in Table 2.

Within and adjoining the site are several main drains including Manjedal Brook that flows south from the north eastern corner of the site and the along Mundijong Road to King. There are two 132kv transmission lines crossing the site with the eastern line in a formal easement. There is trunk water main crossing the middle of the property within a dedicated service corridor.

The area is currently used for broad acre farming being primarily for cattle grazing and equine establishments. It is characterised by large open paddocks with scattered trees, with dwellings located around the periphery. There are old clay pits on Lot 275 which are being rehabilitated.

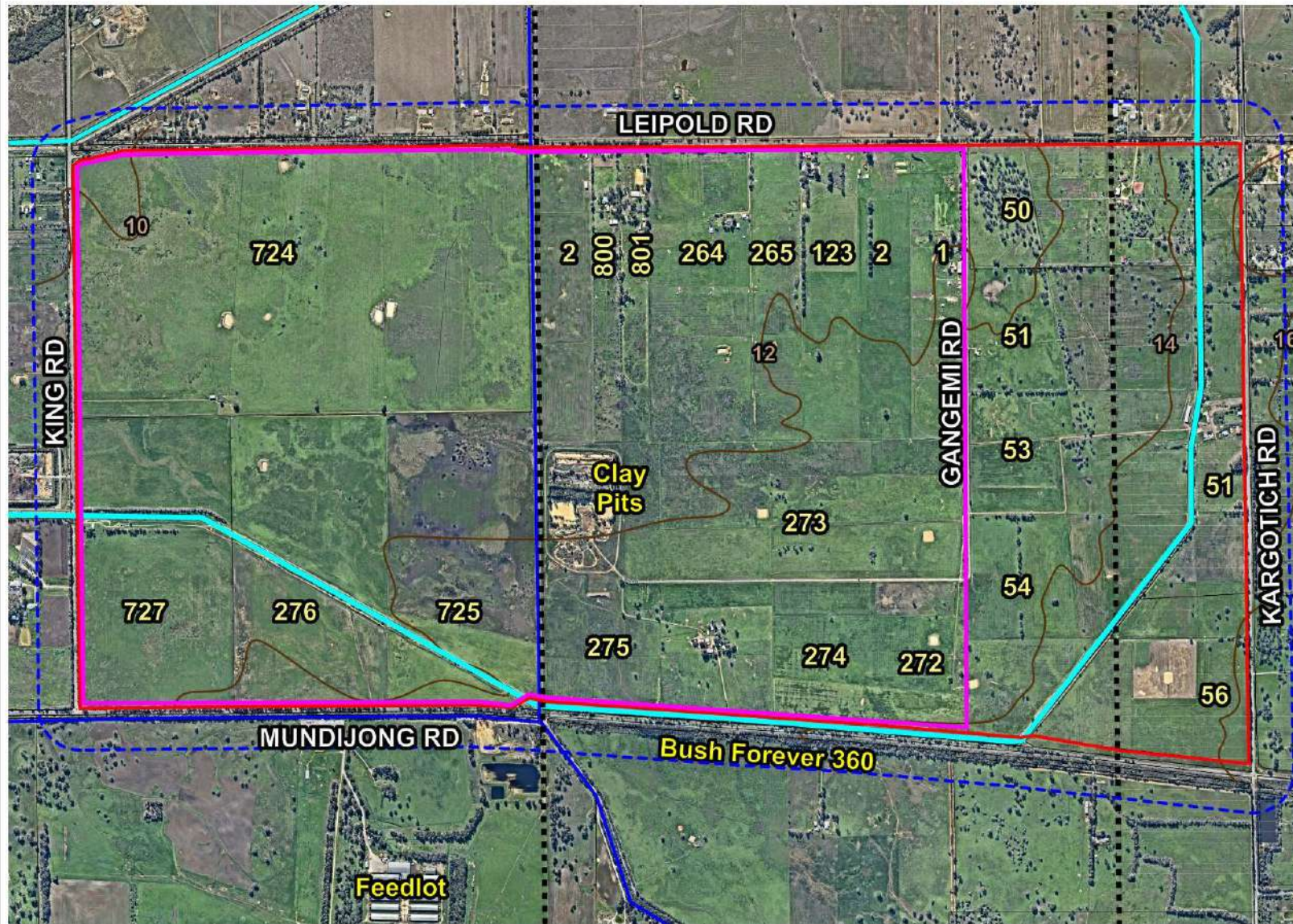
The four roads on the boundaries of the subject land are all sealed with Mundijong Road providing access to the Kwinana Freeway and South Western Highway. Kargotich Road is also a district distributor road extending from Lowlands Road, Mardella to Rowley Road, South Forrestdale. King Road also extends north to Orton Road and Leipold Road is a local sealed road.

There is scattered vegetation on the site and adjacent road reserves typically being Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) and Swamp Sheoak (*Casuarina obesa*). There are some areas of Melaleucas and planted gums for windbreaks and around dwellings and sheds. Bush Forever Site 360 extends along Mundijong Road.

The site has an elevation of between 10m AHD in the north western corner rising to 16m on the eastern boundary. Over the length of the site this is a gradient if less than 1%.

Table 2 Property Details

Number	Lot	Street	Area (ha)
	272	Mundijong Road	31.33
	273	Mundijong Road	13.37
	274	Mundijong Road	44.11
1087	275	Mundijong Road	46.72
	725	Mundijong Road	56.33
	726	Mundijong Road	58.99
771	727	Mundijong Road	58.96
729	724	King Road	158.42
467	2	Leipold Road	21.17
457	800	Leipold Road	10.60
447	801	Leipold Road	10.60
409	264	Leipold Road	46.90
	265	Leipold Road	22.58
389	123	Leipold Road	22.20
365	2	Leipold Road	24.34
331	1	Leipold Road	20.33
267	50	Leipold Road	36.43
	52	Gangemi Road	36.68
	53	Gangemi Road	35.32
	54	Gangemi Road	40.66
1164	51	Kargotich Road	28.56
	56	Kargotich Road	33.99



LEGEND

- STUDY AREA —
- SUBJECT LAND —
- 150m BUFFER - - -
- 2m CONTOURS —
- DRAIN —
- WATER PIPELINE —
- TRANSMISSION LINE - 133kv - - - - -

FIGURE 2
EXISTING CONDITIONS



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/23



geoffrey@lushfire.com.au
0418 954873

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

1.3 Bushfire Prone Land

All of the subject land and the surrounding area are designated as being bushfire prone land as shown in Figure 3. This designation triggers:

- The application of Australian Standard AS3959 Construction of Buildings in Bushfire Prone Areas under the Building Code of Australia;
- The provisions of the Planning and Development (Local Planning Schemes) Regulations 2015; and
- The application of State Planning Policy SPP3.7 Planning in Bushfire Prone Areas.

State Planning Policy SPP3.7 Planning in Bushfire Prone Areas provides in Clause 6.2 that any strategic planning proposal, that has or will, on completion, have a moderate BHL and/or where BAL-12.5 to BAL-29 applies, may be considered for approval where it can be undertaken in accordance with the following policy measures.

- a) the results of a bushfire hazard level assessment determining the applicable hazard level(s) across the subject land, in accordance with the methodology set out in the Guidelines.
- b) the identification of any bushfire hazard issues arising from the assessment; and
- c) clear demonstration that compliance with the bushfire protection criteria in the Guidelines can be achieved in subsequent planning stages.

1.4 Town Planning Framework

The subject land is zoned 'Rural' under the Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 and 'Rural' under the Metropolitan Region Scheme.

The Shire has prepared a new Local Planning Strategy which was endorsed by the Western Australian Planning Commission on the 18th March 2022. The Strategy Map is shown in Figure 4.

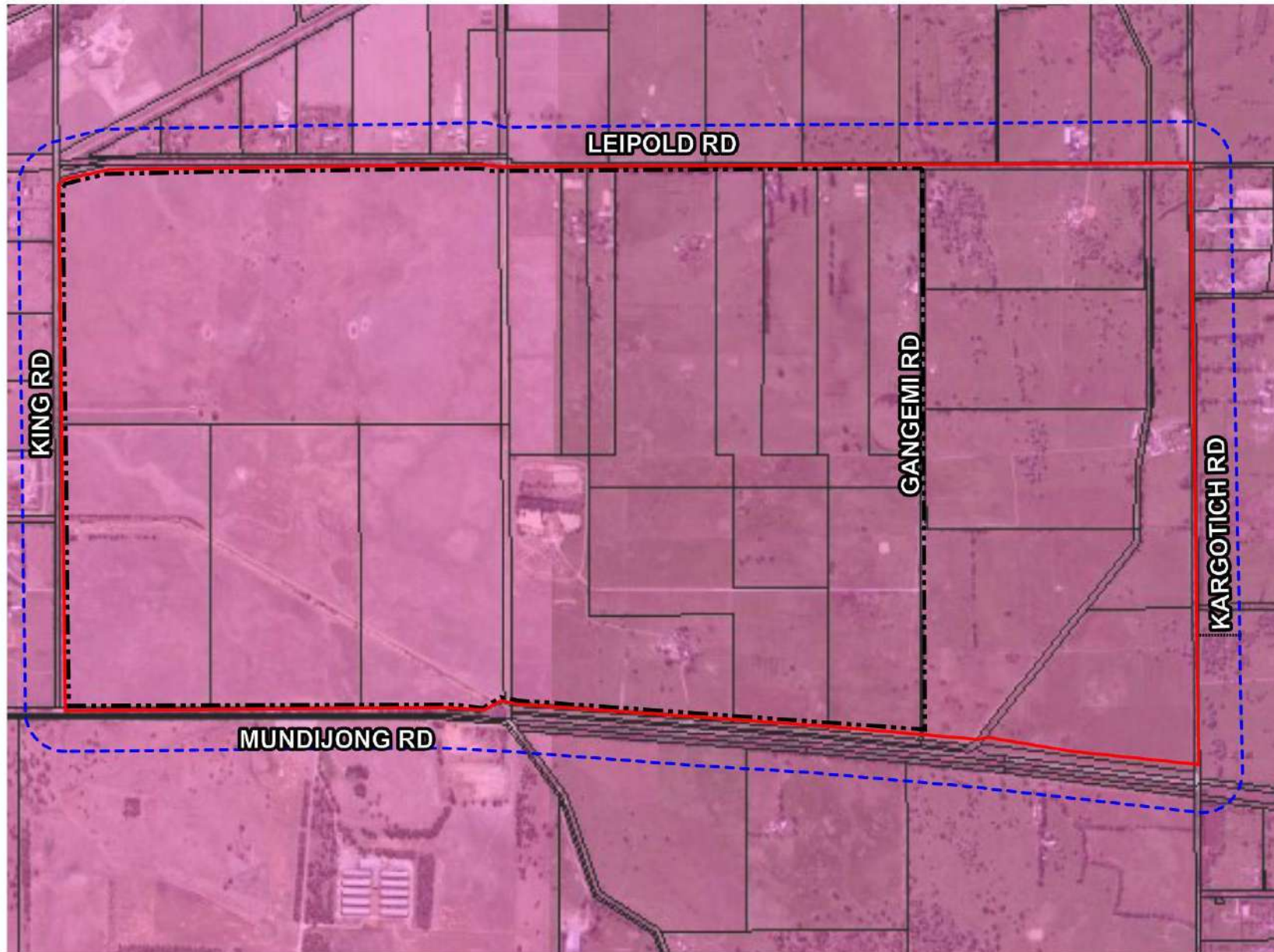
Natural Landscape and Bushfire Risk issues are contained in Section 5.4.1 and the objectives include to:

- Ensure the safety of the community from bushfire risk; and
- Achieve a balance between managing bushfire risk and preserving natural landscapes, the environment and biodiversity values

Table 26: of the Strategy has the following Strategy and Actions

STRATEGY	ACTION
d. Where development is proposed in the vicinity of bushland with regional or local values, there is a presumption that any buildings will be constructed to the appropriate Bushfire Attack Level (BAL).	4. Undertake bushfire hazard assessments as per SPP3.7 at structure planning, subdivision and development stages.
e. Not support the broad-scale clearing of vegetation as a means of addressing bushfire risk.	
f. Ensure future planning and development identified and appropriately manages bushfire risk.	

The land on the eastern side of Kargotich Road is designated in the Local Planning Strategy as 'Industry' and is subject to the West Mundijong Industrial Area – Structure Plan. This plan is shown in Figure 5 and was adopted by the Shire at its Meeting of the 15 March 2021.



LEGEND

- STUDY AREA —
- SUBJECT LAND
- 150m BUFFER
- BUSHFIRE PRONE LAND (2021)

FIGURE 3
BUSHFIRE PRONE LAND



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



geoffrey@lushfire.com.au

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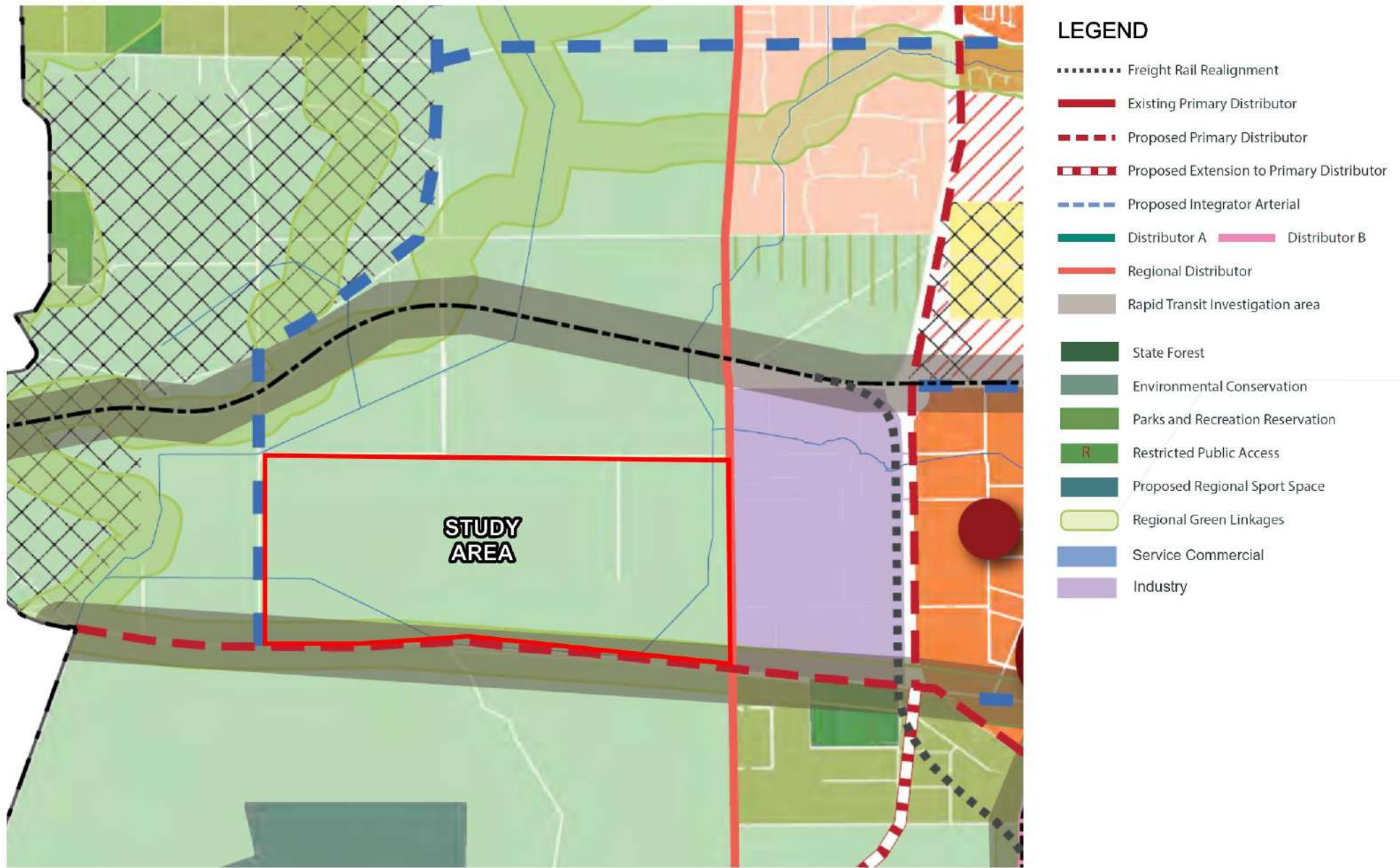


FIGURE 4
APPROVED PLANNING STRATEGY MAP



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



geoffrey@lushfire.com.au

0418 954873

Ordinary Council Meeting 11 December 2023



FIGURE 5
WEST MUNDIJONG STRUCTURE PLAN



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



geoffrey@lushfire.com.au

0418 954873

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

The key issues from these are:

- a) The classification of both Kargotich and Mundijong Roads which may limit opportunities for creating access into and from the subject land.
- b) Potential ecological linkages extending into the site;
- c) The possible revegetation of the proposed multiple use corridor on the eastern side of Kargotich Road; and
- d) The provision of road access in multiple directions.

1.5 Fire Control Notice

The Shire's 2020 / 2021 Fire Control Notice requires that:

On land greater than 1 acre (4047m²):

- Keep grasses below 150mm or if used for grazing ensure rotation of grazed and un-grazed to prevent large fire run.
- Trim all trees and bushes that overhang driveways, access ways and firebreaks to leave a 4 metre wide clearance and a clear vertical axis.
- Install firebreaks that are:
 - Immediately inside all external boundaries.
 - Immediately surrounding all agricultural buildings, sheds or group of buildings.
 - A minimum of 3 metres wide, but not wider than 5 metres.
- Maintain 20m asset protection zones around dwellings or as per your approved BAL/FMP assessment.
- Trim back all trees overhanging buildings.

On land less than 1 acre (4047m²):

- Cut all grass to less than 25mm in height.
- Trim all trees and bushes that overhang driveways, access ways and firebreaks to leave a 4 metre wide clearance and a clear vertical axis.

OR

- Install firebreaks that are:
 - Immediately inside all external boundaries.
 - Immediately surrounding all agricultural buildings, sheds or group of buildings.
 - A minimum of 3 metres wide, but not wider than 5 metres.
- Maintain 20m asset protection zones around dwellings or as per your approved BAL/FMP assessment.
- Trim back all trees overhanging buildings.

1.6 Proposed Development

In order to develop the land for urban purposes it will be necessary to first amend the Metropolitan Region Scheme and the Shire's Local Planning Scheme, followed by further detailed planning through structure planning, subdivision applications, and development applications.

The western portion of the subject land, being 647 hectares situated west of Gangemi Road comprising would be developed as medium density residential development. This would have an R20 zoning an average lot size of 450m² with associated open space, recreational areas and facilities, and neighbourhood amenities.

The land situated between Gangemi Road and Kargotich Road falls outside the MRS Amendment area for the proposed West Mundijong Urban Precinct. This land has nevertheless been assessed as part of this bushfire management plan because it abuts the subject land and may in future accommodate other uses which are compatible with the 1km buffer to the West Mundijong industrial area.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

2.0 Environmental Considerations

2.1 General

State Planning Policy 3.7 (SPP3.7) policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values. An Environmental Assessment was conducted by Aurora Environmental in 2019 which noted that:

- a) The entire study area is mapped as a Multiple Use wetland with an area of Conservation Category Wetland along Mundijong Road.
- b) There are no intact areas of native vegetation in the study area. The only native vegetation remaining comprises scattered paddock trees of Marri (*Corymbia calophylla*), Flooded Gum (*Eucalyptus rudis*) in low-lying areas and Swamp Sheoak (*Casuarina obesa*). Due to on-going low level agricultural uses in the study area, there are no areas of natural regeneration occurring.
- c) The study area does not contain any regionally significant vegetation and there are no Threatened Ecological Communities.
- d) Bush Forever Site 360 (Mundijong and Watkins Roads Bushland, Mundijong/Peel Estate) traverses the southern boundary of the study area.
- e) An environmentally sensitive area (ESA) encroaches into the study area and is attributable to the mapped conservation category wetland, Bush Forever site and TEC in the Mundijong Road reserve.
- f) A notional regional ecological linkage associated with Bush Forever Site 360 extends into the southern portion of the study area along Mundijong Road.
- g) The EPA has indicated that the area mapped as conservation category wetland (Manjedal Brook) be managed and protected by a minimum buffer of 50m.

The environmental features are shown in Figure 6.

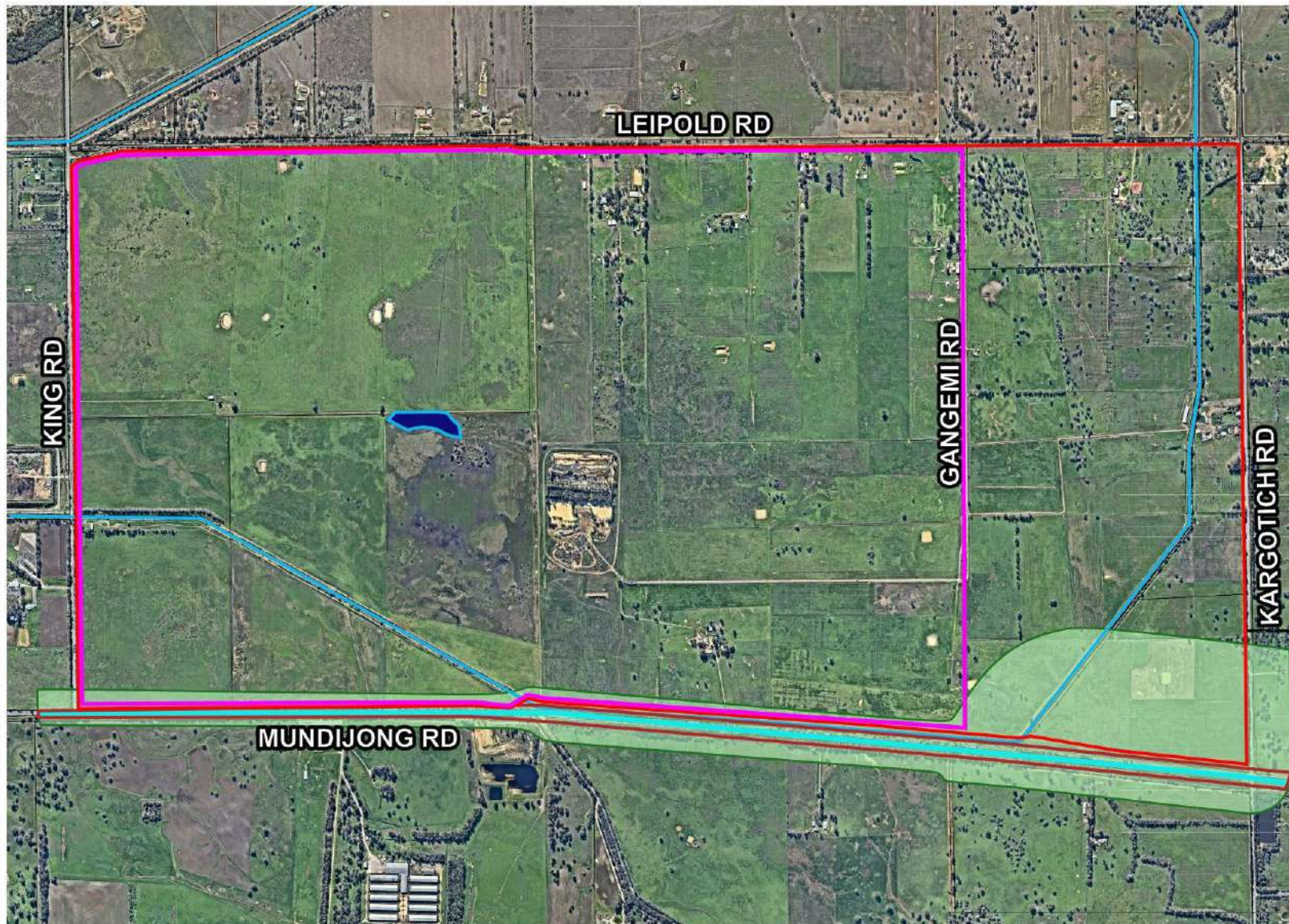
2.2 Clearing, Revegetation and Landscaping

The subject land is already predominantly cleared with only some scattered areas of paddock trees. The proposed development of:

- Medium to high density urban development on the western portion of the site necessitates the clear felling of trees/tree canopy and other flora within the development area for fill placement, drainage, geotechnical and numerous other civil engineering purposes.
- Service commercial/low density residential uses on the eastern portion of the site may allow for some minor tree retention due potentially larger lot sizes.

The potential revegetation areas may include:

- The 50m buffer to the Conservation Category wetland along Mundijong Road;
- The other external road reserves being King, Leipold and Kargotich Roads may have more continuous vegetation;
- The minor ecological linkages extending from the West Mundijong structure plan area;
- The proposed multiple use corridor on the eastern side of Kargotich Road; and
- The existing drainage lines as "living streams." However, depending upon the revegetation specifications these may not become classified vegetation.



LEGEND

- STUDY AREA —
- SUBJECT LAND —
- 105m BUFFER - - -
- ENVIRONMENTALLY SENSITIVE AREA
- BUSH FOREVER SITE 360
- CONSERVATION CATEGORY WETLAND
- DRAINAGE LINE —
- WETLAND (Not separately classified noting that the whole site is classified as a 'multiple use' wetland)

FIGURE 6
ENVIRONMENTAL FEATURES



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



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Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

3.0 Bushfire Assessment Results

3.1 Assessment Inputs - Vegetation Classification

All vegetation within 150m of the site / proposed development was classified in accordance with:

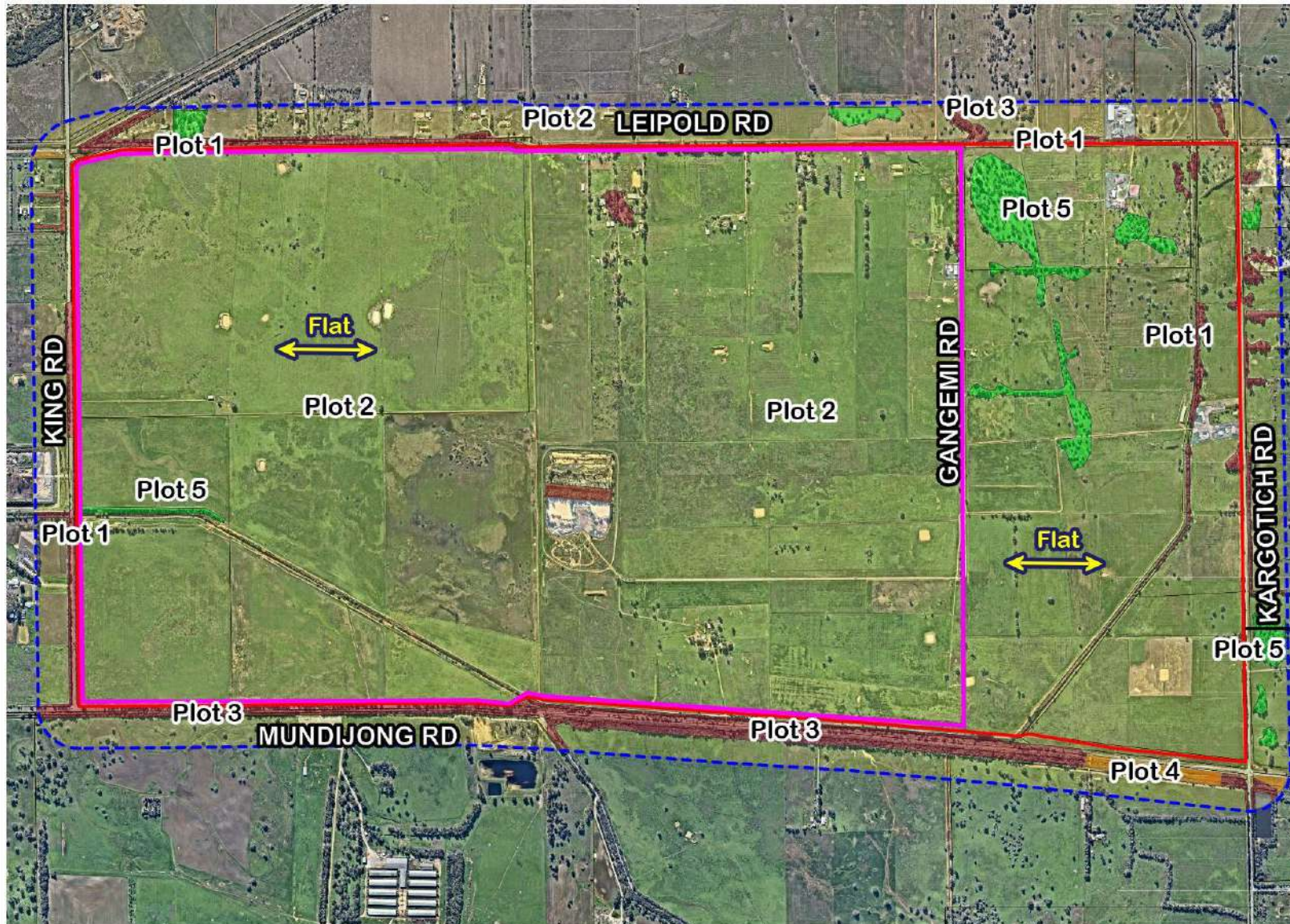
- Clause 2.2.3 of Australian Standard AS3959 Construction of Buildings in Bushfire Prone Areas;
- The Visual Guide for Bushfire Risk Assessment in Western Australia; and
- Applicable Fire Protection Australia BPAD Practice Notes.

It is noted that AS3959 (2018) commenced operation from the 1st May 2019 and this alters the classification of woodland and scrub. Woodlands are now defined as having a grassy understorey with isolated shrubs while Scrub vegetation (tall heath) has been increased from 4 to 6m height.

The vegetation plots are shown in Figure 7 and described in Table 3. The vegetation photographs are shown in Appendix 1. Given the large area of the subject land the vegetation plots have been generalised.

Table 3 Vegetation Descriptions

Vegetation Plot	Classification	Description
1	Class A Forest	This is primarily linear vegetation along the road verges. Both sides of the road are contiguous as there is often only a 10m separation distance. The total width may be 20m in width but is adjacent to other classified vegetation which is typically grassland. This plot also includes boundary windbreaks which are not a single line of trees and also parts of the drainage lines.
2	Class G Grassland	This is generally pasture within the subject land and the surrounding rural properties which is being used for grazing.
3	Class A Forest	This is more substantial areas of vegetation and in particular the bush forever site along Mundijong Road.
4	Class D Scrub	These area areas of scrub vegetation up- to 6m in height generally associated with the drainage areas typically with Melaleucas and in particular parts of the bush forever site along Mundijong Road.
5	Class B Woodland	The woodland areas are groups of paddock trees which are generally Sheoaks with a grassland understorey that is actively being grazed by stock.



LEGEND

- STUDY AREA ———
- SUBJECT LAND ———
- VEGETATION ASSESSMENT AREA (150m from boundary of the study area) - - - - -
- UPSLOPE ➔
- VEGETATION CLASSIFICATION
- CLASS A FOREST ■
- CLASS B WOODLAND ■
- CLASS D SCRUB ■
- CLASS G GRASSLAND ■
- EXCLUDED 2.2.3.2(f) ■

Note

While there may be local variations, the slope across the total site is less than 1% and so is considered to be flat.

Location	Mundijong, King, Leipold, Kargotich Roads
Assessment Date:	16/09/2020
Prepared by:	G Lush
Accreditation Level:	Level 2
Accreditation Number:	BPAD 27682
Accreditation Expiry Date:	February 2023
Date of Aerial Photo:	May 2020

**FIGURE 7
VEGETATION CLASSIFICATIONS**



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



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3.2 Assessment Outputs - Bushfire Hazard Level

The bushfire hazard primarily relates to the vegetation on the site, the type and extent (area) of vegetation and its characteristics. The methodology for determining the bushfire hazard level is contained in the Guidelines for Planning in Bushfire Prone Areas (Section 4.1 and Appendix 2).

The classifications are as follows:

- | | |
|-----------------|---|
| Extreme Hazard | <ul style="list-style-type: none"> • Class A Forest • Class B Woodland (05) • Class D Scrub • Any classified vegetation with a greater than 10 degree slope |
| Moderate Hazard | <ul style="list-style-type: none"> • Class B Open Woodland (06), Low Woodland (07) Low Open Woodland (08) Open Shrubland (09) * • Class C Shrubland • Class E Mallee/Mulga • Class G Grassland including sown pasture and crops • Vegetation that has a low hazard level but is within 100 metres of vegetation of vegetation classified as a moderate or extreme hazard. |
| Low Hazard | <ul style="list-style-type: none"> • Low threat vegetation, may include the following: areas of maintained lawns, golf courses, public recreation reserves and parklands, vineyards, orchards; cultivated gardens, commercial nurseries, nature strips and windbreaks. • Managed grassland in a minimal fuel condition meaning that there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short cropped grass to a nominal height of 100mm. • Non vegetated areas including waterways; roads; footpaths; buildings or rock outcrops. |

The modified vegetation classifications shown in Figure 9 and are based upon the assumptions in Section 2.2 regarding clearing and revegetation. The bushfire hazard assessment levels for the expected developed site are shown in Figure 10.

Most of the subject land is expected to have a low bushfire hazard level when developed. Depending upon the revisions to the bushfire prone mapping the land which is shown as having a low bushfire hazard level, may not be designated as being bushfire prone. Consequently, subdivision and development of that area would not be subject to State Planning Policy SPP3.7 Planning in Bushfire Prone Areas or the Bushfire Protection Criteria.

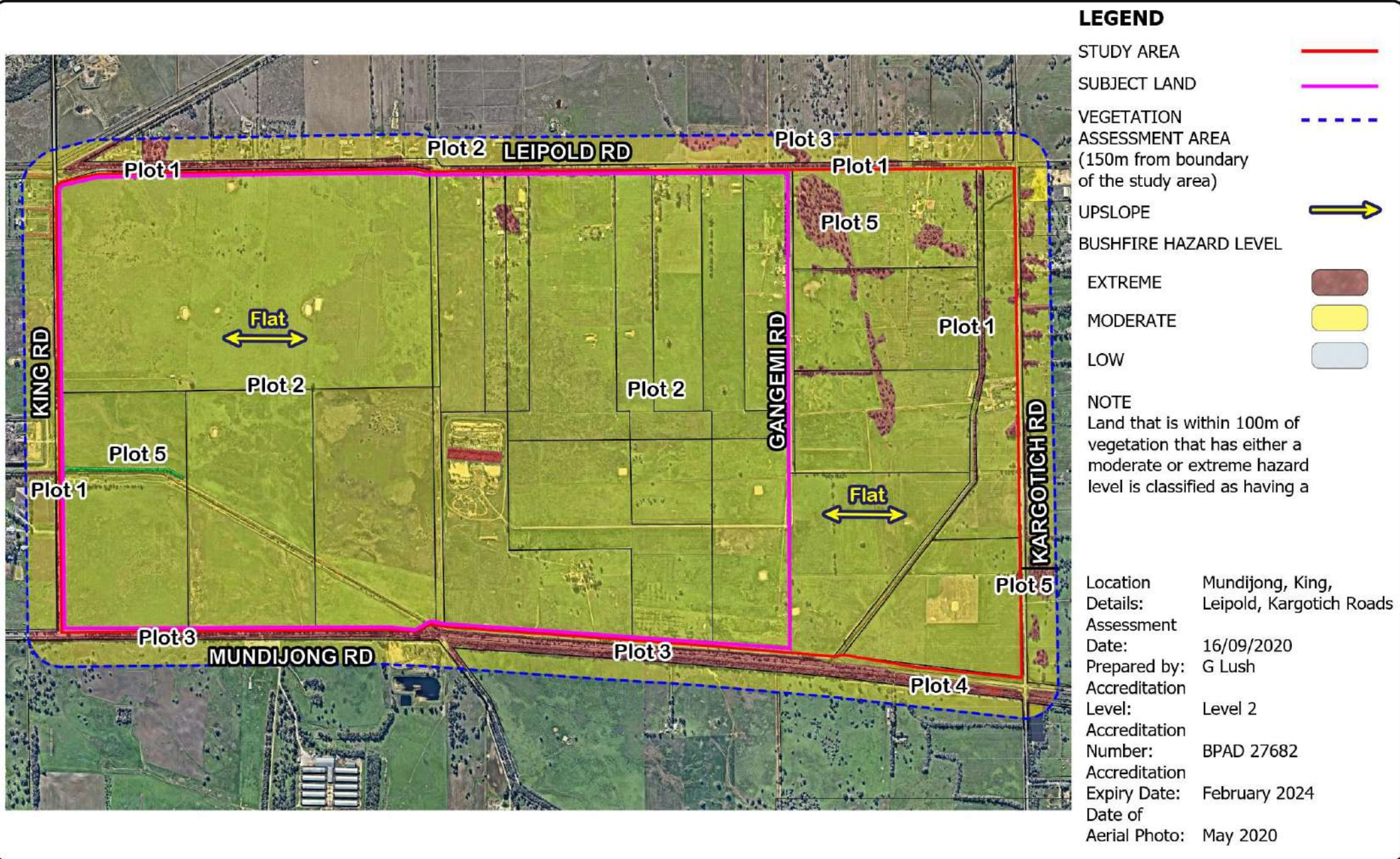


FIGURE 8
BUSHFIRE HAZARD LEVEL
UNDEVELOPED SITE



Ref No 20-050

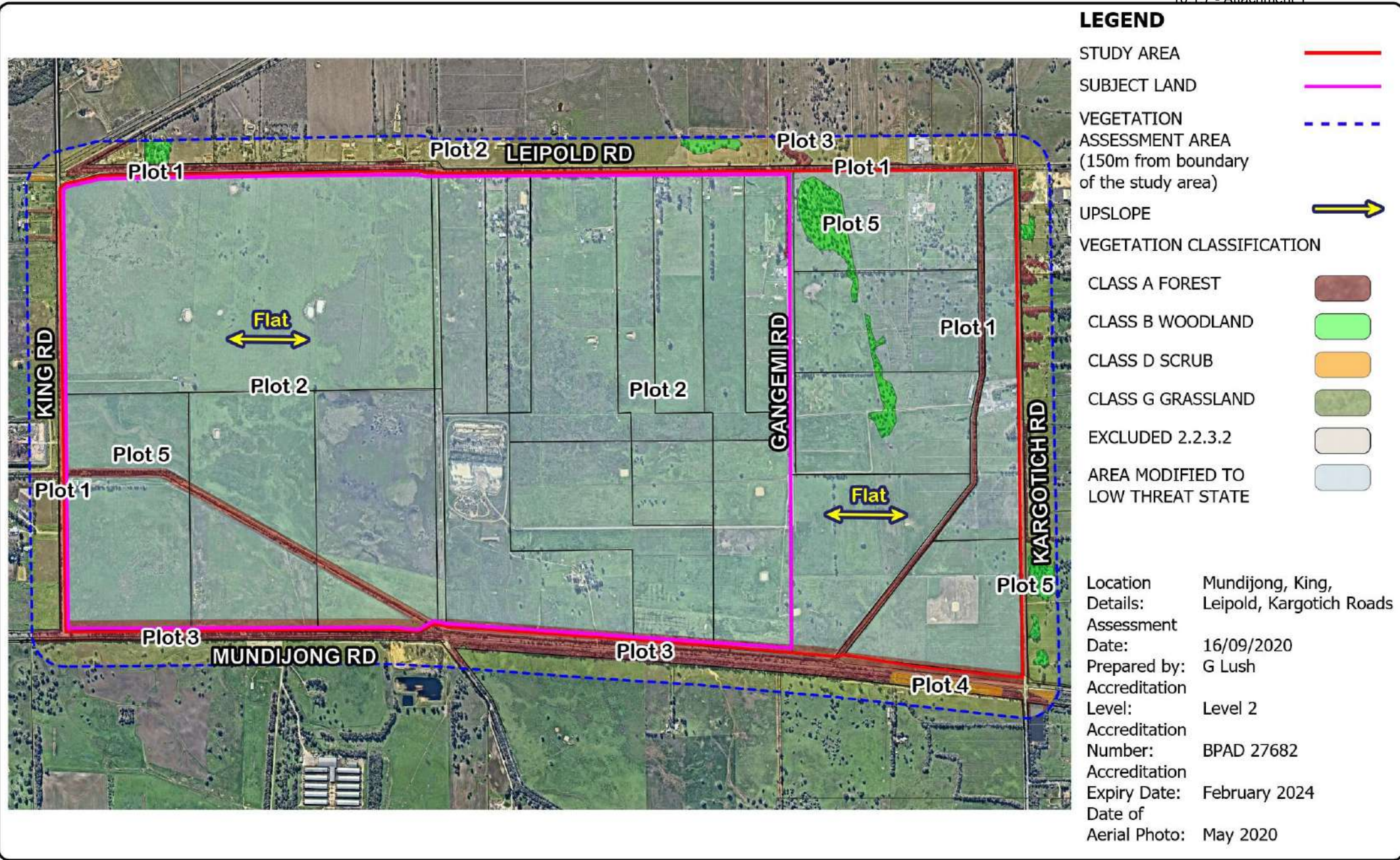
Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



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Ordinary Council Meeting 11 December 2023



**FIGURE 9
MODIFIED VEGETATION CLASSIFICATION**



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



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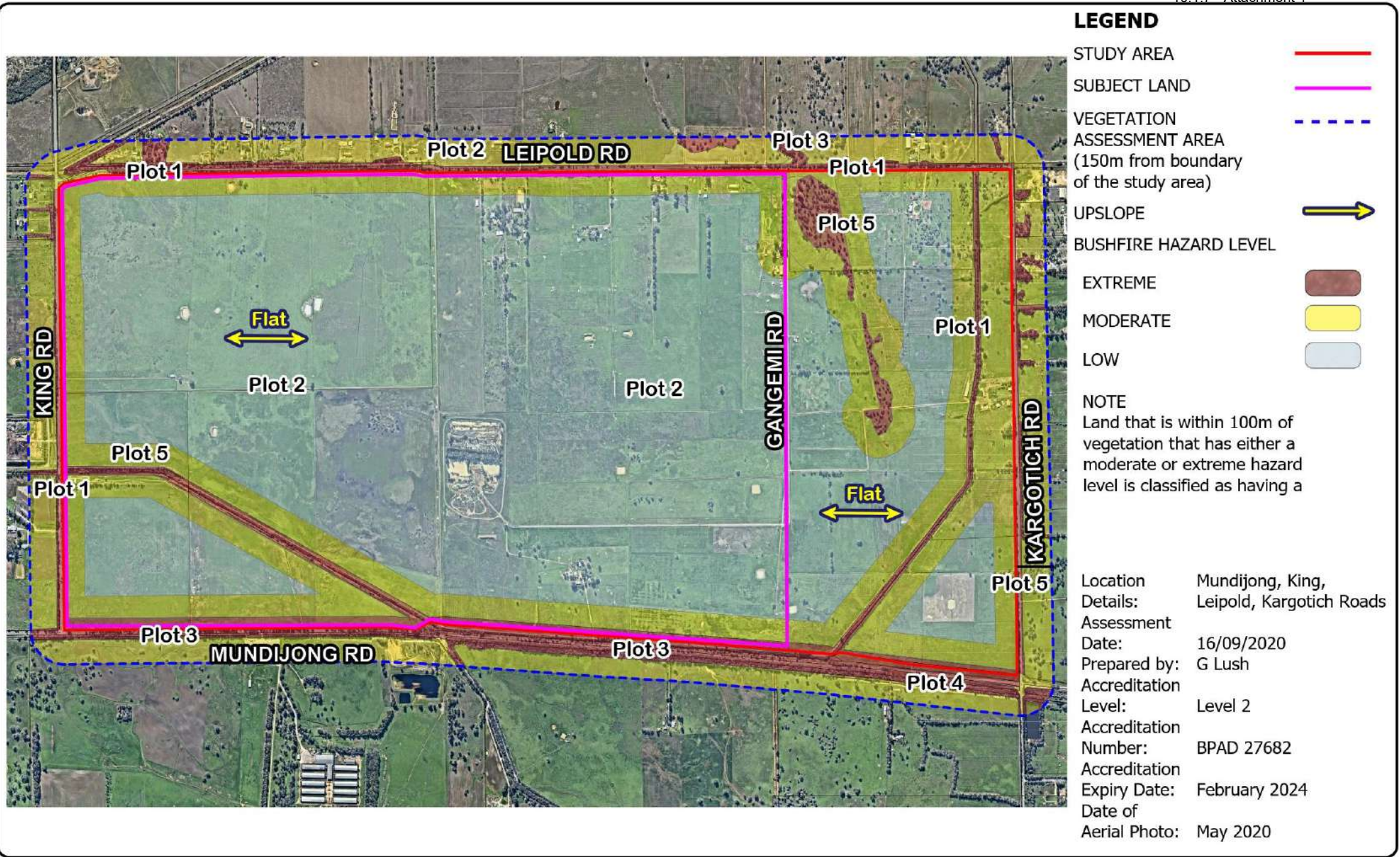


FIGURE 10
BUSHFIRE HAZARD LEVEL
DEVELOPED LAND



Ref No 20-050

Rev	Description	Date
A	Preliminary	10/09/20
B	Council Mods	06/10/21
C	Client Mods	05/05/22



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Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

4.0 Identification of Bushfire Hazard Issues

4.1 District Context

The relationship of the subject land to the surrounding district is shown in Figure 1. The proposed development is introducing substantial values (property and people) which must be protected from the risk posed by the potential bushfire hazard. Bushfires occur regularly within the locality and pose a threat to life and property.

A bushfire can have a number of ignition sources which can originate from either natural or human causes such as:

- Lighting strikes;
- Unattended camp fire;
- Discarded match or cigarette;
- Dry grass in contact with vehicle exhausts;
- Sparks from grinders, slashing or other mechanical operations;
- Backyard rubbish burning;
- Hazard reduction burns;
- Powerlines sparking in strong winds or falling;
- Pole top fires; and
- Deliberate arson.

The surrounding land is a mixture of urban, rural residential, and rural land uses. The rural land uses are typically large properties used for broad acre grazing. The surrounding land is predominantly grassland with dispersed bushland which is both in blocks and also linear bushland along road reserves.

The most significant area of bushland within the locality is situated approximately 2.5kms south west of the site and this is approximately 900 hectares.

The primary bushfire hazard is from a fast moving grass fire which can still have the potential to be a destructive fire threatening life and property. The likelihood of this occurring increases when there is a high chance of ignition due to the amount of fuel, the extent of vegetation curing (drying out) the temperature; relative humidity and wind speed.

The main bushfire threat would be a fire from the south or south west which has the potential to be large scale "landscape" fire which extends for over a kilometre and is likely to occur over lengthy period which could be several days.

There is excellent district access to the subject land from multiple directions on district distributor roads.

4.2 Site Issues

At the local level within the subject land the major bushfire management issue is the interface with the existing and proposed bushland areas. The most significant of these is the proposed 50m wide revegetation buffer adjacent to Mundijong Road conservation category wetland, Bush Forever Site.

Ensuring that the development is able to have multiple access connections to the surrounding roads is also critical. This also includes crossings of the existing drains especially in the south western and south eastern corners of the site.

The most efficient and cost effective fire management measure is to separate development from hazard areas. The greater the separation distance the lower the hazard or BAL rating for the development. This principle is reflected in the SPP 3.7 and the Guidelines by seeking:

- To locate development in areas with either a low or moderate hazard level rating; and/or

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

- To ensure that a maximum BAL-29 rating is applied to any development.

The anticipated bushfire hazard levels for the completed development are shown in Figure 9.

The areas within the site with an extreme hazard level rating are Plot 5 (Woodland) and the potential revegetated drainage lines. These have a combined area of approximately 35 hectares which is 4% of the total site.

The largest area within the site with an extreme hazard rating is Plot 5 located between Gangemi and Kargotich Roads. This has an area of approximately 9 hectares which is 1% of the total site. This contains scattered Sheoaks in paddocks to 15m height with less than 30% foliage coverage over grassland. While a 'woodland' is still classified as having an extreme hazard rating, it is easier to manage and incorporate into development than a forest with dense understorey vegetation. As Plot 5 has been actively grazed the vegetation already has had its lower limbs removed (under pruned) as shown in Photos 22, and 37, the hazard has been further reduced in a similar manner to that promoted in the specifications for an asset protection zone.

The extent to which development can occur within or adjacent to the woodland area (Plot 5) would depend upon the detailed subdivision and development design.

This illustrates that the majority of the subject is expected to have a Low Hazard rating with a Moderate Hazard rating.

4.3 High Risk Land Uses

High risk land uses are those uses which may lead to the potential ignition, prolonged duration and/or increased intensity of a bushfire. Such uses may also expose the community, fire fighters and the surrounding environment to dangerous, uncontrolled substances during a bushfire event. Examples of high risk land uses include service stations, landfill sites, bulk storage of hazardous materials, fuel depots.

Depending upon the specific land use provisions, it may be possible that high risk land uses are permissible within the service commercial area.

SPP 3.7 requires that a development application for any high risk land use is to be accompanied by a Bushfire Management Plan jointly endorsed by the local government and the Department of Fire and Emergency Services. This may include a risk management plan that addresses bushfire risk management measures for any flammable on-site hazards.

These provisions only apply when the development site is designated as being bushfire prone and has a rating of between BAL-12.5 and BAL-29.

4.4 Vulnerable Land Uses

Vulnerable land uses are uses where it is considered that occupants have a lesser capacity to respond in the event of a bushfire, and which may present evacuation challenges. These are generally associated with hospitals, nursing homes and retirement villages. However, they also include any form of tourist accommodation, places of assembly, family day care centres, schools etc.

It is expected that the residential components of the development may include various vulnerable land uses.

SPP 3.7 requires that a development application for a vulnerable land use is to be accompanied by a Bushfire Management Plan jointly endorsed by the local government and the Department of Fire and Emergency Services. This is also to have a Bushfire Emergency Evacuation Plan prepared for the proposal.

These provisions only apply when the development site is designated as being bushfire prone and has a rating of between BAL-12.5 and BAL-29.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

5.0 Assessment Against the Bushfire Protection Criteria

5.1 Compliance Table

A summary of the compliance with the Bushfire Protection Criteria as contained in Version 1.4 (Dec 2021) of the Guidelines for Planning in Bushfire Prone Areas is documented in Table 4. This demonstrates how the Criteria are expected to be complied with at the various planning stages being:

- The amendment to the Local Planning Scheme;
- A subdivision application; and
- A development application.

Version 1.4 of the Guidelines applies the Acceptable Solutions based upon the following planning stages:

- SP** – Strategic planning proposal and structure plan where the lot layout is not known
- Sb** – Structure plan where the lot layout is known and subdivision application
- Dd** – Development application for a single dwelling, ancillary dwelling or minor development
- Do** – Development application for any other development

Table 4 demonstrates how the Criteria are expected to be complied with at the various planning stages being:

- The South Metropolitan Peel Sub-Regional Planning Framework (SMPPRF);
- The amendment to the Metropolitan Region Scheme;
- The amendment to the Local Planning Scheme;
- The preparation of the District Structure Plan;
- A subdivision application; and
- A development application.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

Table 4 BPC Compliance

Development Stage Requirement	Metropolitan Region Scheme Amendment	Local Planning Scheme Amendment	Structure Plan	Subdivision Application	Development Application
Element 1 Location					
A1.1 Development Location	The majority of the land (95%) is expected to have a moderate or low hazard level when developed. Development can achieve a BAL-29 rating. The surrounding land is generally cleared farming land with no major bushland areas.	As per Region Scheme.	Can require the subdivision design to be based upon BAL-12.5 setbacks for new development. A bushfire management plan would be prepared to support the structure plan.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim measures.	Approval of any development application is to have regard to SPP 3.7 and the Guidelines and can control the siting of development.
Element 2 Siting and Design					
A2.1 Asset Protection zone	Can be provided in accordance with a BAL-29 setback. The APZ can potentially be increased to accord with design objective for a lower BAL rating.	Can stipulate as a condition of development that it be setback in accordance with a BAL-29 rating.	Can consider the inclusion of the APZ within each lot or incorporation of other land such as a road reserve.	Would be in accordance with the structure plan and bushfire management plan.	Approval of any development application is to have regard to SPP 3.7 and the Guidelines and can control the siting of development in accordance with an approved bushfire management plan.
Element 3 Vehicular Access					
A3.1 Public Road	The existing site is bounded by four constructed roads and has district access in multiple directions.	The existing site is bounded by four constructed roads and has district access in multiple directions.	The internal road design is expected to comply with design requirements and have external access in multiple directions.	The road design is to comply with design requirements. Interim access for staging to be provided by public road connections.	Is not applicable.
A3.2a Multiple access routes (SP Sb Do)	The site has multiple access routes at both the district and local level.	The site has multiple access routes at both the district and local level.	At both the district and local level the area has multiple external access routes. Internal access routes to be provided connecting to the external road network.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim access measures.	Approval of any development application is to have regard to access under an approved bushfire management plan

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

Development Stage Design Requirement	Metropolitan Region Scheme Amendment	Local Planning Scheme Amendment	Structure Plan	Subdivision Application	Development Application
A3.2b Emergency access way (SP Sb Do)	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim access measures.	Is not applicable.
A3.3 Through-roads (SP Sb)	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.
A3.4a Perimeter roads (SP Sb)	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan.	Is not applicable.
A3.4b Fire service access route (SP Sb)	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim access measures.	Is not applicable.
A3.5 Battle-axe access legs (Sb)	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.
A3.6 Private driveways (Dd Do)	Is not applicable.	Is not applicable.	Is not applicable.	Is not applicable.	It may apply to low density lots in the eastern portion of the site.
A3.7 Fire Service Access Route	Is not applicable.	Is not applicable.	It may be applicable depending upon the subdivision design.	Would be in accordance with the structure plan and bushfire management plan. Any staging would require interim access measures.	Is not applicable.
Element 4 Water					
A4.1 Identification of future water supply (SP)	A reticulated water supply will be required.	A reticulated water supply will be required.	Can consider if any additional hydrants are required.	A reticulated water supply will be required.	Building permit application will assess water supply for structural fire fighting.
A4.2 Provision of water for firefighting purposes Sb Dd Do	A reticulated water supply will be required.	A reticulated water supply will be required.	Can consider if any additional hydrants are required.	A reticulated water supply will be required.	Building permit application will assess water supply for structural fire fighting.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

Development Stage Requirement	Metropolitan Region Scheme Amendment	Local Planning Scheme Amendment	Structure Plan	Subdivision Application	Development Application
High Risk Land Uses					
Proposed high risk land uses need special consideration.	The subject land is potentially suitable for minor high risk uses normally associated with urban development, such as service stations. Major uses are likely to be located in the West Mundijong Industrial Area.	Can be controlled through zoning and development provisions.	Can be controlled through the provisions of any structure plan.	Is not applicable.	Can require a BMP and risk evaluation plan.
Vulnerable Land Uses					
Proposed vulnerable land uses need special consideration.	The subject land is potentially suitable for vulnerable land uses.	Can be controlled through zoning and development provisions.	Can be controlled through the provisions of any structure plan.	Is not applicable.	Can require a BMP and risk evacuation plan.

Land Bounded by Mundijong, Kargotich, Leipold and King Roads, Oldbury

6.0 Conclusion

This report demonstrates and/or identifies:

- a) The existing hazard level is generally moderate due to the existing grassland;
- b) The hazard level on the subject land will be reduced and permanently altered by the site being developed.
- c) The developed site is expected to generally have a low hazard level.
- d) Areas most suitable for land use intensification where the bushfire hazard is low or moderate upon completion.
- e) Conservation areas including threatened ecological communities (TECs), Bush Forever, nature reserves, and wetlands that may constrain the clearing of vegetation to manage or reduce the BAL rating.
- f) The Bushfire Protection Criteria in the Guidelines can be achieved now or in subsequent planning stages.

The proposal complies with the objectives of State Planning Policy 3.7 as:

1. It avoids any increase in the threat of bushfire to people, property and infrastructure.

The proposed development is likely to reduce the existing bushfire hazard within the site as the majority of the land will have a low hazard level and may no longer be classified as being bushfire prone land.

2. It reduces vulnerability to bushfire through the identification and consideration of bushfire risks in the design of the development and the decision-making process.

The bushfire hazard and risks have been identified and assessed in this report.

3. The design of the subdivision and the development takes into account bushfire protection requirements and includes specific bushfire protection measures.

The proposed development will be able to comply with the Bushfire Protection Criteria.

4. Achieves an appropriate balance between bushfire risk management measures and biodiversity, conservation values, and environmental protection.

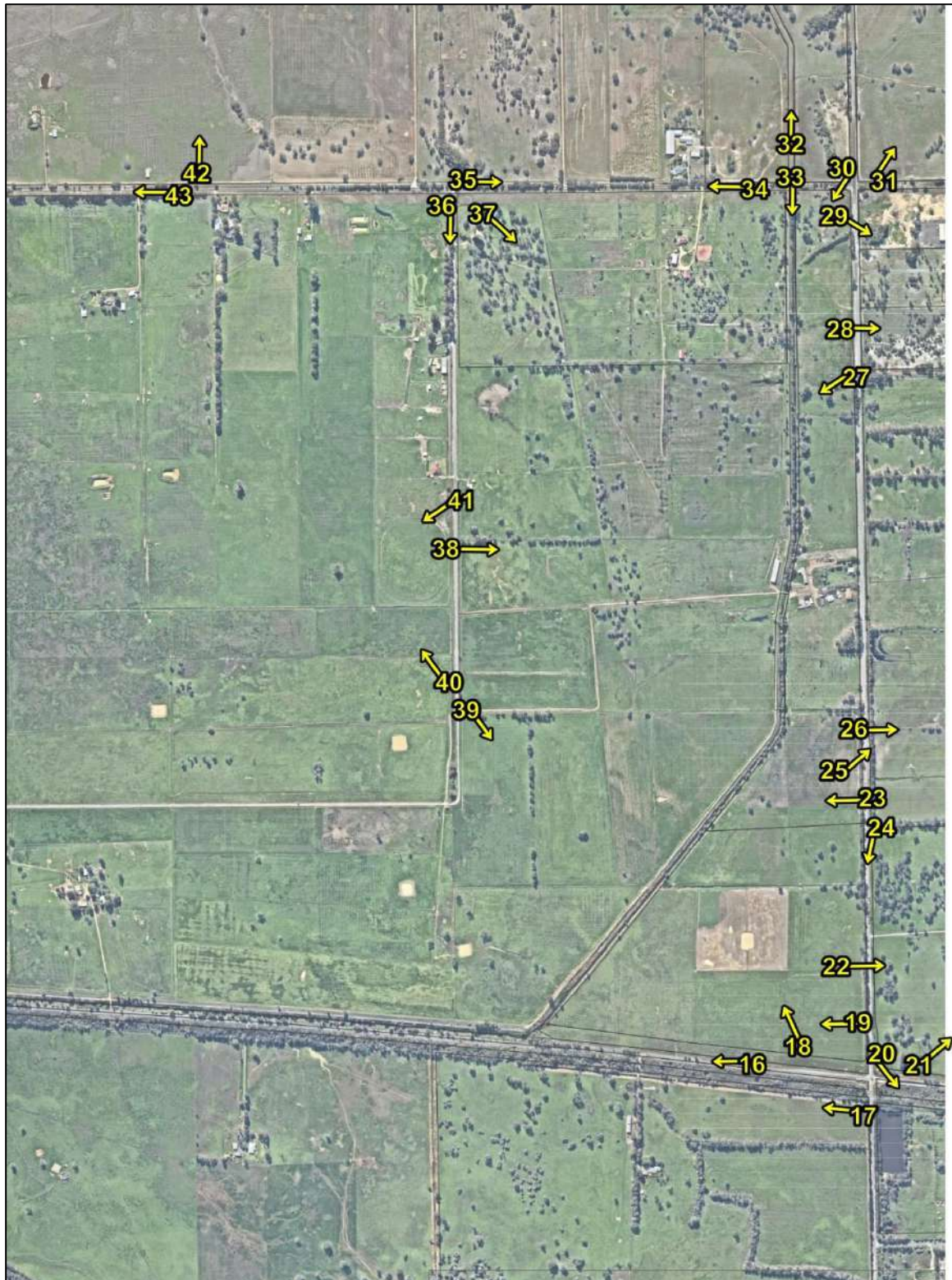
The scattered vegetation on the site which is to be cleared for any development does not have any significant conservation value. The proposed conservation buffers to the wetlands will be incorporated into any subsequent bushfire assessment and management plan.

Appendix 1 - Vegetation Photographs



Photograph Locations Sheet 1

Appendix 1 - Vegetation Photographs



Photograph Locations Sheet 2

Appendix 1 - Vegetation Photographs

Photo 1 Plot 2

Vegetation Classification

Class G Grassland – Tussock grassland G-22

Description

Grassland along Water Corporation drain



Photo 2 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Photo 3 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 4 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 5 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Discontinuous linear forest along main drain. Variable height to 18m, Eucalypts and Sheoaks with shrub or grassland understorey.



Photo 6 Plot 5

Vegetation Classification

Class B Woodland - Woodland B-05

Description

Discontinuous linear vegetation along main drain. Variable height to 10m, with grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 7 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main King Road. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The road reserve is 20m wide and so the trees on either side are considered to be contiguous.



Photo 8 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Photo 9 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Appendix 1 - Vegetation Photographs

Photo 10 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Photo 11 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Photo 12 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Appendix 1 - Vegetation Photographs

Photo 13 Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. Eucalypts to 18m, with more than 30% foliage coverage and shrub or grassland understorey. The trees on either side of the road are considered to be contiguous.



Photo 14 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along main Lightbody Road. Eucalypts to 18m, with Sheoaks more than 30% foliage coverage and shrub or grassland understorey. The road reserve is 20m wide and so the trees on either side are considered to be contiguous.



Photo 15 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land. Photo shows water main pipeline and transmission line.



Appendix 1 - Vegetation Photographs

Photo 16 Plot 4

Vegetation Classification

Class D Scrub - Closed scrub D-13

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. This section contains scrub being a mixture of Wattles and Sheoaks with dense understorey vegetation.



Photo 17 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land. Plot 4 vegetation on the right hand side.



Photo 18 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 19 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Photo 20 Plot 4

Vegetation Classification

Class D Scrub - Closed scrub D-13

Description

Linear vegetation along main Mundijong Road and adjacent land being 40m wide. This section contains scrub being a mixture of Wattles and Sheoaks with dense understorey vegetation.



Photo 21 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Appendix 1 - Vegetation Photographs

Photo 22 Plot 5

Vegetation Classification

Class B Woodland - Woodland B-05

Description

Scattered Sheoaks in paddocks to 15m with less than 30% foliage coverage over grassland.



Photo 23 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Photo 24 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Kargotich Road but not always on both sides of the road. Eucalypts and Sheoaks to 18m, with more than 30% foliage coverage and shrub or grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 24 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Kargotich Road but not always on both sides of the road. Eucalypts and Sheoaks to 18m, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 26 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 27 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 28

Plot 2

Vegetation Classification

Class G Grassland – Tussock grassland G-22

Description

Unmanaged grassland area to 0.5m height.



Photo 29

Plot 3

Vegetation Classification

Class A Forest - Open forest A-03

Description

Eucalypts to 22m, with more than 30% foliage coverage and Melaleuca scrub on the eastern side of Kargotich Road.



Photo 30

Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 31 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 32 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Photo 33 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Discontinuous linear forest along drain. Variable height to 15m, Eucalypts and Sheoaks with shrub or grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 34 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, Sheoaks or Melaleucas, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 35 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, Sheoaks or Melaleucas, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 36 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Gangemi Road but not always on both sides of the road. Eucalypts and Sheoaks to 18m, with more than 30% foliage coverage and shrub or grassland understorey.



Appendix 1 - Vegetation Photographs

Photo 37 Plot 5

Vegetation Classification

Class B Woodland - Woodland B-05

Description

Scattered Sheoaks in paddocks to 15m with less than 30% foliage coverage over grassland.



Photo 38 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land. Windbreak on the left is classified as it is not a single line of trees.



Photo 39 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.



Appendix 1 - Vegetation Photographs

Photo 40 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing pasture areas within the
subject land.



Photo 41 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing pasture areas within the
subject land.



Photo 42 Plot 2

Vegetation Classification

Class G Grassland – Sown
pasture G-26

Description

Gazing areas on surrounding
land.



Appendix 1 - Vegetation Photographs

Photo 43 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, Sheoaks or Melaleucas, with more than 30% foliage coverage and shrub or grassland understorey.



Photo 44 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land. Transmission line and drain also shown.



Photo 45 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing areas on surrounding land.



Appendix 1 - Vegetation Photographs

Photo 46 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, and Sheoaks with more than 30% foliage coverage and shrub or grassland understorey.



Photo 47 Plot 1

Vegetation Classification

Class A Forest - Open forest A-03

Description

Linear vegetation along Leipold Road but not always on both sides of the road. Sections with Eucalypts, and Sheoaks with more than 30% foliage coverage and shrub or grassland understorey.



Photo 48 Plot 2

Vegetation Classification

Class G Grassland – Sown pasture G-26

Description

Gazing pasture areas within the subject land.

