2 June 2022

Our Ref: HOM CAR/220602LWAPC_Updated MRS Request Final

The Chairman
Western Australian Planning Commission
Locked Bag 2506
PERTH WA 6001

Attention: Mr Anthony Muscara & Mr Brett Pye

Dear Chairman

RE: PROPOSED AMENDMENT TO THE METROPOLITAN REGION SCHEME LOT 30 (NO.496) SOLDIERS ROAD, CARDUP

Burgess Design Group, on behalf of our client, Land Group WA Pty Ltd, writes to the Western Australian Planning Commission regarding the proposed *Metropolitan Region Scheme* (MRS) Amendment request to rezone the subject land from 'Rural' to 'Urban' with a concurrent amendment to the *Shire of Serpentine-Jarrahdale Town Planning Scheme No.2* (TPS2) to rezone the land from 'Rural' to 'Urban Development'.

PURPOSE

The proposed MRS amendment and concurrent local planning scheme amendment will facilitate the ultimate development of the subject land for urban purposes to complement the existing residential development immediately to south and southeast of the site. The rezoning and development will take advantage of the readily available and significantly developing servicing infrastructure in the area.

It is also noted that the State Government has planned and is in the process of delivering over a billion dollars of infrastructure projects in the locality due to the areas' significant growth and development over the last decade.

HISTORY OF PROPOSAL

The original MRS Amendment request for the subject site was submitted 13 December 2016. This submission followed significant consultation with Officers of the then Department of Planning in relation to the timing of the MRS Amendment Request.

The subject site was identified as 'Urban Expansion' under the *South Metropolitan Peel Sub-Regional Planning Framework* (the Framework). The Framework also provided broad guidance in relation to the staged provision/development of urban land based on timeframes. The subject site was classified as 'Long Term (Beyond 2031)'.

Initial meetings with the Department revolved around the justification to bring forward the Staging Timeframe identified in the Framework. Officers of the Department were presented with a detailed case as to why it was considered that bringing forward the development of this site could be justified and supported by Officers of the Department and members of the WAPC. The case was built around a multi-faceted justification that incorporated components of construction innovation, sustainability, affordability and response to housing demand.

You may recall the 1 May 2019 briefing of the WAPC presented by Mr Anthony Silvestro, the Managing Director of Land Group WA and Home Group WA, where he outlined his group of companies' intent to use the Cardup site to deliver its new built-form and development initiatives that it had been researching and developing for several years. At that time Mr Silvestro outlined a number of significant benefits and advantages that their proposed development and construction initiatives could deliver from both environmental and economic perspectives. Since that time Land Group WA has continued its research and development of various construction materials & methods seeking to offer greater sustainability and long-term economic benefits to its customers.

The suite of documents supporting this MRS Amendment request include new reports and others that have been recently updated and include:

- Enviro Sustainability Memorandum (Stantec);
- Stantec 10-Star Home Energy Efficiency Memorandum;
- Economic Review (Urbis);
- Revised and updated Environmental Assessment Report (360 Environmental);
- Original Servicing Report by KCTT and updated Engineering Commentary provided by Stantec; and
- Updated Bushfire Management Plan (Bushfire Safety Consulting).

In addition to the updated reports mentioned above this submission highlights the significant changes to the Shire's strategic planning instruments including the recently approved Local Planning Strategy that now lists parameters under which the early development of the site will be supported by the Shire.

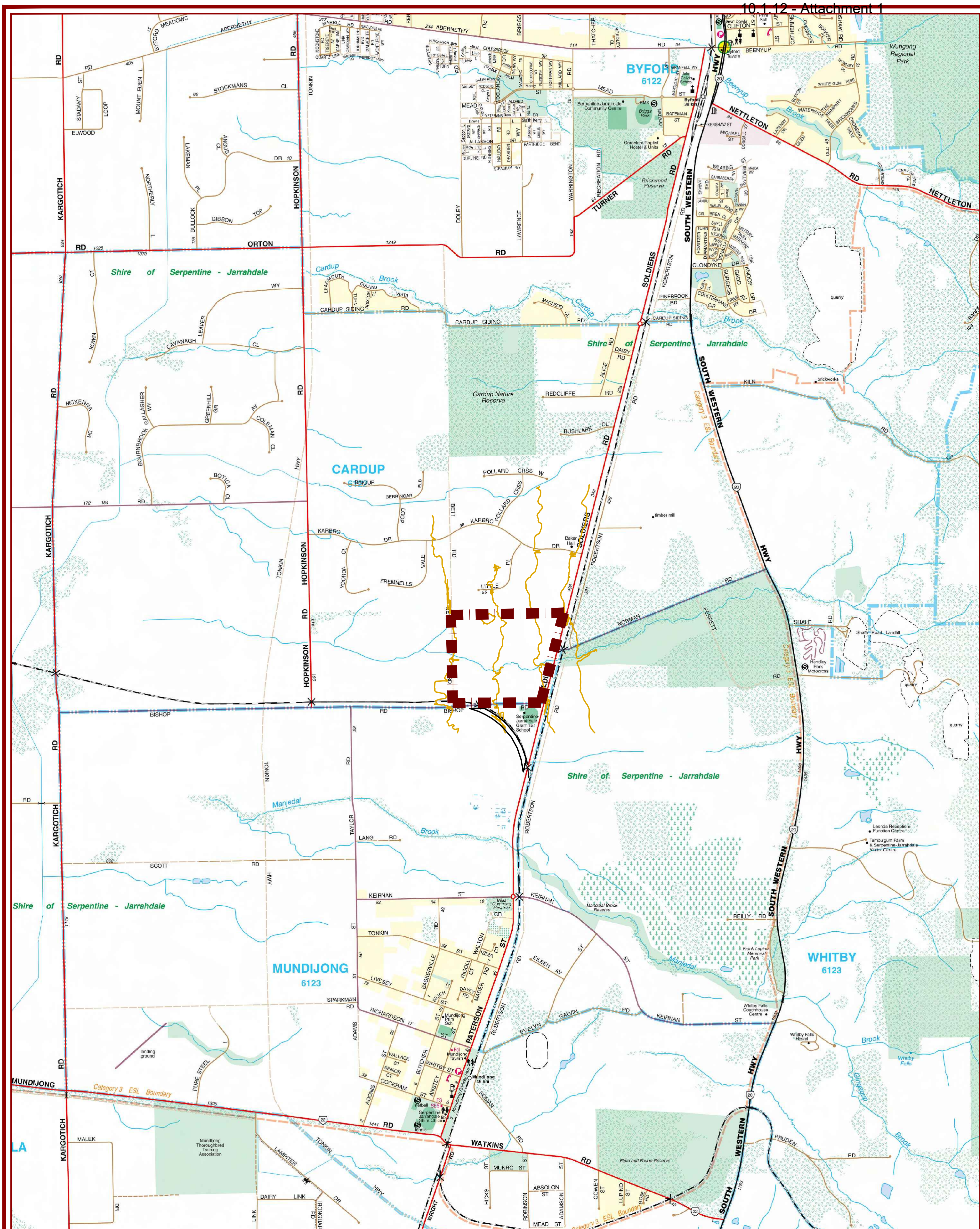
Land Group WA, through this submission, once again requests the support of the WAPC in resolving to initiate this Amendment to the MRS.

SUBJECT SITE

The site comprises a total land area of 55.4667ha and gains direct access to Bishop Road to the south and Soldiers Road to the east (refer Figure 1 - Location Plan). The subject site has operated as a farm for livestock grazing since the 1970's, with several fenced open paddocks, a dwelling, various sheds and structures. A water course traverses the central portion of the site in an east-west direction and is bordered by trees and some remnant vegetation (refer Figure 2 - Aerial Photograph).

The subject site is located within the municipal boundary of the Shire of Serpentine Jarrahdale and is situated approximately 13 kilometres south-west of the Armadale Strategic Metropolitan Centre. The subject site is situated within close proximity to existing and future residential and commercial areas, community facilities and areas of Public Open Space (POS), including:

- The Mundijong District Structure Plan area within which the subject site is located. The plan estimates a population of 58,000 people dependent upon the final distribution of densities and household sizes. It incorporates provision for a new town centre with the opportunity to ultimately link into the Perth urban rail network and promotes the relocation of the existing freight rail line traversing the subject area to its perimeter in conjunction with the construction of the Tonkin Highway extension. It also incorporates the new Mundijong Industrial Precinct and the addition of Development Investigation Areas as indicated by the Sub-regional framework. The subject site forms the northern-most extent of a large urban area, proximate to a planned transit node and district centre, with a high frequency transit corridor along its southern and eastern boundary.
- The Byford Structure Plan area located approximately 2.6km north of the subject site. The Glades at Byford is expected to be home to 10,000 people, and will include a primary school, district high school, a Catholic K-12 school and a village centre with shops, offices and cafes.
- The Cardup Business Park Local Structure Plan area located approximately 1.8km east of the subject site is planned to facilitate a wide variety of lot sizes to accommodate a variety of industrial and business uses.
- The Whitby District Centre located immediately south east of the subject land that will provide cover 8.3ha of land and provide 12,500sqms of retail and commercial floorspace.
- The West Mundijong Industrial Area located south west of the subject site that is expected to commence development in late 2022 and will ultimately cover 440ha of land and generate up to 10,000 jobs.



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

LOCATION PLAN
LOT 30 SOLDIERS ROAD
CARDUP

LEGEND

Subject Land

NORTH

0 200 400 600 800 1km

SCALE 1:40,000 (A4)

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Plan No: HOM CAR 9-01
Date: 18.04.16
Client: HOMEGROUP WA
Planner: JB/MB

SHIRE OF SERPENTINE JARRAHDALE

FIGURE 2

LEGEND

Subject Land

NORTH

0 50 100 150 200 250m

SCALE 1:10,000 (A4)

AERIAL PHOTO

LOT 30 SOLDIERS ROAD

CARDUP

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SHIRE OF SERPENTINE JARRAHDALE

METROPOLITAN REGION SCHEME

The subject site is currently zoned 'Rural' under the *Metropolitan Region Scheme* (MRS) (refer **Figure 3 - MRS Map**).

SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK

The subject site is identified as 'Urban Expansion' under the *South Metropolitan Peel Sub-Regional Planning Framework* (the Framework) representing a 'rounding off' of existing urban areas (refer **Figure 4 - SRPF Map**). As such, the current 'Rural' zoning under the MRS is no longer appropriate.

SHIRE OF SERPENTINE-JARRAHDALE TOWN PLANNING SCHEME NO.2

The subject site is currently zoned 'Rural' under the *Shire of Serpentine-Jarrahdale Town Planning Scheme No.2* (TPS2) (refer **Figure 5 - TPS2 Map**).

SHIRE OF SERPENTINE-JARRAHDALE LOCAL PLANNING STRATEGY (2019)

The Strategy identifies the land as 'Development Investigation Area – DIA1'.

This is part of the broader 'Urban Areas and Townsites' category, being areas that provide housing and associated urban services and amenities. The Shire aims to preserve its distinctive character of having urban centres separated by rural wedges by limiting urban sprawl.

The site forms part of the broader 'Mundijong' urban area, for which the stated objectives are:

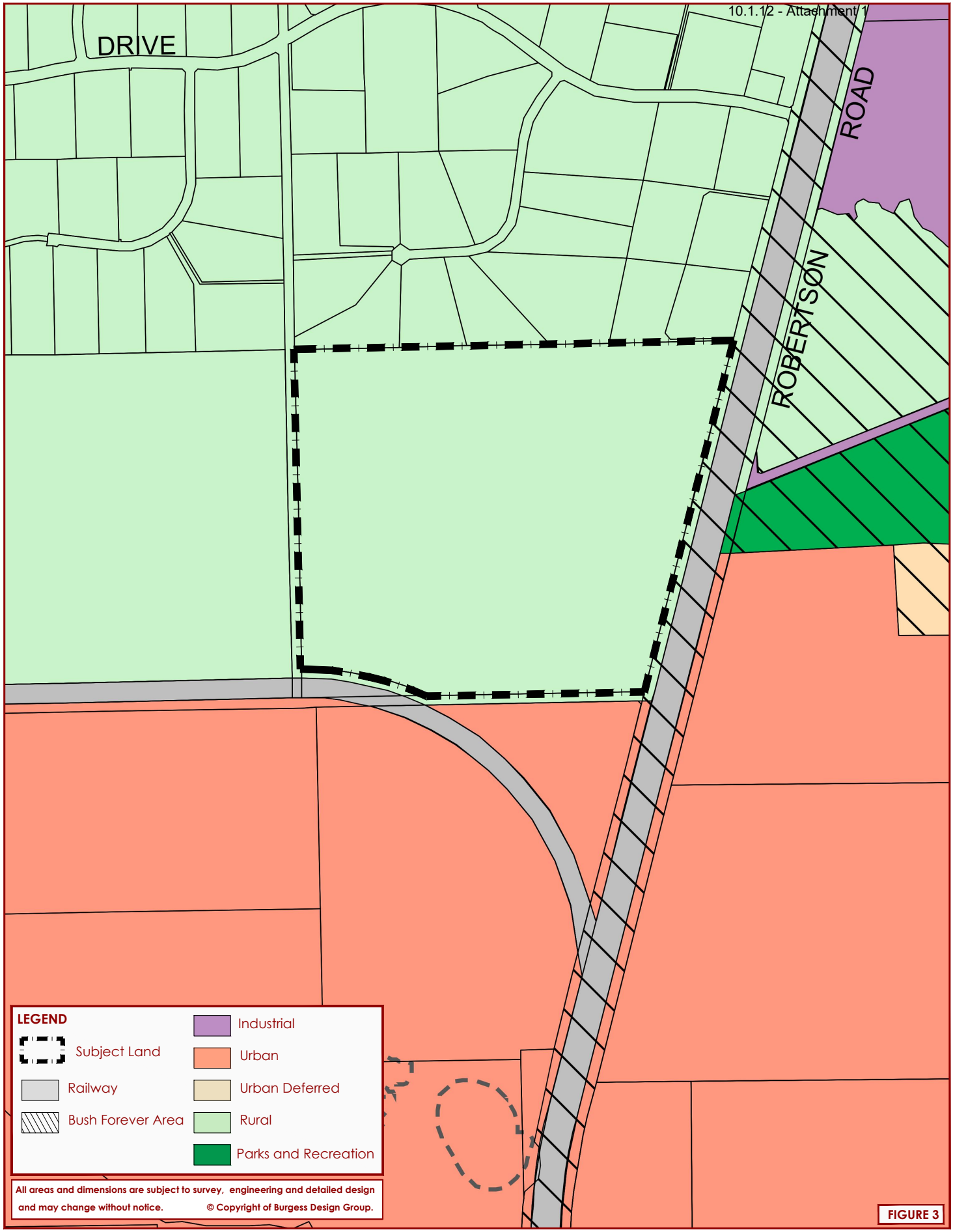
- *Achieve a diversity of housing types to provide choice, adaptability and to accommodate a range of incomes, households and life stages and to deliver housing product which will attract people to live in Mundijong.*
- *Achieve distinctive urban precincts within Mundijong.*
- *Integrate new housing and urban development with the older urban development patterns and housing as well as natural areas in a sensitive manner.*
- *Encourage urban development and housing to be environmentally sustainable and resource efficient.*

This classification for the subject land was introduced into the Strategy following significant liaison between Burgess Design Group, acting on behalf of Land Group WA, and the Shire of Serpentine Jarrahdale. The Shire's Officers have been briefed in detail in regards to Land Group WA's intention to develop the site for affordable and sustainable housing opportunities and to seek the early initiation of the land development process. On that basis the Shire has agreed that there is merit in the consideration of early development of the site subject to the development reflecting a number of environmental and sustainability objectives as detailed below:-

> *The purpose and intent of DIA1 is to explore the potential for urban expansion with consideration for innovative housing opportunities. A structure plan will be required which addresses the following matters:*

- *Investigate opportunities for innovative housing typologies that have consideration for best practice sustainability;*
- *Exemplar resource and energy efficiency;*
- *Water minimisation;*
- *Alternate construct methods.*
- *Investigate current zoning and land uses;*
- *Manage the transition of land uses most specifically to the north;*
- *Better utilize available land;*
- *Deliver innovative land use and housing diversity and choice;*
- *Reduce the need for people to travel by car;*
- *Identify infrastructure requirements;*
- *Servicing requirements;*
- *Visual/landscape protection;*
- *Bushfire hazard;*
- *Interface with Bishop Road, Soldiers Road, the future extension of Tonkin Highway and the newly identified roads (Doley and Norman road extensions) required by the sub-regional framework (sic); and*
- *Any other requirements that may be determined by the Shire of Serpentine Jarrahdale or State government agencies.*

The identification of the land for urban uses in the Shire's Strategy is generally consistent with the *South Metropolitan Peel Sub Regional Planning Framework (2018)*, which identifies the land as 'Urban Expansion'. However, it should be noted that the State level Framework makes a distinction between 'investigation' areas and 'expansion' areas, where the Shire Strategy does not. Namely, under the Framework, land identified as Urban Expansion is considered to be less constrained and better located in terms of proximity to major centres and growth areas. We agree with this characterisation as it relates to the site due to its ability to be developed in the short to medium term.



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

FIGURE 3

NORTH

0 50 100 150 200 250m

SCALE 1:10,000 (A4)

METROPOLITAN REGION SCHEME

LOT 30 SOLDIERS ROAD

CARDUP

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SHIRE OF SERPENTINE JARRAHDALE

Legend

- Framework boundary
- Peel-Harvey Coastal Plain Catchment Area (SPP 2.1)

Framework land uses

- Railway
- Urban
- Urban deferred
- Urban expansion
- Urban investigation (Refer to Table 2 for key considerations)
- City centre
- Industrial
- Industrial expansion
- Industrial investigation (Refer to Table 7 for key considerations)
- Port installations
- Port installations development
- Rural residential
- Rural
- State forest
- Open space
- Open space investigation
- Rural residential investigation (Refer to Table 6 for key considerations)
- Waterway
- Public purposes
- Planning investigation (Refer to Table 3 for key considerations)
- Proposed public purposes
- Proposed Open Space - Sport

Regional roads (MRS/PRS)

- Existing
- Proposed

Rail

- Passenger rail - existing
- Passenger rail - proposed Stage 1 METRONET
- Passenger rail - further investigation (conceptual only and subject to further investigation)
- Freight rail (post-2031 investigation)

NOTE: Transit corridors are shown on Plan 5

Activity centres

- Strategic metropolitan
- Secondary
- District
- Specialised centre
- Specialised node

FIGURE 4

LEGEND

Subject Land

NORTH

0 100 200 300 400 500m

SCALE 1:30,000 (A3)

SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK

LOT 30 SOLDIERS ROAD

CARDUP

SHIRE OF SERPENTINE JARRAHDALE

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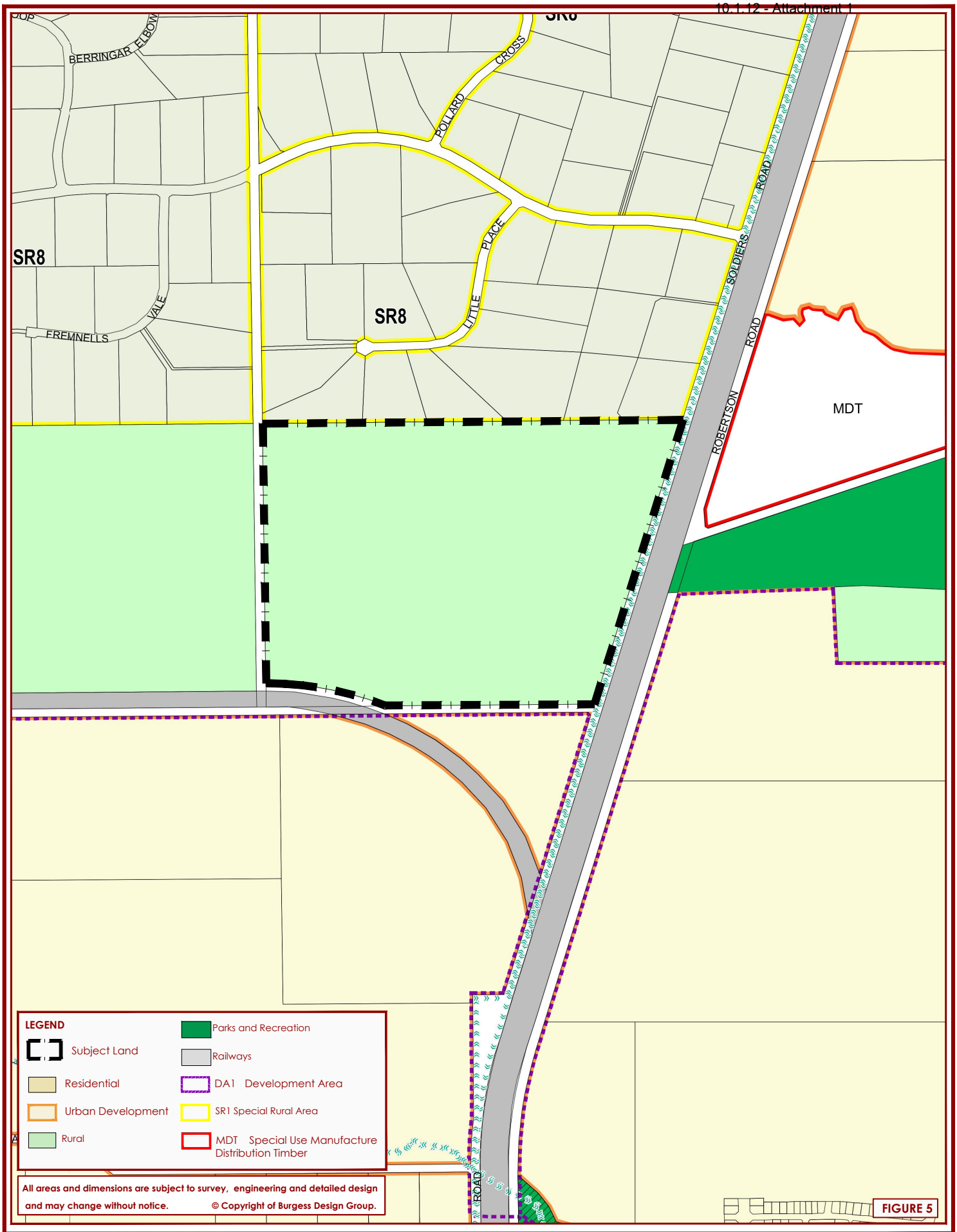
Date: 04.03.21 Planner: MS



NORTH

0 50 100 150 200 250m

SCALE 1:10,000 (A4)

TOWN PLANNING SCHEME NO.2

LOT 30 SOLDIERS ROAD

CARDUP

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SHIRE OF SERPENTINE JARRAHDALE

MUNDIJONG DISTRICT STRUCTURE PLAN

The *Mundijong District Structure Plan* (DSP) has been adopted by the Shire of Serpentine-Jarrahdale and endorsed by the WAPC (subject to modifications) and provides overall guidance to the structure, vision and objectives identified for the planning and development of Mundijong.

As with the Local Planning Strategy the DSP identifies the land as 'Development Investigation Area 1' (DIA1).and specifies the same list of matters to be addressed through the Structure Planning process for the Shire to consider early development of the land.

MUNDIJONG/WHITBY DEVELOPMENT CONTRIBUTION PLAN (DCP)

A draft *Mundijong/Whitby Developer Contribution Plan* has been prepared by the Shire to guide the provision of Traditional Infrastructure and Community Facilities. The Developer Contribution Plan ensures the equitable distribution of common infrastructure costs between developers and landowners as envisaged by State Planning Policy 3.6 Developers Contribution Arrangements.

The DCP is soon to be finalised but the subject site has not been included within that area. It is important that the subject site is ultimatley incorporated into the DCP as it will benefit all landowners/developers in the area by ensuring an equitable and reduced level of costs per new dwelling/lot.

STATE PLANNING POLICY 5.4 ROAD AND RAIL NOISE (SPP 5.4)

SPP 5.4 identifies situations or proposals that require the assessment of transport noise impacts and establishes noise criteria to be used in the assessment of these proposals. Given the site's proximity to the current freight rail line, an acoustic assessment will be required.

An acoustic assessment will determine, by noise modelling, the noise levels from the freight rail line that would be received at future residences; assess the predicted noise levels for compliance with SPP5.4; and identify measures that can be adopted to reduce transport noise, if required. It is further noted that the State has committed to the realignment of the Freight rail line in the future.

STATE PLANNING POLICY 3.7 PLANNING IN BUSHFIRE PRONE AREAS (SPP 3.7)

State Planning Policy No. 3.7: Planning in Bushfire Prone Areas (SPP 3.7) applies to all higher order strategic planning documents, strategic planning proposals, subdivision and development applications located in designated bushfire prone area.

Bushfire Hazard Level assessments are required to accompany region planning scheme amendments and provide a 'broad-brush' means of determining the potential intensity of a bushfire for a particular area. A Bushfire Hazard Level assessment in the form part of a Bushfire Management Plan has been prepared by Bushfire Safety Consulting specifies how the bushfire protection criteria will be met at subsequent stages of the planning process (refer Appendix 7).

MRS AMENDMENT JUSTIFICATION

This Amendment request may be read in conjunction with our original MRS Amendment request of 13 December 2016 that provides significant justification for the proposed amendment and our later correspondence dated 20 September 2017 that responded to the preliminary submissions of the relevant referral agencies. A written response to the Urban Staging Criteria was also submitted on 28 May 2019 further supporting the proposal. However, this correspondence will incorporate updated components of that information to assist officers in assessing the current request.

Staging and Sequencing

As previously mentioned, the Framework provides broad guidance in relation to the staged provision/development of urban land based on suggested timeframes.

The subject site is classified as 'Long Term (Beyond 2031)'. However, we strongly contend that there is sufficient justification to bring forward this timing. This position is also supported by the Shire's Planning Strategy that identifies the special circumstances where early subdivision of this land will be supported.

It is also important to note that, even with a decision to initiate the proposed MRS Amendment in the short term, the time required to undertake the various planning processes required to reach the subdivision stage would mean that development on the ground would be unlikely to commence prior to 2026. The development of the site will then occur in a staged manner, over an approximate 10 year period, taking the full delivery of the project well beyond the 2031 timeframe.

The timeframes set out in the table below are estimates only and will be affected by the significant work that will be required to fully plan and develop the site. The full development process from MRS Amendment, Structure Planning, detailed design and engineering, site/infrastructure construction, marketing/sales, through to construction and completion of habitable dwellings occurs over a significant timeframe with the potential for multiple delays along the way.

The early initiation of this MRS Amendment will assist in providing a timing-contingency into the many stages of the development process.

Task	Timing	Approval Target
MRS Amendment (Concurrent LPS)	12-18 months	Mid-Late 2023
Structure Plan	12 months	Mid-Late 2024
DCP (Amendment)	12 months	Mid 2025
Subdivision Design & Approvals (Planning & Engineering)	6-12 months	Mid-Late 2025
Headworks & Stage 1 Construction	12 months	Mid-Late 2026

Land Sales & Community Infrastructure (Parks etc)	6-12+ months	Early-Mid 2027
Homebuilding	6-12+ months	Late 2027 - 2028
Community Activation Development of All Stages		2028 2038

It is noted that a number of the above stages of the development process can be run in (partial) parallel. However, even with these potential time savings the delivery of fully constructed dwellings is estimated to occur over a 10 year period between 2028 and 2038+. Given the long lead times towards development there is strong justification for the subject land to be included in the broader planning for the district that is being undertaken at the present time (and ongoing) rather than seeking to incorporate it into the planning processes at a later date. The incorporation of the site into the district level DCP at the earliest point is certainly one of the most important reasons for the initiation of the MRS Amendment. There is no doubt that the ultimate development of this land will benefit from the various items that will be delivered through the District DCP. If the land is not incorporated into this DCP then the opportunity to collect contributions towards these items may be lost.

The inclusion of the subject land within the DCP may allow for the provision of increased or improved infrastructure or simply assist in reducing the overall contributions of other developers/landowners in the area. This may have the benefit of improving affordability for the lots to be delivered by other land developers in the area – a very real potential benefit of the land's early inclusion in the DCP. Whilst we understand that the DCP is close to finalisation we consider that an amendment to include this land within the DCP at the earliest possible time will benefit all landowners/developers and the wider community.

Sustainable and Affordable Housing Goals

As with our previous formal request, it is still the intent of Land Group WA to develop the subject site to provide affordable housing and sustainable housing opportunities in the locality.

Affordability and sustainability are progressive concerns throughout the residential housing sector nationally and within the state of Western Australia. Meads Private Estate can address these concerns effectively by ensuring that the subdivision design and house designs promote a sustainable way of living without the mortgage stress associated with affordability. The approval and successful delivery of new development projects that address these two issues will assist in reducing the negative impact on the financial wellbeing of individuals, families and communities throughout the state.

Land Group WA intends to leverage the significant benefits of being an owner/developer and to use the site to deliver a range of potential benefits under three core points of difference. Those key differences are expanded below:-

1. Developer/Builder Synergies

   Land Group WA was established by Home Group WA to capture the synergies and economies of scale by the developer/builder business model. Given the size and development potential of the Meads Private Estate project, Land Group WA will be able to maximise the synergies and economies of scale that the developer/ builder business model creates to achieve a community with maximum affordable housing and sustainability (energy efficiency) options available to the new homebuyer.

2. Sustainable Development Initiatives

   Land Group WA has engaged Stantec's Sustainability Division to ensure that sustainability initiatives are established and integrated from the outset of the project, across all project disciplines. In an effort to ensure the sustainable outcomes to be delivered are measured and verified, Land Group WA will be seeking formal certification through the independent national rating tool Enviro Development (refer Appendix 1).

   To further complement and enhance the sustainable development initiatives, Land Group WA are proposing to build WA's first 10 Star Demonstration House at Mead's Private Estate. This home will be the culmination of many years of research and will stand as a show piece for what is possible in energy-efficient design. Stantec's Energy Efficiency team has been working with Home Group to develop a 10-star house (refer Appendix 2). Over 600 designs have been modelled as part of the extensive design testing. Land Group WA intends to market this home and create a destination within Serpentine-Jarrahdale for the wider Perth community to demonstrate what is possible and help educate both the general public and industry on how to achieve varying levels of energy-efficient design outcomes within a reasonable budget.

   In addition to the above mentioned initiatives there will also be the improved use of recycled fill. access to recycled resources via the Silvestro Family group of construction companies allows the option for recycled products to form part of our import fill program. Land Group WA has an existing relationship with 'Instant Waste Management', and through it, intend to use recycled clean fill for any import fill required within the proposed subdivision at Cardup. Instant Waste's Involvement will be as follows:

   - Provide a waste recycling management program that will divert 80% to 90% of rubbish away from landfill.
   - Through the recycling program these recycled materials will then be used to offset the need to purchase fill sand for the development.

3. Housing Affordability

Land Group WA, in conjunction with its affiliated companies, holds the long-term objective of delivering affordable and sustainable housing to the Western Australian market by integrating all facets of land development and construction from social outcomes to materials and use of resources. Meads Private Estate will be the showpiece of this strategy.

In passing on the efficiency savings to the ultimate buyers, Land Group WA will be able to bring another group of potential homeowners into the marketplace.

Land Group WA also seeks to draw on the significant interest and demand for houses that incorporate sustainable, energy efficient design elements that provide long term energy/money savings to owners. Potential buyers will be given the opportunity to select home designs incorporating varying levels of sustainability elements. The higher the level of energy efficiency rating the higher the level of long-term energy savings.

Housing Market

A specific objective identified in the '*Affordable Housing Strategy 2010-2020 Opening Doors to Affordable Housing*' released by the Government of Western Australia, is for 20,000 additional housing opportunities be available for low-to-moderate income earners. The proposed development at Cardup is aligned with this objective and will provide private sector assistance to the State Government in delivering its commitments for affordable housing within the state.

It is very important to note that significant time has passed since the submission of the original Amendment request and the circumstances of the housing market in WA have changed. The housing market experienced a significant contraction during that time (in an already depressed market) due to the Covid Pandemic and the much-reduced net migration into the State. More recently, with the staged lifting of restrictions, the demand for housing has begun to increase and this is projected to continue into the future.

Land Group WA commissioned the preparation of an Economic Review of the proposed Meads Private Estate to review demand for housing in the area and in particular to understand the appetite for housing with sustainable design features. A copy of this report is attached as Appendix 3. This report has sought to review the general planning context for the site, including the growth aspirations in the Serpentine Jarrahdale area.

The report has analysed the potential demand for sustainable housing in the local market and reviewed the population growth expected in the area that will drive demand for new sustainable forms of housing development. The report has also identified the existing and planned infrastructure in the area that would support and justify the early development of Meads Private Estate.

The analysis has found that there is significant demand, particularly amongst first home buyers, for sustainable energy saving features when considering purchasing a home. There is strong population

growth within the Shire and it is important that affordable housing supply is maintained to ensure this growth is supported and can continue.

The report finds that the location of Meads Estate will be particularly attractive to first home buyers given its siting within the walkable catchment for the planned Whitby Activity Centre including 12,500sqms of commercial floorspace that will include 2 supermarkets, a department store and 55 specialty shops.. The proposed Centre is in addition to over $1 Billion of committed infrastructure funding in the south east corridor with even more projects in the planning stages. Much of this new infrastructure has been planned and committed too since the original MRS Amendment request in 2016 and reinforces the development pressures on this corridor. Committed projects in the area include but are not limited to:-

a. Kiernan Park Sporting Precinct
   - Funding = $20M State Funding Commitment for Stage 1A. Total Cost of All Stages = $161M.
   - Expected Completion Stage 1A = December 2023

b. Tonkin Highway Extension (Thomas Rd to South West Hwy Extension) including Bishop Rd Interchange
   - Funding = $404M Federal & $101M State Funding Committed
   - Expected Completion = 2024

c. Byford Passenger Rail
   - Funding = $475.5M Federal Govt committed to the $885M project.
   - Expected Completion = Late 2024

d. West Mundijong Industrial Area
   - Status = Zoning complete, Stage 1 to be constructed late 2022
   - Scale = 440 ha of industrial land to create 880 industrial lots including an intermodal facility, and 10,000 new local jobs

e. West Port and specifically the Freight Corridors East to Shire of SJ
   - Funding = Total Cost Est at $4 Billion.
   - Scale = A world-class container port and trade network

It is noted that this planned infrastructure not only improves the facilities and services for the future population of the corridor but also contributes significantly to the future employment opportunities for future residents.

Along with the development of extended regional road (Tonkin Highway extension) and rail infrastructure (Byford Passenger Rail) providing easier access to existing job centres there will be other major emerging employment opportunities developed including the West Mundijong Industrial Areas and Westport.

One of the most important findings of the report is the importance of the Serpentine Jarrahdale Municipality in providing affordable housing within Perth's housing market. It was found that land in the Shire was 38% more affordable that land in the north west corridor. Land Group WA seeks to

leverage this by offering even greater sustainability and long-term energy saving options for its prospective homebuyers.

URBAN STAGING CRITERIA

This section specifically responds to a number of the urban staging criteria set out in Perth and Peel at 3.5 Million. Please refer to the information below that responds to each of the stated criteria.

1. The proposal represents a logical expansion and consolidation of the existing developed urban form.

The development of the site is considered to represent a logical extension of the urban front given:

- Land immediately east of the site is zoned 'Urban Development' under the local Scheme and currently being developed in accordance with the *Whitby Local Structure Plan* which provides a framework for residential uses, a public open space network, primary schools, a high school, technical school and a district centre (just 750m south of the site);
- Land to the north-east of the site is identified for Industrial development under the *Cardup Business Park Local Structure Plan* providing opportunities for local employment; and.
- Land immediately south of the site is zoned 'Urban' under the Metropolitan Region Scheme and falls within the planned Mundijong DSP (comprising a new town centre and 3 local centres, several primary and secondary schools, possible future TAFE, residential land uses).

This demonstrates there is clearly a context for urban uses.

It is also important to consider the broader regional context. The Mundijong DSP does not intend to create an isolated satellite city. Rather, it is a logical extension of an urban growth corridor; namely from Armadale and Byford. The Shire has adopted a strategy of retaining rural 'fingers' by protecting parcels of rural residential development to protect the unique landscape character of the area. However, this does not materially change the fact that Mundijong is part of an urban corridor growing from the north to the south. That is to say, the retention of some equine properties in the northern part of Cardup will not change that the district is part of the Perth metropolitan region and that when most people go to work in the morning, or when they need to access major services, or when they catch the Byford extension of the rail network, they'll be travelling north. To that end, we believe the subject site represents a logical extension of that front. As noted above, the site is also adjacent to urban development under construction as part of the *Whitby Local Structure Plan* such that it is a logical extension of the urban fabric. Furthermore, it is located more proximate to existing and planned employment generating uses in nearby industrial and commercial areas than most developing land in the district and is even within the walkable catchment of a planned district centre. Importantly, the subject site is also sufficient in area to support development of a scale to support structure planning and delivery of suitable urban amenity compared to much of the heavily fragmented land to the south which may not see enough consolidation to achieve the critical mass needed to fund planning and development for a number of years.

2. The proposal is compatible with the economic development of the area and the planned provision of employment opportunities for the projected population within the sub-region.

The subject land is located immediately north of the Whitby District Structure Plan Area that is intended to accommodate 15,000 dwellings to house a population of around 58,000 residents. The DSP includes significant land to be developed for commercial and industrial purposes.

The Cardup Business Park Local Structure Plan area located east of the subject site is planned to facilitate a wide variety of lot sizes to accommodate a variety of industrial and business uses. The long-term development of the business park will ensure that residents will benefit from new jobs close to home.

Cardup is also within close proximity to the Byford Structure Plan Area and greater Armadale. These areas are expected to provide a significant number of jobs over the next 5-20 years as they grow and service expanding populations.

The MRS rezoning of the site and its ultimate inclusion in the Development Contribution Plan for the Mundijong Whitby urban cell will also benefit the long-term economic development of the locality. The timing of this MRS amendment is critical, with an opportunity for the site to be included in the Mundijong/Whitby Development Contribution Plan (DCP).

If the requested MRS amendment is not promptly progressed there will be significant implications for not only developers but the Shire as the later amendment to an approved DCP is complex with development contributions calculated on the projected population growth and lot yield. Any MRS amendment and subsequent development of the site would significantly change projected population and lot yield estimates, ultimately affecting the DCP rate per ha.

The development of the site will benefit directly from the infrastructure included in the Mundijong Whitby DCP and as such should be incorporated within the DCP area. The inclusion of the site in the DCP will ensure the equitable sharing of costs among landowners. As such, the timing of the MRS amendment is critical to allow this area to be included in the DCP before it gains final approval.

3. The development can be readily accessed without the provision of additional transport infrastructure, unless that infrastructure is already funded.

The site directly abuts Bishop Road to the south, and Soldiers Road to the East. Bishop Road is classified as a significant local road / local distributor that provides an important east-west connection. Soldiers Road is a Rural local road / regional distributor that provides district level access to surrounding areas. The development of the site will provide an opportunity to upgrade these roads as necessary to accommodate increased traffic from the planned development of the broader district.

Discussions with Main Roads WA have raised no issues with the transport planning for the development cell. Planning and construction and of the local transport network will not be impacted by the development of the subject land.

Notably, the location of the site on the northern side of Mundijong means it will make more efficient use of planned district and regional-level road upgrades linking north to the metropolitan area. This includes planned upgrades of Soldiers Road and Bishop Road, together with the extension of Tonkin Highway. This reinforces that the site is a local extension of the broader urban front from the north and will provide for an efficient use of resources that will support the growth of Mundijong.

4. The proposal will not detrimentally impact upon the staging timeframes of other urban land, in terms of the ability to service other land.

The site is relatively unconstrained, largely cleared and has limited environmental constraints that often impede other development sites.

This aligns with the Sub-regional Framework's aim of *'concentrating new urban areas in cleared pastureland rather than impacting on areas with regionally-significant conservation values.'*

Our previous submissions on this proposed MRS Amendment have shown that the land can be serviced over its total development timeframe in the context of the ongoing development of the Whitby DSP area directly to the south. Stantec has continued servicing discussions with relevant agencies and no major issues have been raised. Recent advice from the Water Corporation and Western Power (refer letter from Stantec dated 7 April 2021) indicates that servicing of the site is not problematic and will continue to be refined as the development commencement moves closer.

5. Agreed and finalised funding arrangements are in place with essential service providers, acknowledging that funding is the responsibility of the landowner, unless provided for in a current capital works program of the relevant servicing authority.

The site is capable of being readily serviced by essential infrastructure, and will ensure the timely and efficient delivery of electricity, water and wastewater. This aligns with the objectives of the Sub-regional Framework for areas identified suitable for future urban.

Refer to the previously submitted KCTT Infrastructure Servicing Report and the attached correspondence of Stantec dated 7 April 2021 that provides an update to the original KCTT report.

6. Servicing can be economically provided over its lifespan.

Refer comments above and attached.

DPLH Officer Raised Concerns

In further correspondence of 10 December 2019, Officers of the Department provided advice and reasons as to why they considered that they would not be able to support the proposed Amendment at that time. Those reasons and our responses are set out below:

1. Consistency with the Framework

In the Staging Plan of the Framework, the site is designated as having a 'Long Term (Beyond 2031)' timeframe. The Framework states that the timeframes in the Staging Plan are anticipated timeframes only, and it provides criteria which need to be addressed to obtain support for any

proposal that is not sequential and/or is inconsistent with the timing depicted in the staging plan. It is noted that in your letter the WAPC dated 28 May 2019 you outlined the reasons why you consider that this proposed amendment is consistent with these criteria. These reasons have been considered, but it is advised that the proposed amendment is unlikely to be consistent with the first criteria in the Framework (The proposal represents a logical expansion and consolidation of the existing urban development urban form) for the reasons outlined in point 4 below.

As already mentioned in this Amendment request we consider that the timing and staging of this development site is now aligned with the intent of the Framework. The original Amendment request was submitted in 2016 and significant changes have occurred since that time. Other than the passing of time bringing us much closer to the 2031 staging date of the Framework there have been significant developments in the planning and infrastructure provision in the locality. The State has spent significant capital on the extension of Tonkin Highway and has committed to the extension of the passenger rail system to nearby Byford. The reasoning and justification for delaying the development of this land under the Framework is no longer relevant.

Furthermore, it is noted that even when originally identified for future development under the Framework the land itself was considered somewhat detached from the remaining Urban land shown in the Framework. However, it is noted that the site directly abuts urban uses to the south and is within the walkable catchment of the proposed Mundijong Activity Centre to the south. Furthermore, as noted above, Mundijong is not intended to be an isolated satellite city such that the site represents a logical extension of the urban front from the north and will provide for the efficient use of resources as vital services, amenities and infrastructure grows from the north to service the district. More locally, the site itself is the last portion future Urban land abutting the Whitby DSP and should be incorporated into that DSP to take advantage of the proposed infrastructure.

We believe that one of the main questions that should be posed in considering this proposal is "What harm would it create?". In this instance the only identifiable harm would result from not incorporating it into the broader planning processes at this time and missing the opportunity for the land to be included within the DCP for the area and to take advantage of the infrastructure being provided by the State at great expense.

2. Regional road planning is yet to be finalised for this locality

The roads adjacent to the site (Betts, Bishop and Soldiers Roads) are identified as Proposed Integrator Arterial Road in the Framework and may become Other Regional Roads in the MRS in the future. The Framework also states that a westward extension of Norman Road to Bishop Road may be appropriate. This potential road extension is also shown in the draft Mundijong District Structure Plan. The regional road planning investigations for this area are yet to be finalised. Until these investigations have been sufficiently progressed, it cannot be determined with any certainty if any part of the site needs to be reserved as Other Regional Roads under the MRS. As such, it would be premature to initiate the proposed amendment until the regional road planning has progressed to a point where these requirements can be appropriately determined.

Burgess Design Group has undertaken a number of consultation meetings with Main Roads WA in regards to the current and proposed traffic layout in this locality. Main Roads WA has indicated that

it sees no issue with the development of this land as it will not impact on the broader planned road hierarchy. Furthermore, it is unclear how the progression of planning over the site would negatively affect road planning given road upgrades are a standard and expected part of the process, and that none of the expected upgrades would materially impact the form or layout of development. It is also unclear how, specifically, the site would present an impediment to regional road planning while it seemingly was not an issue for the 5,000ha of land zoned for urban and industrial uses immediately south of the site. In any event, we believe it is unlikely that the progression of development, including detailed traffic modelling, would compromise and not enhance road planning.

With regard to the potential westward extension of Norman Road, Burgess Design Group and Land Group WA have made a number of submissions objecting to this, most recently concerning the Shire of Serpentine-Jarrahdale Draft Local Planning Strategy that discussed the extension. The Statutory Planning Committee of the WAPC, in its decision on 29 June 2021, supported its removal from the draft Strategy, with the Schedule of Modifications stating:

> "*...removing reference to connection to Norman Road as a consideration. This connection will connect the Cardup Industrial Area with a future Urban Area and is not considered appropriate*".

As such, we believe this issue is now resolved.

3. There is unlikely to be a demonstrated need for additional Urban zoned land in this locality

> *The Framework states there is sufficient undeveloped land classified as Urban, Urban Deferred, Urban Expansion and Urban Investigation in the south-eastern sector of the South Metropolitan and Peel sub-region to meet forecast housing requirements for about 50 years. Additionally, there is over 900 hectares of undeveloped land which is zoned Urban under the MRS in the Mundijong and Whitby areas. On this basis, it is likely that there is sufficient Urban zoned land in the area to meet housing requirements for considerable period of time and, as such, it is unlikely that there is a demonstrated need for more land to be zoned Urban.*

Whilst there may be a significant area of zoned land available for development it is completely unknown whether all of the land is capable of development or if the landowners have any intent on selling/developing the land. The subject site is not only capable of being developed in the short to medium term but Land Group WA are primed to progress and develop the land in an innovative and sustainable manner that sets it aside from other developments in the area. The potential for Land Group WA to set a new benchmark for sustainability and affordability is presented in this Amendment request as the justification for bringing the rezoning and release of this land forward.

It is also important to consider what issues are meant to be prevented in considering 'need'. Principally, this concerns the efficient delivery of infrastructure and to ensure existing urban land is not being undermined. As outlined previously herein, the site is not expected to negatively impact either of these matters. Servicing authorities are supportive of the proposal, and strategically, the site is a logical extension of the broader urban front from the north. More locally, the site is within the walkable catchment of the planned district centre south east of the site, with urban

development progressing within a parcel immediately east of the site. As such, the development of the subject land has a clear regional and local context and will support the efficient delivery of services and infrastructure - not undermine them.

Whilst we acknowledge the point being made by the Officer of the DPLH we seek their support and the support of the WAPC to provide the opportunity for this exciting vision of Land Group WA to be implemented on the basis that it will provide an additional portion of Western Australians the opportunity to enter the housing market whilst also providing other buyers with increased choices in energy efficient sustainable design.

4. The site is located a significant distance from the existing urban development front

Whilst the site is located adjacent to existing Urban zoned land to the east and south, it is located approximately one kilometre from the nearest urban development front in Whitby and about 2.5 kilometres from the nearest urban development front in Byford. Given there is a significant amount of undeveloped Urban zoned land in Mundijong and Whitby and the considerable period of time it may take for this land to be developed, it could take a while for the urban development front to reach this site. If residential development was to occur on this site in the meantime, there is a significant risk that it could remain isolated from other urban areas and not be well integrated with the rest of the Mundijong townsite or be provided with appropriate access to facilities and services such as shops and schools and other community facilities for a significant period of time. This would be likely to result in any residential development on the site having a low level of amenity and not be consistent with the intent and objectives of the Framework, State Planning Policy 3: Urban Growth and Settlement and Liveable Neighbourhoods

Regardless of the development of other areas it is noted that the site is somewhat detached from some of the other urban development parcels in the locality. However, in reality the land is located within the walkable catchment of the proposed Whitby Activity Centre and is located directly opposite an existing school. We also note that the area of Whitby currently under development is itself some distance from existing amenities such as the Mundijong Town Centre. It is the nature of growth areas that, for a short time, a sufficient population has to grow to support planned amenities. The subject site is considered to be an ideal candidate for that growth. It is located within walking distance of the planned activity centre, and regionally, it is located closer to more major services to the north than other areas to the south. It is also important to consider, as discussed above, Land Group WA is actively seeking to develop the site while others' intentions to the south are unknown, with significant land fragmentation around the existing town centre a significant hindrance to the assembly of the critical mass needed to support a project. As such, the proposed development of the subject site is considered to support and not undermine the ongoing growth of Mundijong.

Furthermore, the lead time for the planning processes and 10 years of staged development of the site take the timing for delivery well beyond the 2031 timeframe.

TECHNICAL REPORTS

Updated technical reports have been prepared in support of the proposal. In this regard, environmental and infrastructure servicing reports attached herewith demonstrate that the subject site is suitable for the proposed rezoning, with no unmanageable constraints to short/medium-term urban development.

ENVIRONMENTAL CONSIDERATIONS

An Environmental Assessment Report prepared by 360 Environmental has found that there are no significant environmental or heritage values, issues and/or constraints that would preclude the site being developed for residential purposes (refer Appendix 4). The following provides an outline of the findings.

Topography

The elevation of the site ranges from 49 m Australian Height Datum (AHD) in the north-eastern corner of the site to 35m ADH along the western boundary.

Acid Sulfate Soils

Acid Sulfate Soils (ASS): ASS risk mapping by the Department of Environment Regulation (DER) has identified the majority of the site as having a 'moderate to low risk of ASS occurring within 3 m of natural soil surface but high to moderate risk of ASS beyond 3 m of natural soil surface'. An ASS self-assessment form will be completed for the site once detailed engineering design has been undertaken. This will inform the risk of ASS and whether an investigation will be required.

Contamination

A search of the DER Contaminated Sites Database did not identify any contaminated sites present within the site (DER 2016a).

Aboriginal Heritage

No heritage listed areas were found in the vicinity of the site. The Government of Western Australia's State Heritage Office identified no known heritage areas in the vicinity of the site.

Hydrology

Groundwater

There are no available groundwater contours across the site. Fifteen groundwater monitoring wells were installed across the site for a pre and post development groundwater monitoring program during early July 2016. During the first two groundwater monitoring events in July and August the depth to groundwater from ground level ranged from 0.54 m in the western portion of the site to 10.66 m in the eastern corner of the site.

Surface Water

A minor creekline traverses the centre of the site. A Multiple Use Wetland (MUW) is mapped across most of the site. Two CCWs exist within the Railway Reserve immediately to the east of the site. One of the CCWs is located 21 m east of the site and the other is located 54 m to the east of the site. The CCWs to the east of the site are currently affected by human disturbance and due to the presence of: Soldiers Road which is within 7 m of the CCW closest to the site; and the railway track which separates the two CCWs. The adjacent CCWs are upstream from the site; therefore, surface water from the site will flow to the west of the site and away from the CCWs. It is considered unlikely that the proposed development will impact on the already disturbed CCWs. The management of surface water and groundwater will be addressed in the Local Water Management Strategy (LWMS) prepared to accompany the LSP submission. An Urban Water Management Plan will be prepared at subdivision approval stage when more detailed engineering design has been undertaken.

Flora and Vegetation

The site is largely devoid of native vegetation and likely to have limited remaining environmental value. The vegetation onsite is parkland cleared and consists of Eucalyptus spp. with no understorey. A Level 2 Flora and Vegetation Survey has been scheduled for spring 2016 to assess the vegetation on site. This flora and vegetation survey will be included in the LSP submission. Furthermore, future development will retain the creek line within the site as along with an appropriate foreshore setback. This will result in the retention of riparian vegetation that forms a substantial portion of the vegetation within the site.

Fauna

A likelihood assessment found that the site is likely to offer occasional habitat for the Forest Red-tailed, Baudin's and Carnaby's Black Cockatoos and Rainbow Bee-eater. The site also has the potential to offer habitat for the Southern Brown Bandicoot. Due to fragmented nature of the habitat and lack of understorey the site is not seen to provide significant habitat for any conservation significant fauna species.

Environmentally Sensitive Area (ESA)

Bush Forever exists directly to the east and north-east of the site. Cardup Nature Reserve, which is a Department of Parks and Wildlife (DPaW) managed land, exists approximately 1.25 km north of the site. Two Perth Regional Ecological Linkages extend along the eastern portion of the site. However, as the site is predominantly devoid of native vegetation, the site does not contribute to the ecological linkage. A small portion of the eastern edge of the site is classified as an Environmentally Sensitive Area (ESA) due to a generic 50 m CCW buffer extending into the site.

Surrounding Land Uses and Buffers

The site exists within one Environmental Protection Authority (EPA) recommended industrial activity buffer for sensitive land uses. This is a cement products manufacturing facility located approximately 220 m north-east of the site. The EPA recommends a minimum separation distance of 300 to 500 m

between concrete batching or cement products manufacturing and sensitive land uses (EPA 2015). A noise assessment will be undertaken as part of the local structure planning process in order to determine if the noise levels from the facility are acceptable for future residential development. The vegetated strip which exists along the northern boundary of the site will be retained post-development. This will assist in screening any dust emissions from the nearby cement products manufacturing facility.

ENGINEERING/SERVICING

There has been no significant changes in the engineering and servicing conditions of the site since the preparation of the original servicing report prepared by KCTT in 2016. This report has been attached as Appendix 5 with an update provided by Stantec at Appendix 6.

Stormwater Drainage

The central watercourse provides a natural drain (living stream) for the development. Stormwater drainage modelling and cut to fill techniques will be required to ensure roads and lots on the boundaries of the site can reach the designated outfall.

The project engineers will continue to review stormwater drainage requirements, however at this early phase of the project the following drainage requirements are used as a holistic retention requirement for the total 55.47 hectares of land (based on it all being developable): -

- 1 in 1-year event – 2% @ 300mm average depth or 1.11 hectares
- 1 in 5-year event – 5% @ 500mm average depth or 2.77 hectares
- 1 in 100-year event – 8% @ 650mm average depth or 4.44 hectares

The 1 in 100 treatment area includes all roadways and existing watercourses.

Water

Water Corporation planning indicates the extension of a 500mm distribution main 1km from Watkins Road and a 300mm distribution main 3km from Watkins Road. A 250mm reticulation main would then require a 1km extension to the intersection of Soldiers Road and Bishop to which a 200mm reticulation main would then traverse westbound 300m to the proposed entrance of the development. This is in accordance with Water Corporation Planning with portions of the distribution main already scheduled for extension in the near future.

Wastewater (Sewer)

Current Water Corporation planning indicates that the site is split into two catchments. The northern half of the site is intended to be serviced by a proposed pumping station B that will connect to the main Byford WWPS. The southern half of the site falls within the proposed pumping station Mundijong A.

The Water Corporation advised that there is a possibility of the site being included into considerations for the Scott Rd WWPS if the area can be connected via gravity sewers and does not adversely affect the depth of the incoming sewers. The maximum depth of the inlet sewer to the Scott Rd WWPS is set at approximately 6m below NS.

Gas

Gas services will be designed jointly with ATCO Gas. Gas services are located adjacent to the site. Major assets include: 150 ST PVC – 5.3HP 1900kPa in the development side of Soldiers Road, and 150 ST – 6.2HP 1900kPa in the development side of Bishop Road.

Power

Power services immediately adjacent to the site are likely to be suitable for connection. There are existing HV and LV lines in Bishop Road, Soldiers Road and Little Road.

The project engineers expect that future servicing of this site will require the standard network of underground HV and LV with transformer/switchgear sites approximately for every 50 to 60 residential lots (or their load equivalent for other land uses).

Telecommunications

Telecommunication services will be designed by an experienced communications consultant and coordinated with either NBN or Telstra depending on the nearest fibre exchange. The Whitby Town development has been serviced by NBN giving reasonable cause for the site to be also connected to NBN.

CONCLUSIONS

The site is identified as 'Urban Expansion' under the *South Metropolitan Peel Sub-Regional Planning Framework* and the Amendment therefore assists in achieving the State's strategic planning direction for this area. The site is also appropriately situated between areas recognised for urban development and therefore presents a logical and orderly response to urban expansion and infill.

The amendment will facilitate the residential development of the land following detailed local structure planning and subdivision approval. The timely initiation of the rezoning of this land will allow for its consideration in ongoing strategic planning considerations including the relevant DCP and Shire Planning Strategies.

Land Group WA was established (by Home Group WA) to capture the synergies and economies of scale by the developer/builder business model. Given the size and development potential of the subject land, Land Group WA seeks to maximise the synergies and economies of scale that the developer/ builder business model creates and pass on those benefits to land/home buyers by way of more affordable house and land options.

Land Group WA, in conjunction with its affiliated companies, holds the long-term objective of delivering more affordable and sustainable housing options to Western Australia and creating a new market for their products. This objective can be achieved on the subject land by implementing the various strategies outlined in this Amendment request (and attached documents) to produce affordable and sustainable land for sale, and affordable houses to be built on that land. In passing on the efficiency savings to the ultimate buyers Land Group WA will be able to bring another group of potential homeowners into the marketplace.

We hereby seek the support of Officers of the Department and members of the WAPC in supporting this MRS Amendment request on the basis that it will assist in the development and provision of innovative and affordable housing opportunities to a greater number of Western Australians than would normally have the opportunity to enter our local housing market. We strongly believe that this presents reasonable justification for supporting the departure from the specified staging requirements of the State Framework and does so whilst representing orderly and proper planning of the locality. The remaining Structure Plan Process would allow for the planning and consideration of any items that are considered to require further detailed assessment.

Given the above, the proposed MRS Amendment represents a logical and well-planned reclassification of land that is not unduly constrained in terms of development potential. Should you require any additional information or wish to discuss this matter further, please do not hesitate to contact the Mark Szabo at our office on (08) 9328 6411.

Yours faithfully
BURGESS DESIGN GROUP

MARK SZABO
ASSOCIATE DIRECTOR

CC

- Mr Anthony Silvestro – Home Group WA

Appendices

- Appendix 1 - Enviro-Developer Sustainability Memorandum (Stantec)
- Appendix 2 - 10-Star Home Energy Efficiency Memorandum (Stantec)
- Appendix 3 - Economic Review (Urbis)
- Appendix 4 - Environmental Assessment Report (360 Environmental)
- Appendix 5 - Infrastructure Servicing Report (Kctt)
- Appendix 6 - Infrastructure Servicing Letter (Stantec)
- Appendix 7 - Bushfire Management Plan (Bushfire Safety Consulting)

APPENDIX 1:
ENVIRO-DEVELOPER SUSTAINABILITY MEMORANDUM (STANTEC)

Memo – Sustainability EnviroDevelopment

Stantec

Enquiries: Prasanna Suraweera / Hannah Cunningham
Project No: 301250790

To: Land Group WA
From: Prasanna Suraweera
Date: 03/02/2022

Subject: Lot 30 Soldiers Road Cardup – Residential Subdivision EnviroDevelopment Certification

This memorandum aims to outline the approach to sustainable design for this project and confirm the Sustainability objectives and targets for Lot 30 Soldiers Road – Residential Subdivision Development located in Cardup.

Land Group WA recognises the importance of sustainability in both land development as well as within the built form. The climate change impacts experienced today are considered severe and active steps need to be taken to mitigate the risks as well as to prevent further negative impacts. This aligns directly with the current State and National Emissions Reduction Targets[1].

The above objective has been embraced as a key objective for the development and will be used as a core pillar in the development of the sustainability strategy.

To ensure that sustainability is considered in a holistic manner, it has been proposed to utilise an established sustainability framework, namely EnviroDevelopment tool, developed by the Urban Development Institute of Australia (UDIA).

EnviroDevelopment scheme assesses outstanding sustainability performance across several elements including:

- Ecosystems
- Materials
- Waste
- Water
- Energy
- Community

Land Group WA has appointed Stantec Australia to lead the integration of the sustainability initiatives for the project. With the goal of certifying[2] against six elements outlined above[3]. To date, Stantec have prepared reverse project briefs of each discipline engaged and project stakeholders including:

- Bush Fire Consultant
- Civil Engineering
- Client
- Electrical
- Environmental Consultant
- Head contractor
- Home Builder
- Land Clearing and Demolition
- Landscaping
- Planning Brief
- Traffic Consultant
- Waste Consultant

[1] https://www.environment.gov.au/system/files/resources/f52d7587-8103-49a3-aeb6-651885fa6095/files/summary-australias-2030-emissions-reduction-target.doc#:~:text=Australia's%202030%20Emission%20Reduction%20Target&text=The%20Australian%20Government%20will%20reduce,below%202000%20levels%20by%202020.
[2] Pending further design and investigation.
[3] With a minimum of four to gain certification.

Memo – Sustainability EnviroDevelopment

Stantec

To ensure there is a designated focus on the Enviro Developer targets and key principles. In line with the established vision, a particular focus will be around energy and mitigating associated emissions.

EnviroDevelopment Benefits

EnviroDevelopment has been designed to benefit a wide range of groups and the environment. The system offers numerous benefits for home buyers and local government bodies.

Home buyers and occupiers:

- Reduced operating costs.
- Eligibility for rebates and incentives.
- Healthier homes and communities.
- Satisfaction at reducing ecological footprint.

Local government groups:

- A more attractive, liveable, and sustainable region.
- Increased community awareness of the importance of protecting the environment.
- More efficient use of resources whilst facilitating population growth.
- Reduced pressure and demand on infrastructure and services.
- Increased awareness of strategies to enhance sustainability.

The Elements of EnviroDevelopment

ECOSYSTEMS

Protect and enhance native ecosystems and ecological function by rehabilitating degraded sites. This includes consideration of aquatic ecosystems, landform, flora and fauna. An example of this would be to encourage protection and rehabilitation of riparian[4] vegetation and wetlands.

ENERGY

Implement measures to optimise energy reduction across the project beyond current regulatory requirements. This considers reduction of greenhouse gases through energy efficient appliances and fixtures, passive design[5] and behaviour change.

[4] Relating to wetlands adjacent to rivers and streams.
[5] Techniques used in building design to ensure that it's naturally cooler in summer and warmer in winter which include; orientation, thermal mass, insulation, general shading and windows.

Memo – Sustainability EnviroDevelopment

Stantec

Implement waste management procedures and practices to reduce the amount of waste to landfill and facilitate recycling considering demolition or land clearing phases as well as construction and post-construction phases.

Utilise environmentally responsible materials and construction methods to lower environmental impacts of material usage. Considering the use of recycled, reused, renewable, non-toxic, and locally sourced materials with low lifecycle energy. Encourage higher indoor air quality through choice of low Volatile Organic Compounds (VOC)[6] emitting materials.

Introduce measures that would achieve at least a 20 per cent reduction in potable water use beyond regulatory measures and have no potable water irrigation requirements. Through water efficiency mechanisms such as efficient fittings, planting drought tolerant species, source substitution (rainwater tanks) and education initiatives.

This includes consideration of community consultation; ongoing community governance and engagement; place making; community prosperity; local facilities; safety and accessibility; and indoor environment quality. Encourage healthy and active lifestyles, community spirit, local facilities, alternative transport modes, and accessible and flexible design[7]. that welcomes a diversity of people and adapts to their changing needs.

EnviroDevelopment Essential Requirements

To be eligible for certification, each project must demonstrate compliance against the following essential requirements:

- Establish a community education program targeting residents/tenants/ users which specifically addresses:
  - information regarding the waste hierarchy of reduce, reuse, and recycle.
  - energy and water efficiency; and
  - use of environmentally responsible materials, emissions and maintenance.

Example mechanisms include interpretive signage, fact sheets, and end user manuals.

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[6] Volatile Organic Compounds (VOC)s include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products.

[7] The project will require 50% of all dwellings to achieve “silver” performance under the Living Housing design guidelines which improve accessibility to ensure future occupants do not need to retrofit their homes to improve access.

Memo – Sustainability
EnviroDevelopment

- Conduct thorough site analysis, prior to the planning and design phase using an appropriately qualified professional to identify areas of prime significance for conservation and to identify areas where clearing and/or major earthworks should not occur. The project must adequately consider and preserve significant areas based on the advice of this report
- Plan, implement, and maintain effective sediment and erosion control measures during construction and operation. As a minimum, these should comply with all regulatory requirements.
- Where relevant, recycle and reuse all vegetative debris on site (e.g., for landscaping or composting purposes). If not feasible, arrangements should be made for vegetative debris to be transported for reuse or disposed of by a licensed recycler or reprocessor. There should be no pit burning of green waste on site.
- Demonstrate assessment of solar orientation options to provide best practice solar access opportunities.
- Demonstrate how the project will reduce greenhouse gas emissions beyond regulatory requirements.
- Demonstrate how the project will reduce potable water consumption for irrigation.
- Demonstrate how community consultation and feedback has been incorporated into the projects design or activities.

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Memo – Sustainability EnviroDevelopment

Project Team

The ESD team is led by Prasanna Suraweera, who is an accredited Green Star Professional, and Senior Sustainability Project Engineer within the Sustainability department at Stantec Australia. Assisted by Hannah Cunningham a Sustainability Engineer and a EnviroDevelopment Accredited Professional.

Prasanna Suraweera

Sustainability Project Engineer, Director / Australian Discipline Leader

There are a thousand sustainability options out there and what I love doing is finding the right path to meet the client's needs. It's like solving a puzzle with an environmentally sustainable goal, I really savour finding that balance between innovative performance and cost constraints. Prasanna is a sustainability section manager, Australian discipline leader, and has recently been appointed a Director in our Perth office. He's also accredited by Green Star and an active sustainability advocate in Western Australia.

About Prasanna

Prasanna joined the company as a Mechanical Engineer, proving his ability and flair as a founding member of the Sustainability section before becoming a Project Engineer and ultimately, the ESD team's Section leader. His ability to successfully drive projects with a commercial awareness whilst engaging stakeholders at every level, made him a favourite with Stantec clients; an aptitude that was rewarded with the invitation to become a Stantec Director.

Accredited by Green Star and an active sustainability advocate in WA, Pras has the expertise and experience to optimize sustainable design in projects encompassing all sectors. Over the 14+ years Pras has been with Stantec, he has acquired a solid record of steering his projects through to completion and has earned our clients' trust and respect.

Project highlights

Vasse Newtown EnviroDevelopment
Waterbank – buildings E & G
59 Albany Highway, Perth
RAC Headquarters Cityswitch
Fairlanes - NABERS
RAAF Base Pearce Redevelopment – Elements E, J
Applecross SHS Redevelopment
Greater Curtin – Stage 1
Hedland Health Campus Redevelopment
Joondalup Hospital ESD
Albany Health Campus
Burswood Tower 6
Perth City Link Lots 2 & 3A
Lot 7 EQ Base Build
Leighton Beach Apartments – ESD
Elizabeth Quay – Stage 2 – Lots 9 & 10
Viridian, China Green
Midland Gate – Stage 3 Redevelopment
New Perth Optus Stadium
City of Perth Library
Old Perth Boys School Next Stage - Sustainability
Latitude 32, Flinders Street
QEII Medical Centre – Central Energy Plant

Qualifications

- Bachelor of Science in Engineering (Mechanical), Curtin University of Technology (Hons)

Industry accreditations/bodies

- Member, Institution of Engineers, Australia
- National Australian Built Environment Rating System (NABERS) Accredited Assessor
- Green Star Accredited Professional, Green Building Council of Australia

Memo – Sustainability EnviroDevelopment

Stantec

Hannah Cunningham

Sustainability Engineer

With a background in conservation, horticulture and sustainability I am passionate about the importance of the work I do - ensuring our projects are optimised to meet the needs of the present without compromising future generations.

About Hannah

Joining Stantec in 2021, Hannah's environmental background and avid interest in sustainability and built environments led to her assisting the Sustainability team with a range of WELL and Green Star certification projects in the commercial and residential sectors. Since then, she has worked with a number of our key clients, identifying initiatives to achieve better outcomes for the communities in which they operate. Carrying out reviews, she focuses particularly on improving indoor environmental quality via materials selection to reduce indoor pollutants; minimising potable water consumption, reducing pesticide use and improving lighting and visual comfort. She has also been involved in urban heat island effect reduction and calculating the ecological value for projects.

Hannah has also assisted our Energy Services team with solar PV simulation modelling, the production of design documentation and interpreting specifications for feasibility studies. Through this work she has developed an extensive knowledge of all phases of the project lifecycle. Hannah maintains her knowledge of current trends by staying abreast of developments in the renewable energy industry.

Project highlights

Water Corporation - Solar PV Projects	Chevron Fit-Out, 1 The Esplanade
Murdoch University Health and Knowledge Precinct	Symbio Labs
MRL - 20 Walters Drive	

Qualifications

- Bachelor of Science (Environmental Studies and Policy), Victoria University of Wellington

Industry accreditations/bodies

- Green Star Accredited Professional
- EnviroDevelopment Professional
- Member, Environment Institute of Australia, and New Zealand INC

We trust that the above is sufficient for your present requirements. Should you require any further information, please do not hesitate to contact us.

Yours sincerely,

Prasanna Suraweera

for **Stantec Australia Pty Ltd**

APPENDIX 2:
10-STAR HOME ENERGY EFFIECIENCY MEMORANDUM (STANTEC)

Stantec

10 Star House

Project: 10 Star House – Home Group WA | **Project No:** 301250843

To: Daniel Vangelovski | **Date:** 06/04/2022

From: Callum Burgess

RE: Energy Efficiency Options Assessment

Stantec have been working with Home Group WA (HGWA) to assist in the development of innovative solutions to energy efficient housing, with the aim of creating a 10-star rated house prototype for Home Group to offer to the WA homebuilding market. This outcome will present a significant improvement compared to current building code requirements and energy efficiency performance in the project home market, demonstrating exceptional leadership and forward thinking by HGWA. Stantec's sustainability team aims to highlight potential opportunities for homebuilding materials and construction methodologies capable of achieving a highly energy efficient house, aligning with HGWA's transition to market leading, affordable housing. Stantec have undertaken extensive design option testing, including modelling over 600 designs with various parameters to achieve this milestone.

The current requirement under NCC 2019 for residential dwellings is a star rating of 6 stars, this equates to an energy load of 70 MJ/m^2. To achieve a 10 star rating, the energy load must be less than 4.0 MJ/m^2, a 94% reduction in energy used to heat and cool the dwelling from the standard.

Findings:

Based on the options assessment, several combinations of glazing and building element selections were found to achieve the goal of 10 stars. The goal of a 10 star rated house could be achieved under the following conditions:

- External Walls – Reverse brick veneer with insulation
- Internal Walls – Cast concrete
- Roof – Metal deck with insulation in a light colour
- Floor – Concrete slab on ground
- Floor Coverings – Carpet to bedrooms, tiles to wet areas and living room, timber to activity/theatre
- Windows – Double glazed low emissivity windows
- Shading Devices – Eaves and vergola
- Orientation – North facing
- Ceiling Penetrations – Sealed exhaust fans to wet areas and ceiling fans to living rooms and bedrooms.

Several combined building scenarios were tested with the resulting star rating presented below.

Single Low E Clear	Single Low E Neutral	Single Low E Grey	Double Clear	Double Grey	Double Low E Clear	Double Low E Neutral	Double Low E Grey
9.85	9.67	9.50	9.94	9.84	10.00	9.95	9.84
9.91	9.79	9.62	10.00	9.92	**10.00**	10.00	9.90
9.82	9.63	9.48	9.92	9.82	10.00	9.94	9.81
9.80	9.64	9.49	9.91	9.80	10.00	9.92	9.81

Methodology:

Using standard constructions as a base case scenario, variations to building elements have been tested independently to determine the optimal scenarios which achieve the highest NatHERS star rating for a range of glazing options below:

Glazing Options

- Eight glazing options were tested, double glazed low e clear was the ideal glazing option.

Modification of External Walls

- Reverse brick veneer was the optimal wall construction, significantly outperforming alternatives

Modification of Internal Walls

- Increasing the thermal mass of the internal walls (i.e. concrete) significantly increases the star rating of the house by taking advantage of free heating in the afternoon to warm into the night in winter.

Modification of Floor and Wall Colour

- Darker colour internal floors performed better as the darker colour reduced the heating load without significantly influencing the total cooling loads.

Modification of Window Dimensions

- Reducing the glazing area relative to the wall area of the façade improved the star rating of the house.

Modification of Shading Devices

- Eaves have a positive impact on the rating, more so when glazing with a higher SHGC is used.
- Shading devices were able to maximise the winter heating and minimise summer cooling loads.

Modification of Roof Insulation

- Metal deck roof constructions were the optimum roof construction

Modification of Ceiling Fans

- Ceiling fans improved the overall star rating by reducing the total cooling load in each room.

Modification of Building Orientation

- Variation from the north facing orientation negatively impacts performance, this is partially due to the highlight windows in the living room requiring a north orientation to maximise winter sun and minimise summer sun.

Stantec are continuing to work with HGWA to refine and finalise the various sustainability considerations which will underpin the delivery of an affordable 10 star energy efficient home.

Yours sincerely

Stantec Australia Pty Ltd

Callum Burgess
Sustainability Engineer

APPENDIX 3:
ECONOMIC REVIEW (URBIS)

URBIS

LOT 30 SOLDIERS ROAD CARDUP
ECONOMIC REVIEW

Prepared for Land Group WA
April 2022

CONTENTS

01

INTRODUCTION

REPORT STRUCTURE

Report Background

Urbis was engaged by Land Group WA to undertake an Economic Review of the proposed Meads Private Estate at Lot 30 Soldiers Road Cardup.

The diagram to the right shows the methodology used for this project.

Methodology

LOCAL AND REGIONAL CONTEXT

Review of local and regional planning context, including growth aspirations in the Serpentine Jarrahdale area

DEMAND FOR SUSTAINABLE HOUSING

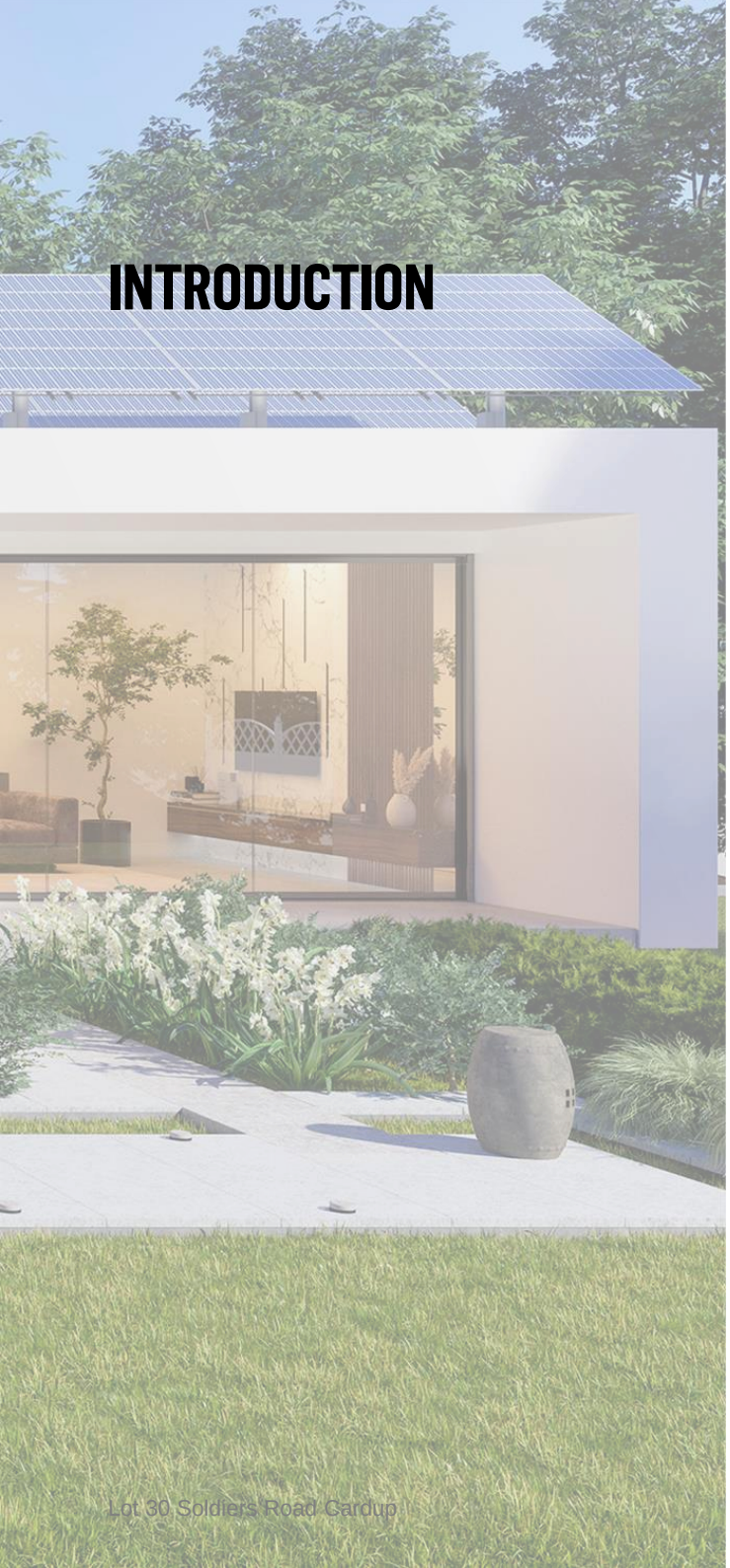
Analysis of the potential demand for sustainable housing using the UDIA Home Purchaser Sentiment Survey

INFRASTRUC-TURE REVIEW

Review existing and planned infrastructure in the area that would support development on the site

POPULATION GROWTH

Review historical and future population growth in the area that will drive demand for new sustainable housing.



INTRODUCTION

Land Group WA and Home Group are in the planning stages for the Meads Private Estate. The estate is slated for Lot 30 Soldiers Road Cardup.

By leveraging the developer / builder business model, the two Silvestro Building Group companies are aiming to create a highly innovative, sustainable estate. The project is intended to develop WA's first 10 Star Demonstration Home.

The Meads Private Estate vision includes delivering affordable, as well as energy-efficient housing, to suit the needs of first home buyers and those households that were previously priced out of the market.

The synergies available from undertaking the project as developer / builder are expected to allow the estate to provide a new benchmark in WA for sustainable housing, supported by excellent planning and design.

The site for the estate is located in the growing south east corridor of Perth, where considerable population growth and major infrastructure works are building new communities for the future.

KEY FINDINGS

Key findings

1. **Strong demand for sustainable housing:** the Urbis UDIA Home Purchaser Sentiment Survey shows that 91% of the Perth market surveyed was interested in energy efficient features.
2. **First home buyer sentiment:** first home buyers and young people were particularly likely to be interested in energy saving features and would be a key buyer market for Meads Private Estate.
3. **Unique product:** the Meads Private Estate is very well placed to provide an innovative sustainable product to the first home buyer market.
4. **Activity Centre growth:** the Whitby Activity centre is planned for within the walkable catchment of the Meads Private Estate.
5. **Infrastructure funding:** there is over $1billion of committed funding, with more projects in the planning stages, to support growth in the south east corridor.
6. **Strong population growth:** the Shire of Serpentine Jarrahdale is in the midst of significant population growth.
7. **Supply is key to affordable housing:** the Shire of Serpentine Jarrahdale offers the most affordable average lot price in the south east corridor, and maintaining supply will allow this to continue.

91%

Of Perth market surveyed interested in energy efficient features

+$1B

Committed funding for infrastructure in the region

88%

Forecast population growth in the Shire of Serpentine Jarrahdale (2021-2036)

REGIONAL CONTEXT

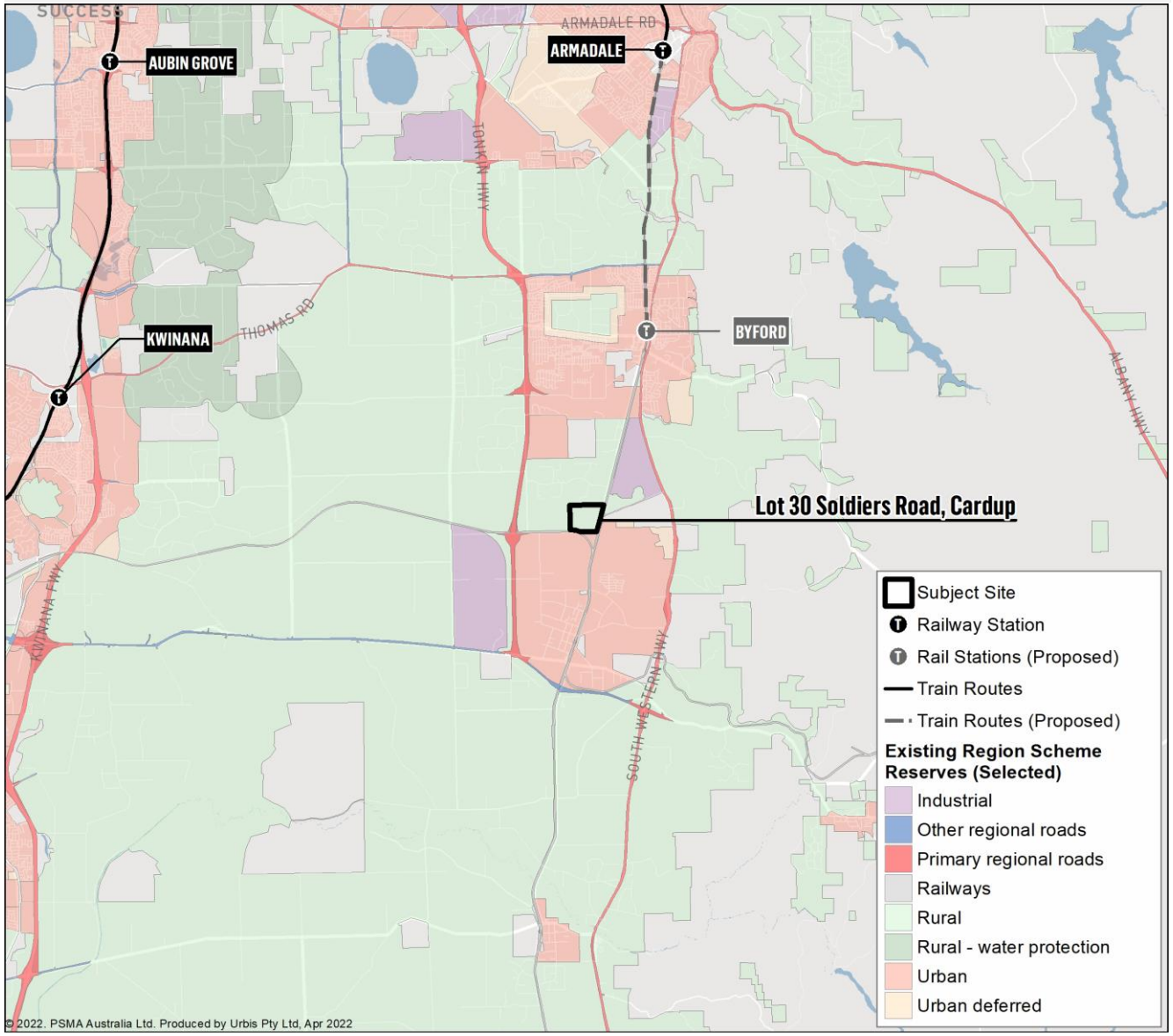
Key Findings

Lot 30 Soldiers Road, is located in Cardup, a suburb of the Shire of Serpentine Jarrahdale, 35 km south-east of Perth.

The LGA is part of Perth's south east growth corridor. It has seen some of the highest population growth in the country.

The site is currently zoned Rural under the Metropolitan Region Scheme. The area will be influenced by significant infrastructure works that are planned or in progress. These include the METRONET Byford Rail Extension and the Tonkin Highway Extension which will improve connection to the southern suburbs.

Regional Context



LOCAL CONTEXT

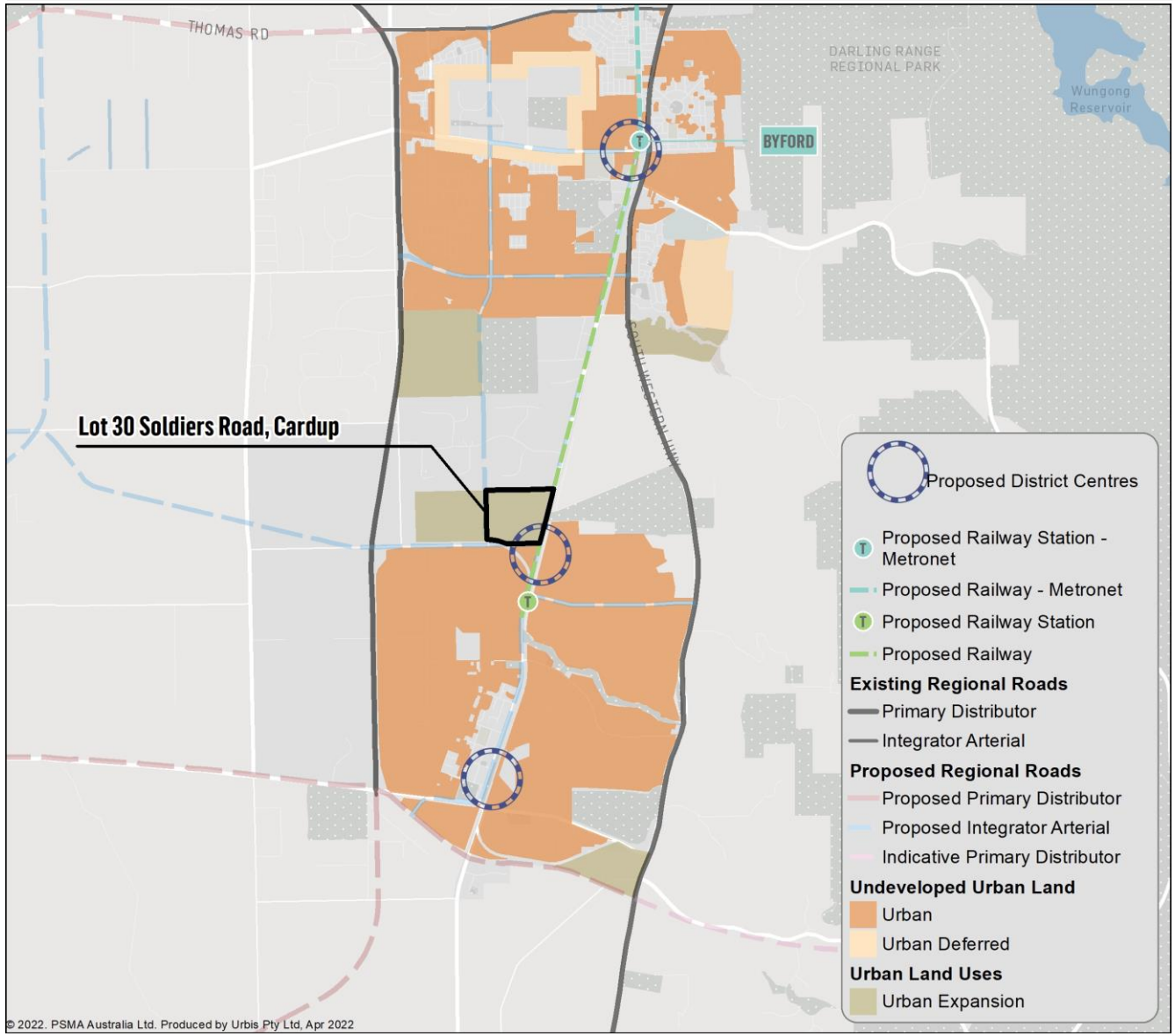
Key Findings

Subject to planning approvals, Lot 30 Soldiers Road, Cardup is slated to become Meads Private Estate - a residential estate with a high focus on sustainability.

Soldiers Road, on the eastern side of the site, runs parallel to Robinson Road, and the proposed extension of the Armadale Train Line to Byford. The train line currently services the regional Australind train service. To the south, the site is bounded by Bishop Road.

The site is designated as Urban Expansion in the South Metropolitan Peel Sub-Regional Planning Framework. The local area is expected to see strong urban growth as surrounding land estates develop.

Site Map



02

SUSTAINABLE HOUSING DEMAND

SUMMARY

SUSTAINABLE HOUSING DEMAND

Perth is seeing a growing demand for sustainable housing. Meads Private Estate aims to bring new levels of innovation that will be made possible because of synergies captured by both builder and developer coming from one group of companies. The Estate aims to have the first 10 Star Demonstration Home in WA.

The Urbis / UDIA Home Purchaser Sentiment Survey provides evidence that market demand for energy saving features is strong. This is particularly the case for younger first home buyers who are likely to be a key buyer group for Meads Private Estate.

Key finding from the survey are:

91% OF PERTH MARKET SURVEYED HAD SOME INTEREST IN ENERGY EFFICIENT FEATURES

95% OF FIRST HOME BUYERS INTERESTED IN ADDITION OF ENERGY SAVING FEATURES

25-34 AGE GROUP MOST INTERESTED IN ADDITION OF ENERGY SAVING FEATURES

44% INDICATED THAT THEY WOULD BE PREPARED TO PAY IN EXCESS OF $5,000 FOR ENERGY SAVING FEATURES AND 62% OF PEOPLE INDICATED THAT A THREE YEAR PLUS PAYBACK WAS ACCEPTABLE

Source: Urbis / UDIA Home Purchaser Sentiment Survey

KEY FINDINGS

STRONG DEMAND FROM FIRST HOME BUYERS

STRONG DEMAND FROM YOUNG PEOPLE

SUSTAINABLE HOUSING DEVELOPMENT

Land Group WA and Home Group have an ambitious vision to develop a high quality, sustainable community in Cardup – **Meads Private Estate**.

Land Group WA and Home Group are committed to harnessing the **synergies and economies of scale that the developer/builder business model** offers. These synergies are expected to be of particular relevance for the development of a sustainable community like that envisioned for Cardup.

Opportunities for developing sustainably and for a sustainable community as builder/developers include:

- Lot configuration with regard to affordable house design,
- Ease of adaptability to market conditions,
- Control of civil and built form sustainability outcomes,
- Quality driven Design Guidelines for built form,
- Access to recycled resources from parent company, Silvestro Building Group,
- Reduced development timeframes, and
- Cost savings that are passed to the home buyer.

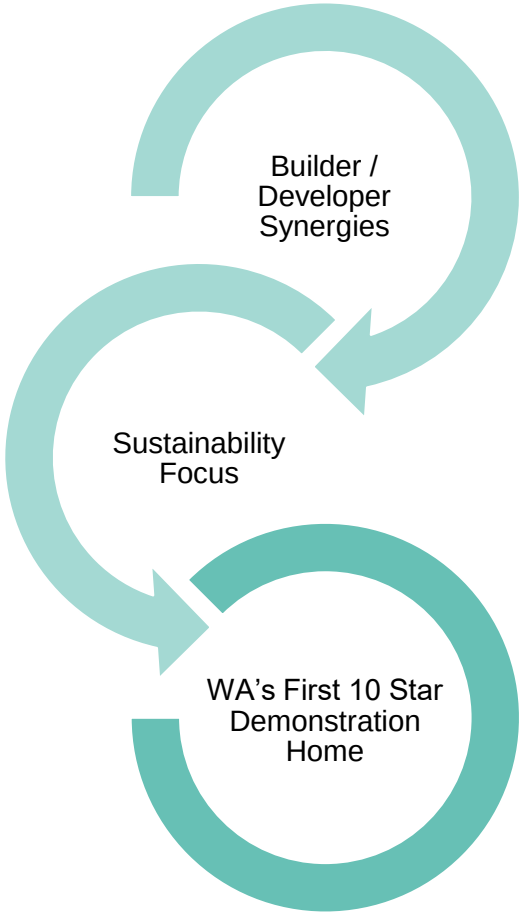
The Meads Private Estate project is expected to deliver not only a high quality and sustainable development, but **WA's first 10 Star Demonstration Home**. The developers "intend to advertise this home and create a destination for Serpentine Jarrahdale that will demonstrate what is possible and help **educate both the general public and industry on how to achieve energy-efficient design outcomes**".

EnviroDevelopment is a nationally recognised certification and branding system providing independent verification of a development project's sustainability performance. The Meads Private Estate **is aiming to achieve the highest possible EnviroDevelopment rating of all six leaves** which will mean having a focus on sustainability in all the following areas; Ecosystems, Waste, Energy, Materials, Water and Community.

The developers intend for the Meads Private Estate to be a sustainable community that is affordable for first home buyers and low-income earners, as a direct result of the synergies of the builder/developer model and focus on sustainability. The provision of affordable energy efficient residential development is a unique opportunity within the context of the existing first home buyer market. The Meads Private Estate will provide choice for this segment of the market.

This section outlines the Perth market's attitude towards sustainable development, as captured by the Urbis / UDIA Home Purchaser Sentiment Survey. It highlights that **the Perth market is seeking energy efficient** homes.

Source: Land Group WA



URBIS / UDIA HOME PURCHASER SENTIMENT SURVEY

Survey Details

The **Urbis / UDIA Home Purchaser Sentiment Survey**, delivered by UDIA WA in partnership with Urbis, provides insight into the housing market from a buyer's perspective. The survey is undertaken biannually to test market sentiment. The most recent survey was completed in October 2021 and included 506 respondents.

This survey included questions about energy efficiency features. The two questions were:

- Question 7: What length of payback period would be important for energy features?
- Question 8: How much would you be willing to pay to add energy saving features to your home?

These questions provide **evidence of the propensity of the Perth market to add energy saving features to their homes**, which is of particular relevance to the Meads Private Estate's vision for offering a sustainable development.

The survey captures evidence of the willingness to pay for energy saving home features. It also provides evidence of the preferred payback period for the addition of energy saving features to the homes of those surveyed in the Perth market. That is, the preferred period before the break even point, at which the initial cost of investment in the energy features is recovered.

Survey Questions

Payment Amount

Q: How much would you be willing to pay to add energy saving features to your home?

Payback Period

Q: If you were paying to add energy features to your home, what length of payback period would be important?

URBIS / UDIA HOME PURCHASER SENTIMENT SURVEY CONT.

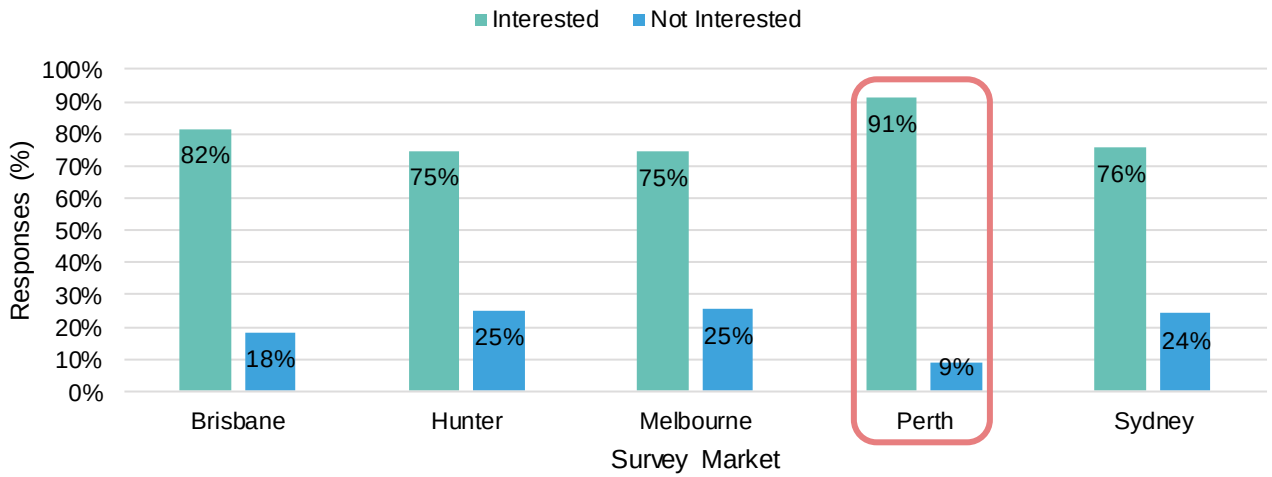
Key Insights

The **Perth market has a significant interest** in adding energy saving features to homes. This market sentiment indicates an appetite for sustainable developments like the Meads Private Estate.

The survey indicates that **Perth survey respondents registered higher interest (91%)** in energy saving features when compared to Melbourne (74%), Sydney (76%) and Brisbane (82%).

Importantly, only 9% of respondents recorded no interest at all in adding energy efficiency features to newly purchased homes. This survey result indicates a strong interest in the Perth market for energy efficient features in homes.

Q: How much would you be willing to pay to add energy saving features?



Source: UDIA Home Purchaser Sentimement Survey October 2021

Q: How much would you be willing to pay to add energy saving features?

Source: UDIA Home Purchaser Sentiment Survey October 2021

URBIS / UDIA HOME PURCHASER SENTIMENT SURVEY CONT.

Q: How much would you be willing to pay to add energy saving features to your home?

Key Insights

The success of the Meads Private Estate will be influenced by the market demand for energy saving features. **The Perth market is favourable towards added energy saving features**.

The **target market** for the Meads Private Estate, young, **first home buyers**, is **very interested** in the addition of energy saving features, which the estate offers.

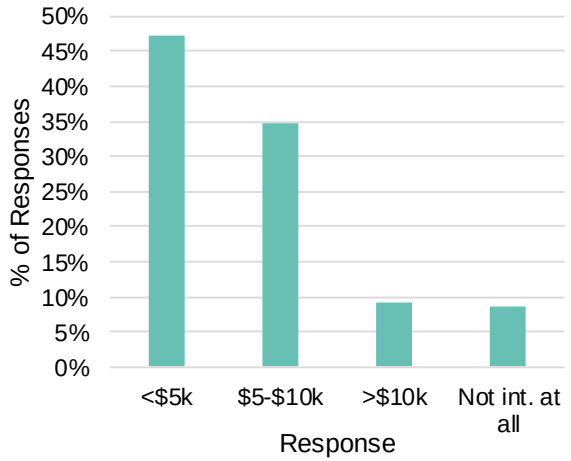
The October 2021 UDIA Home Purchaser Sentiment Survey asked respondents how much they would be willing to pay to add energy saving features to their homes. 47.2% of respondents indicated that they would be willing to pay up to $5,000 for energy saving features, while 34.8% responded with $5,000 - $10,000 and 9.3% indicated over $10,000.

Of those surveyed in the Perth market, the **25-34 age group were most likely to be interested** in adding energy saving features to their homes (>99%). This demographic cohort are likely the type of purchaser expected for the Meads Private Estate.

Another cohort of interest, **first home buyers, were more likely to be interested overall**, and more likely to indicate a willingness to pay $5,000 - $10,000, than respondents who were not first home buyers.

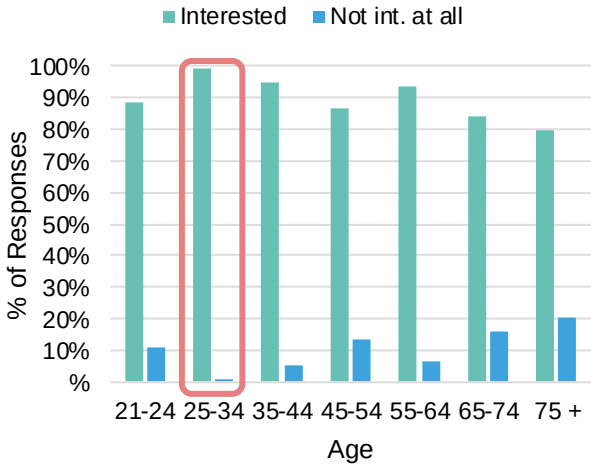
The survey also indicated that those respondents that were part of **family households were highly likely to be interested** in adding energy saving features to their homes (~92% for those with and without children).

Overall, Perth, October 2021



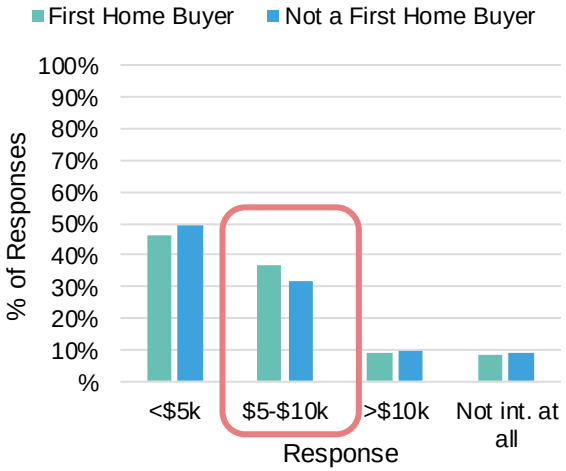
Source: UDIA Home Purchaser Sentiment Survey

Age, Perth, October 2021



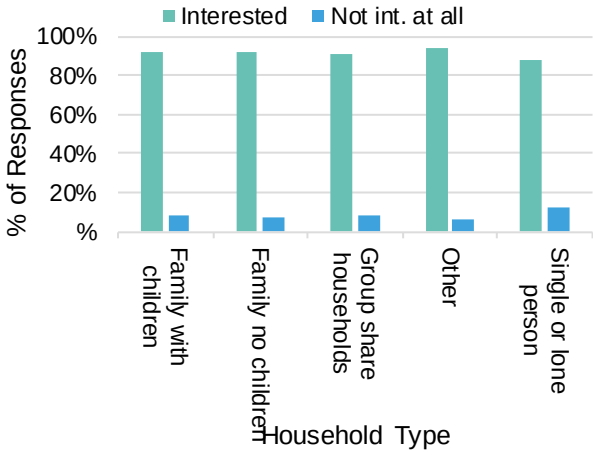
Source: UDIA Home Purchaser Sentiment Survey

First Home Buyer, Perth, October 2021



Source: UDIA Home Purchaser Sentiment Survey

Household Type, Perth, October 2021



Source: UDIA Home Purchaser Sentiment Survey

URBIS / UDIA HOME PURCHASER SENTIMENT SURVEY CONT.

Key Insights

Such is the **interest in energy saving features**, a significant number of home purchasers are **willing to accept long pay back periods** for the addition of these features. There is a strong outlook for home purchasers willing to accept a payback period of over three years (61.9% of those surveyed).

The results of the survey indicate that of the cohort surveyed in the Perth market, those in the **target market** for the proposed Meads Private Estate would be **likely to accept a payback period of at least six years for energy efficient features**.

First home buyers are a cohort addressed in the objectives for the development, with housing affordability for low income first home buyers a focus area for the project.

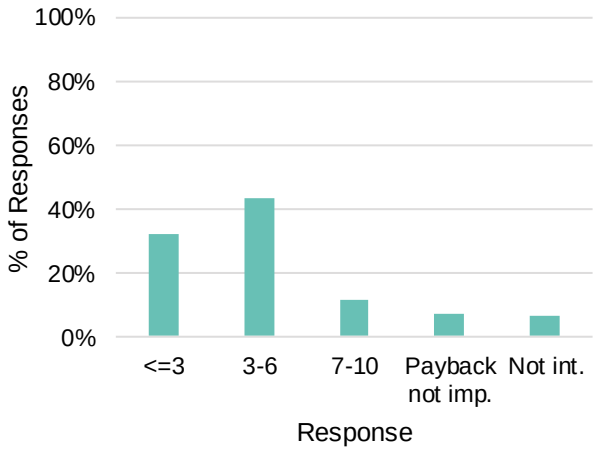
First home buyers that were surveyed were more likely than non-first home buyers to indicate that they **would prefer a payback period between 0 and 10 years**. Only 5.3% of first home buyers surveyed indicated that they were not interested at all in adding energy features. This is lower than the 8.2% of non-first home buyers surveyed.

The demographic features of the Cardup region and the typology of the development make **young families another cohort of interest**.

Those surveyed who live in **family households**, with or without children, **were likely to indicate that a pay back period of up to six years** is their preference. Less family households than single or lone person households indicated in the survey no interest at all.

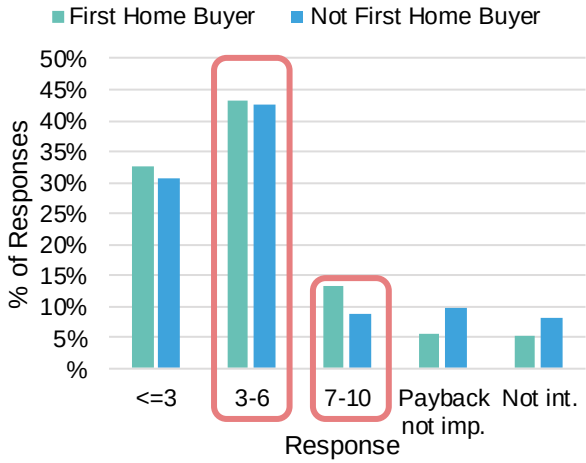
Q: If you were paying to add energy features to your home, what length of payback period would be important?

Overall, Perth, October 2021



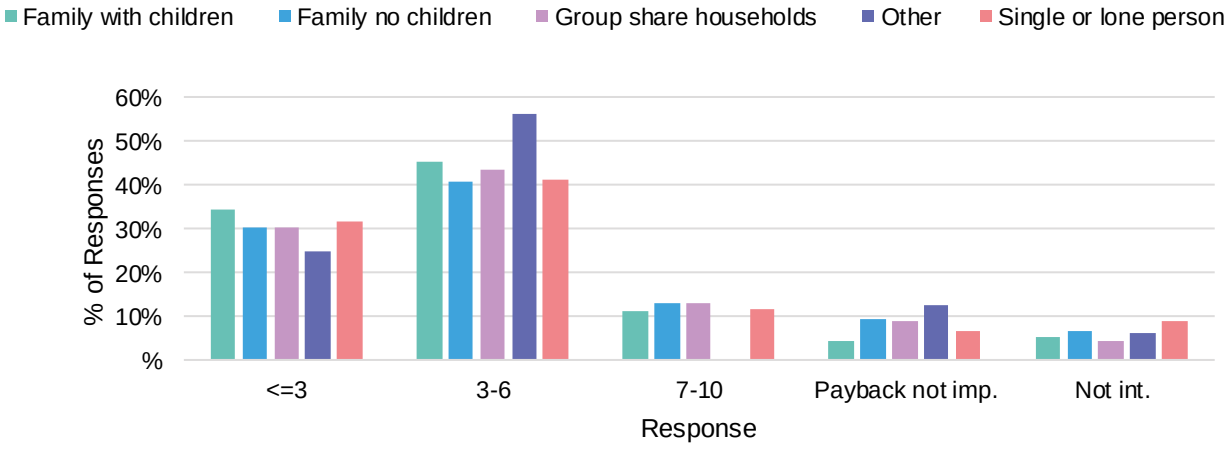
Source: UDIA Home Purchaser Sentiment Survey

First Home Buyer, Perth, October 2021



Source: UDIA Home Purchaser Sentiment Survey

Household Type, Perth, October 2021



Source: UDIA Home Purchaser Sentiment Survey

03

REGIONAL GROWTH OPPORTUNITY

SUMMARY

REGIONAL GROWTH FACTORS

The Meads Private Estate is well-located to maximise utilisation of existing, committed, and planned infrastructure.

All levels of government are planning for major infrastructure and population services that will support a growing population in the Serpentine-Jarrahdale area. These projects will support a new sustainable community in Cardup.

Key data points for this are:

750M DISTANCE TO PROPOSED FUTURE WHITBY ACTIVITY CENTRE AND TRAIN STATION

5KM DISTANCE TO FUTURE BYFORD STATION

42 MINUTE TRAIN RIDE TO PERTH CBD FROM PROPOSED NEW BYFORD STATION

+$1B COMMITTED FUNDING FOR INFRASTRUCTURE PROJECTS

2023 CONSTRUCTION EXPECTED TO BE UNDERWAY ON ROAD AND RAIL PROJECTS

KEY FINDINGS

STRONG PLANNING FRAMEWORK

LARGE INFRASTRUCTURE PIPELINE

LOCAL GROWTH – ACTIVITY CENTRES

Key Insights

The site for the Meads Private Estate is located on currently rural land, just to the north of a proposed district structure plan that is planned to address the strong population growth that is expected in the Shire of Serpentine Jarrahdale.

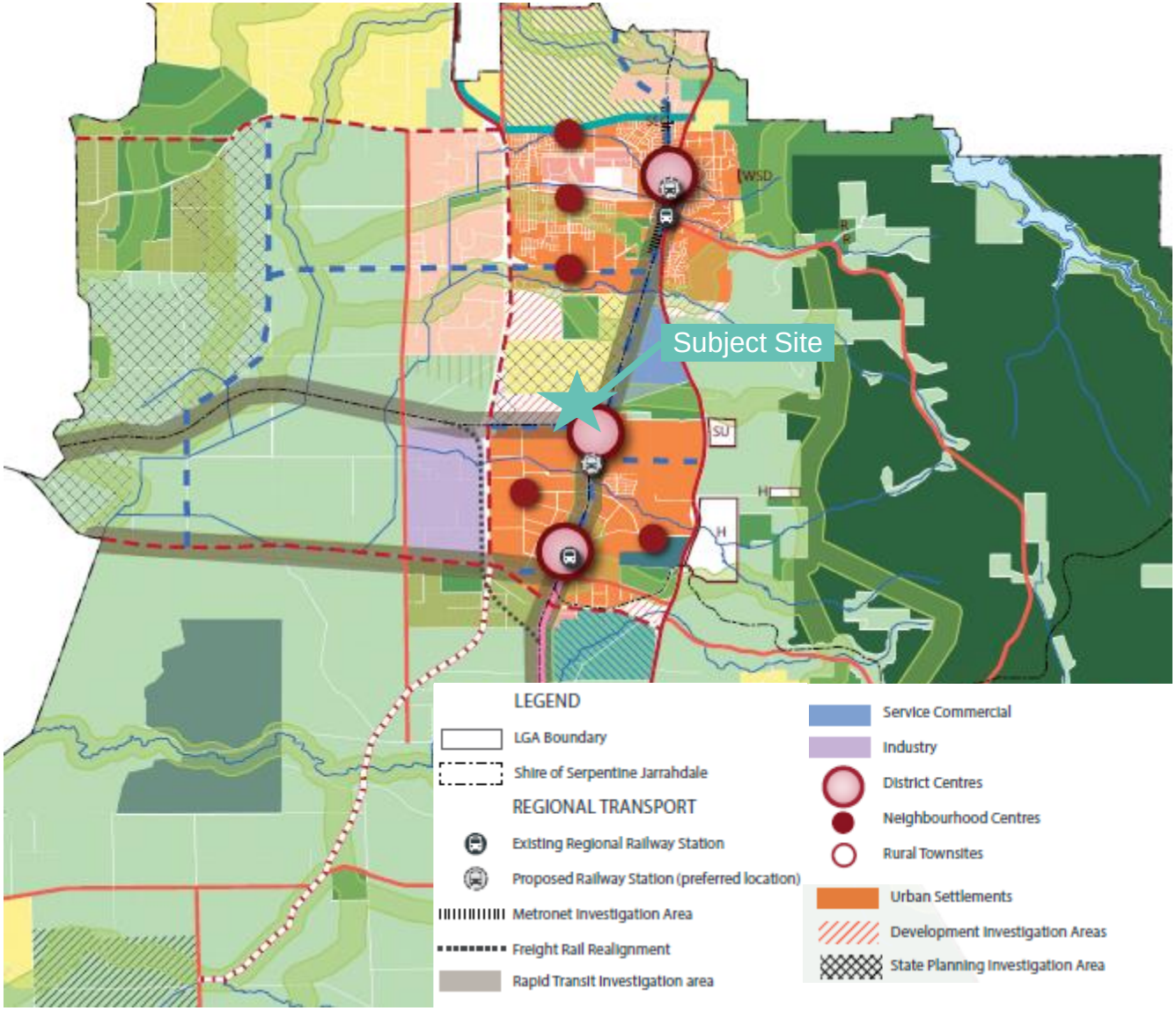
The planning strategies and plans for the Byford / Cardup / Mundijong / Whitby region make provision for **infrastructure to develop in line with population growth in the area**, and support land uses that will provide for communities as they develop.

The Draft Local Planning Strategy outlines a vision for several emerging activity centres that will provide employment, retail and population services.

The Mundijong District Structure Plan (draft) borders the site to the south and extends south beyond Mundijong Road. Within this area, there is an existing **Whitby Activity Centre Plan**. The realised activity centre plan would support the site with the delivery of retail and population services land uses, all **within 750m of the Meads Private Estate**. The activity centre plan makes provision for a **technical college within 500m** of the subject site, and three schools, all of which make the area attractive for first home buyers and young families. It also includes an indicative site for a **future train station,** which would further develop the connectivity of the area.

The Byford District Structure Plan (draft) covers the area from Cardup Siding Road in the south to Oakford Road in the north. The Byford DSP provisions for a district centre, supported by the planned Byford Station.

Draft Local Planning Strategy, Shire of Serpentine Jarrahdale



Source: Shire of Serpentine Jarrahdale Draft Local Planning Strategy

REGIONAL CONNECTIVITY

Key Insights

Beyond the local area, the site of the Meads Private Estate is well-positioned to benefit from the maturation of infrastructure, particularly transport-related, in the south east of Perth.

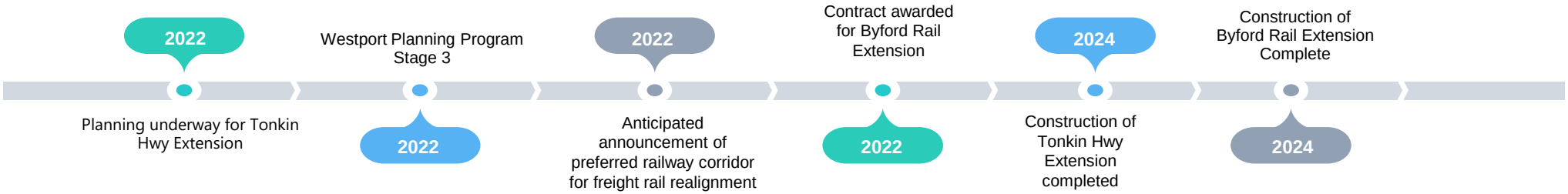
In recent years, all levels of government have made significant funding contributions towards the construction of infrastructure that will service the growing population in the south east. Road and rail are being prepared to accommodate increased usage and maintain safety and efficiency.

Meads Private Estate will benefit from new transport routes connecting it to emerging employment nodes, including the future port at Kwinana and the surrounding industrial ecosystem.

Proposed upgrades to Anketell Road, along with the realignment of the freight rail corridor, will increase accessibility for residents of the Shire of Serpentine Jarrahdale to the future port, the Kwinana industrial zone, the Latitude 32 industrial zone and the Australian Marine Complex.

Other transport improvements that are in the planning and construction phases are the METRONET Byford Rail Extension, and the Tonkin Highway extension and associated freight rail realignment.

Source: Westport



Source: Main Roads Western Australia, Department of Infrastructure, Transport, Regional Development and Communications, Westport
Note: all timings are estimates and subject to change

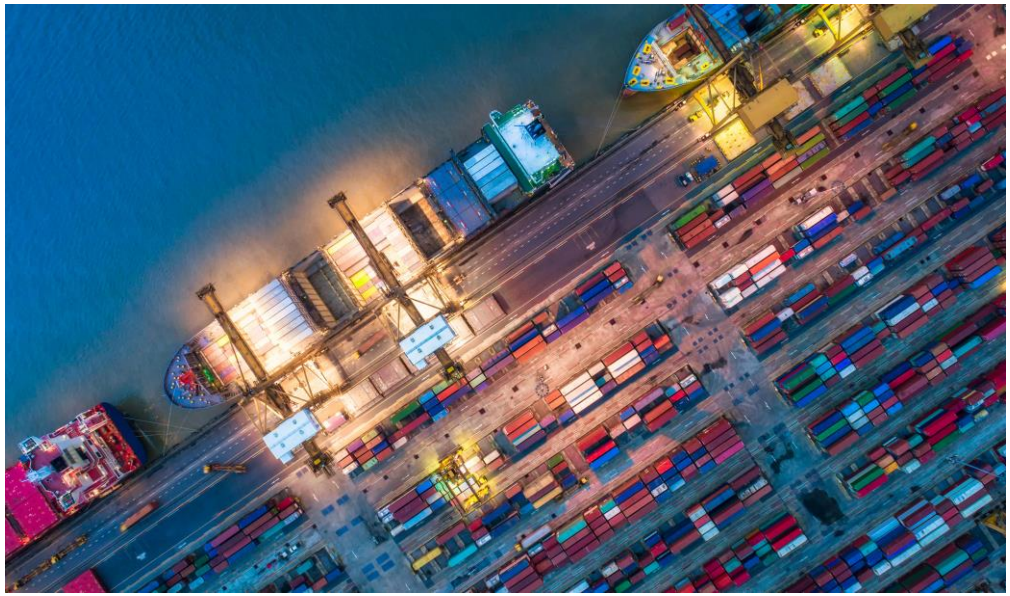
LOCAL EMPLOYMENT AREAS

Key Insights

Employment opportunities in the south east corridor will expand with the realisation of state-level major projects. New employment nodes at the West Mundijong Industrial Area and the future port in Kwinana will broaden employment options for residents at the Meads Private Estate, beyond the significant retail and commercial opportunities that are expected at the activity centres.

Agriculture, Forestry and Fishing, Construction and Manufacturing are in the top five industries of employment for residents of the Shire of Serpentine Jarrahdale. Expansion of employment land uses suited to these industries will **contribute to the attractiveness of residential development in the area**, such as Meads Private Estate.

Meads Private Estate's site is located opposite the northern edge of the West Mundijong Industrial Area on Bishop Road. The future port in Kwinana, with detailed planning still underway, will be located around 20km from the site, and accessible via Mundijong Road.



West Mundijong Industrial Area

The West Mundijong Industrial Area Structure Plan outlines that **880 industrial lots** are possible in the area. The industrial zone would be accompanied by infrastructure including the realignment of the Kwinana Freight Rail Line and a potential intermodal in the area.

The Business Case for supporting enabling infrastructure suggests that the West Mundijong Industrial Area could support **11,700 jobs in the area over 30 years** if the project is delivered to full capacity. This significant job creation provides important employment opportunity for potential residents of Meads Private Estate and adds to the attractiveness of the development for home buyers.

Westport

The WA Government is in the process of planning for a new container port and logistics network in Kwinana**. Westport is a once in a generation upgrade to WA's trade routes and supply chains** that will deliver jobs in the area in the construction and operational phases.

The new port is currently expected to be located in the Outer Harbour in Kwinana, co-located with the Kwinana Industrial Area and other strategic sites. The intent is for the industrial zone and surrounds to drive clusters of economic activity and innovation.

The proximity of the port to the Meads Private Estate, which will be connected by revitalised transport assets, will offer even greater **employment opportunities** to residents in Perth's south east.

Source: Forecast.id, West Mundijong Industrial Area Enabling Infrastructure Business Case (Pracsys)

REGIONAL RAIL INFRASTRUCTURE

Key Insights

A strong pipeline of infrastructure in Perth's south east is unlocking opportunity for new communities in the region, such as the Meads Private Estate. Investment in rail infrastructure in the south east corridor will have a major impact on Cardup.

METRONET is the **largest ever investment in public transport in WA** and will see up to 22 new stations, including the new Byford Station. The **extension of the Armadale Line south to Byford** is an important investment to support the fast-growing region. The project is just one example of state-level investment that acknowledges the south east corridor as a thriving growth area, transitioning from its rural roots, that will be home to many new residents in the future.

The proposed new Byford Train Station is located approximately five kilometres north from the subject site. **Travel from the station to Perth will be around 42 minutes**. The station will be the southern most station on the line and support continued growth in the region.

Improved rail connection via the Armadale Train Line to the Perth CBD will **unlock more efficient access to employment, as well as population services like health and education, for residents of the area**.

Armadale is the strategic metropolitan centre servicing the south east corridor, and with the addition of the station, will be more accessible than ever for residents. Armadale offers a range of health services, including the Armadale Health Service, two major shopping centres and a TAFE campus.

METRONET Armadale Line Projects

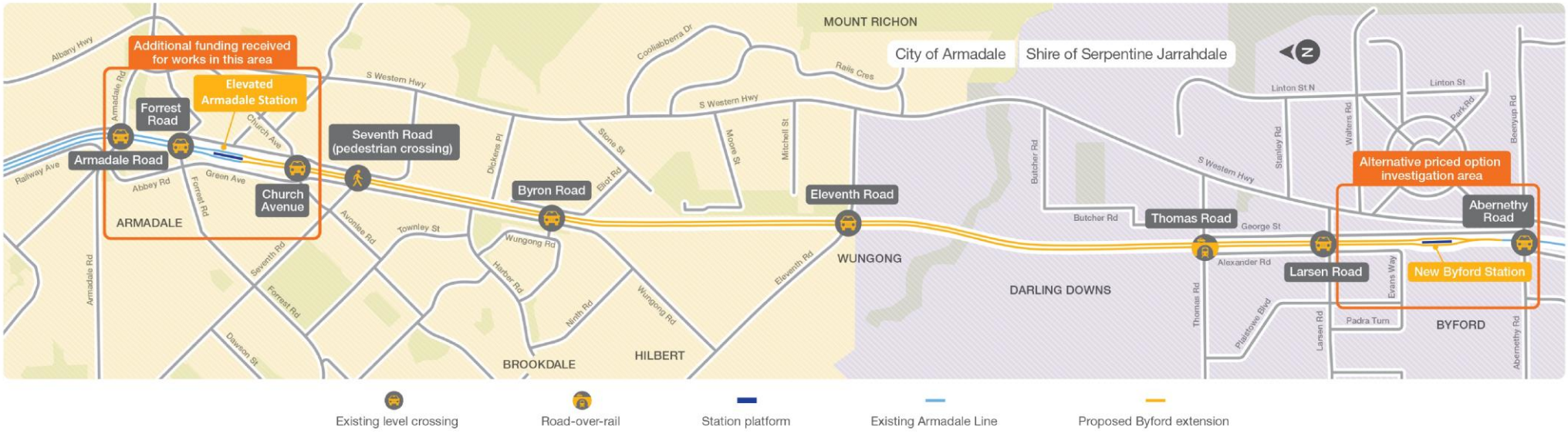


Image source: METRONET

REGIONAL ROAD INFRASTRUCTURE

Key Insights

The Tonkin Highway Extension aims to address issues that could arise as a result of population growth in the south east region. It will **ease congestion, improve freight travel times and improve safety outcomes**. These outcomes will have positive impacts on the subject site for the Meads Private Estate, that will be connected to the Highway via Bishop Road.

The Tonkin Highway Extension is in the planning phase and represents further investment by state and federal government into **supporting the growth of the south east region with key infrastructure**. $604 million is committed from the federal government for the project that is expected to begin in 2023.

This project is an example of planning outcomes that are being considered proactively with the expectation that the Serpentine-Jarrahdale area will grow, through communities like Meads Private estate.

The future extension of the Tonkin Highway is an **important piece of road infrastructure for Serpentine-Jarrahdale**. The highway is the major north-south connection in Perth's east and currently ends at Thomas Road in Oakford, north of the subject site. The extension project, while still in an indicative planning stage, will extend south to Mundijong Road.

Additionally, planning for the **realignment of the freight rail** will have a positive impact on road and pedestrian connectivity in Cardup and Mundijong. This project acknowledges the need to connect the freight rail to the West Mundijong Industrial Area, while **improving amenity and safety in developing urban areas.**

Tonkin Highway Extension

Image Source: Main Roads Western Australia
Note: indicative only and subject to change

LOCAL GROWTH – EDUCATION

Key Insights

Schools are vital to support a growing population. Local schools are also a key consideration for young families and first home buyers, who are the target market for the Meads Private Estate.

The site for Meads Private Estate is conveniently **located opposite Court Grammar School** on Bishop Road.

The school is an independent, coeducational, Anglican school that caters to students from Pre-K to Year 12 and had 711 students in 2021.

Local structure plans in the area make provision for a number of new school sites, which will ultimately be determined by the Department of Education.

Local Schools

Image source: Court Grammar School

04

HOUSING NEED

SUMMARY

HOUSING NEED

Historical population growth, population forecasts and planning documents indicate that the Serpentine-Jarrahdale area is in the midst of massive population growth. Continued development that suits the needs of the community is needed to accommodate this growth.

Continued population growth is an important driver for economic development, with communities like the Meads Private Estate delivering an expanded workforce to the region.

The south east corridor and particularly Serpentine-Jarrahdale offers relatively affordable residential land compared to other areas of Perth. Maintaining high levels of available land supply will be a key factor in this. Whilst much of the future land supply in the south east corridor is not owned by developers able to quickly bring the land to the market the Meads Private Estate land holding can be brought to the market quickly pending planning approvals.

Key data points for this are:

7% PER ANNUM POPULATION GROWTH 2010-2020

88% FORECAST POPULATION GROWTH 2021-2036

538 10-YEAR AVERAGE NEW DEVELOPMENT APPROVALS PER ANNUM TO JUNE 2021

$71,642 SERPENTINE JARRAHDALE LAND WAS $71,642 (OR 38%) MORE AFFORDABLE THAN THE NORTH WEST CORRIDOR

All figures for Shire of Serpentine Jarrahdale
Source: ABS, Forecast.id

KEY FINDINGS

STRONG POPULATION GROWTH

STRONG DEVELOPMENT MARKET

HIGH LEVELS OF SUPPLY WILL MAINTAIN AFFORDABILITY

LOCAL GROWTH FORECASTS

Key Findings

Historically, the Shire of Serpentine Jarrahdale has seen major population growth – with the **number of residents close to doubling from 2010-2020** (ABS ERP). The Shire has increased in size by 16,719 people over this period.

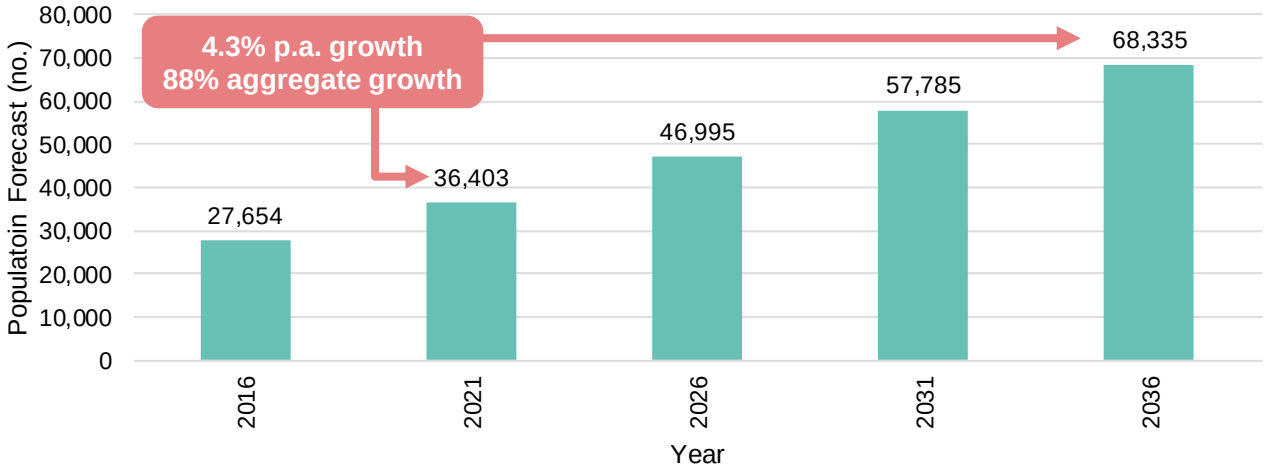
Strong growth is anticipated to continue, and **diverse and affordable housing options will be required to adequately support the population**.

The Shire of Serpentine Jarrahdale's Local Planning Strategy (LPS) is a key document that outlines the Shire's expectations for population growth, and their strategy for accommodating this growth, in a planning context. The Shire has adopted Forecast.id 's population forecast to 2036 in its LPS. The forecast expects **significant growth of 31,933 between 2021 and 2036**. This represents aggregate growth of **88% over the period**, or 4.3% average per annum.

Estimated Resident Population, Shire of Serpentine Jarrahdale, 2001-2021

Source: ABS

Population Forecast, Shire of Serpentine Jarrahdale, 2016-2036



Source: Forecast.id

NEW DEVELOPMENT IN SHIRE OF SERPENTINE JARRAHDALE

Key Findings

New dwelling approvals (NDAs) and vacant land sales are both indicators of new development that leads to population growth. With the **strong growth projections for the Shire of Serpentine Jarrahdale**, both measures can be used as tools to assess movement towards the targets.

Significant development has been occurring in the Shire since 2006 when Mundijong and Whitby were zoned Urban under the MRS. NDAs for houses in the Shire of Serpentine Jarrahdale reached a peak of 900 in the 12 months to June 2014.

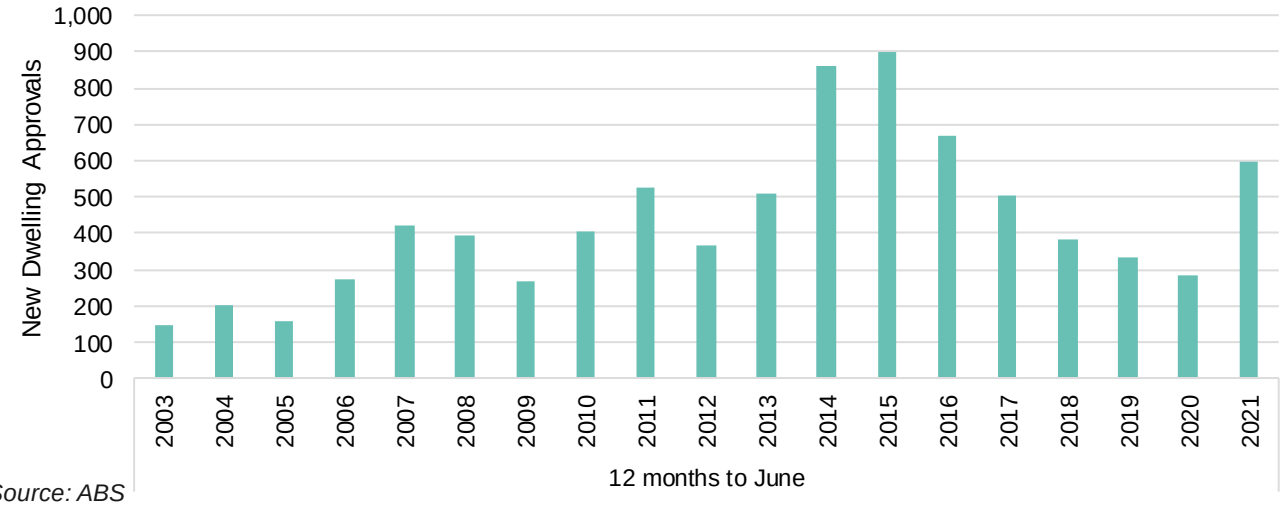
NDAs were above the 10-year average in the area of 538 p.a. recording a strong 597, in the 12 months to June 2021. NDAs bounced back in 2021, after the worst effects of the Covid-19 pandemic were felt in WA, to **near record highs**.

Vacant land sales by developers in the Shire of Serpentine Jarrahdale follow a similar trend to NDAs, as expected, with a lag between the land sales and NDAs.

Land sales in the Shire peaked in 2013, with 865. Strong numbers have been recorded over the last two years with 498 in 2020 and 279 in 2021.

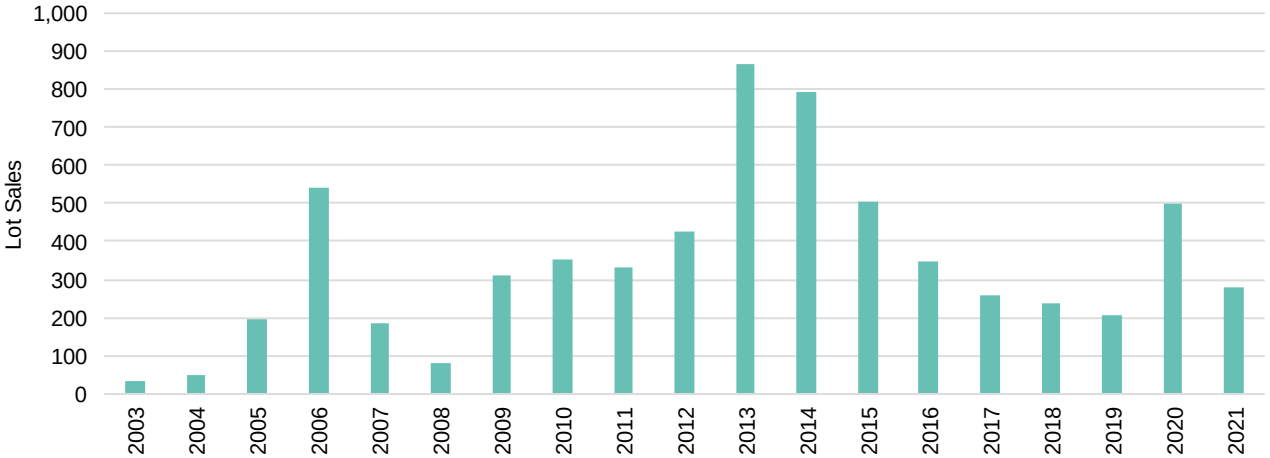
The high numbers of NDAs and vacant land sales by developers in the area indicate that, in line with state and local planning policy, **the area is experiencing significant urban development and accompanying growth in population**.

New Dwelling Approvals (Houses), Shire of Serpentine Jarrahdale, 2003-2021



Source: ABS

Land Sales by Developers, Shire of Serpentine Jarrahdale, 2003-2021



Source: LandGate

AFFORDABILITY OF LAND

Key Insights

The continuation of lot supply in Serpentine Jarrahdale is a key factor to ensuring housing affordability, which is an important tenet of residential development in the south east corridor.

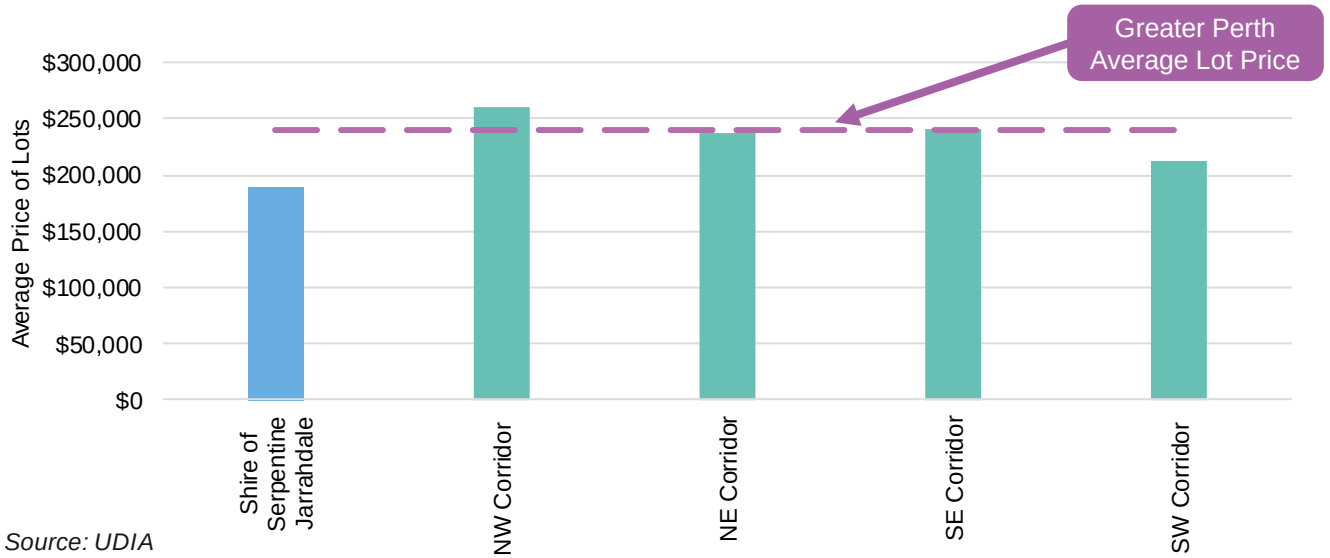
Lots in the Shire of Serpentine-Jarrahdale were more affordable than the Greater Perth average and the growth corridor averages in Q4 2021. In particular, the average price for lots in Serpentine Jarrahdale was $71,642 (or 38%) more affordable than the average for the North West corridor. The Shire is the most affordable option for buyers looking to purchase in the south east corridor, of which it is the southern most area.

As existing estates near completion, increasing supply of residential lots is expected to be required to maintain downward pressure on prices in the market. As such, future lot supply in the Shire of Serpentine Jarrahdale is expected to contribute to prices in the region remaining low in comparison to other developer-led growth areas in Greater Perth.

Maintaining high levels of competitive supply is a key part of maintaining affordability. Land prices started to increase in Perth in 2021 and the UDIA WA shows that the most competitive areas of Perth with the most active estates being the NW and SW corridors saw the lowest rates of land price growth on a rate per sq.m basis.

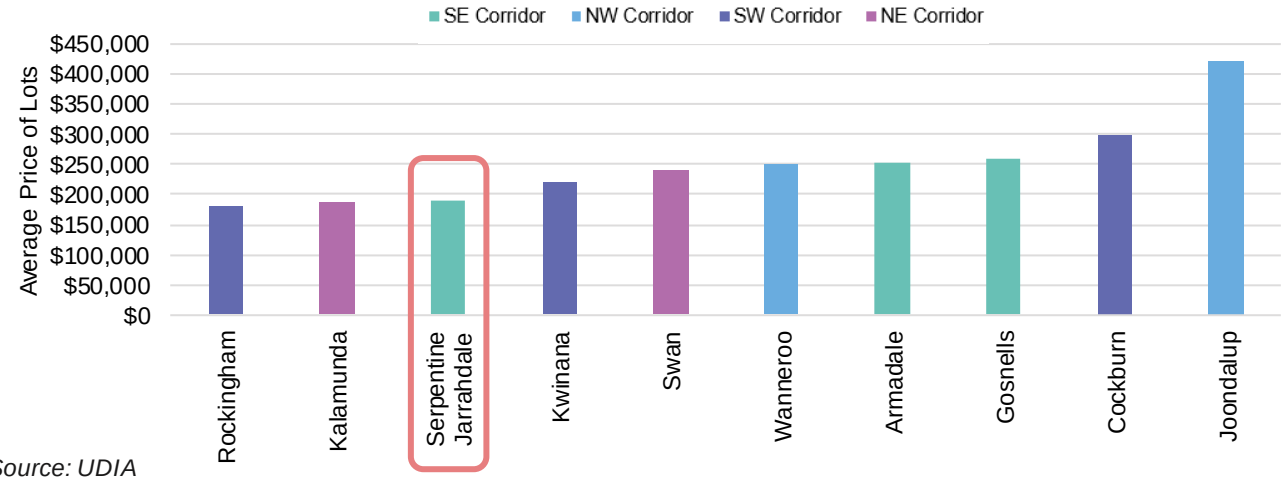
Whilst there are a number of parcels of land that could be developed for residential development within the Shire of Serpentine Jarrahdale many do not have owners who are looking to move development forward in the short term. Whilst not currently zoned correctly the owners of the Meads Estate land are looking to proceed with development as quickly as possible. This would add to the supply in the area and assist in maintaining affordability.

Average Lot Price, Growth Corridors v Serpentine Jarrahdale, Q4 2021



Source: UDIA

Average Lot Price, Local Government Areas, Q4 2021



Source: UDIA

COVID-19 AND THE POTENTIAL IMPACT ON DATA INFORMATION

The data and information that informs and supports our opinions, estimates, surveys, forecasts, projections, conclusion, judgments, assumptions and recommendations contained in this report (Report Content) are predominantly generated over long periods, and is reflective of the circumstances applying in the past. Significant economic, health and other local and world events can, however, take a period of time for the market to absorb and to be reflected in such data and information. In many instances a change in market thinking and actual market conditions as at the date of this report may not be reflected in the data and information used to support the Report Content.

The recent international outbreak of the Novel Coronavirus (COVID-19), which the World Health Organisation declared a global health emergency in January 2020 and pandemic on 11 March 2020, has and continues to cause considerable business uncertainty which in turn materially impacts market conditions and the Australian and world economies more broadly.

The uncertainty has and is continuing to impact the Australian real estate market and business operations. The full extent of the impact on the real estate market and more broadly on the Australian economy and how long that impact will last is not known and it is not possible to accurately and definitively predict. Some business sectors, such as the retail, hotel and tourism sectors, have reported material impacts on trading performance. For example, Shopping Centre operators are reporting material reductions in foot traffic numbers, particularly in centres that ordinarily experience a high proportion of international visitors.

The data and information that informs and supports the Report Content is current as at the date of this report and (unless otherwise specifically stated in the Report) does not necessarily reflect the full impact of the COVID-19 Outbreak on the Australian economy, the asset(s) and any associated business operations to which the report relates. It is not possible to ascertain with certainty at this time how the market and the Australian economy more broadly will respond to this unprecedented event and the various programs and initiatives governments have adopted in attempting to address its impact. It is possible that the market conditions applying to the asset(s) and any associated business operations to which the report relates and the business sector to which they belong has been, and may be further, materially impacted by the COVID-19 Outbreak within a short space of time and that it will have a longer lasting impact than we have assumed. Clearly, the COVID-19 Outbreak is an important risk factor you must carefully consider when relying on the report and the Report Content.

Where we have sought to address the impact of the COVID-19 Outbreak in the Report, we have had to make estimates, assumptions, conclusions and judgements that (unless otherwise specifically stated in the Report) are not directly supported by available and reliable data and information. Any Report Content addressing the impact of the COVID-19 Outbreak on the asset(s) and any associated business operations to which the report relates or the Australian economy more broadly is (unless otherwise specifically stated in the Report) unsupported by specific and reliable data and information and must not be relied on.

To the maximum extent permitted by law, Urbis (its officers, employees and agents) expressly disclaim all liability and responsibility, whether direct or indirect, to any person (including the Instructing Party) in respect of any loss suffered or incurred as a result of the COVID-19 Outbreak materially impacting the Report Content, but only to the extent that such impact is not reflected in the data and information used to support the Report Content.

This report is dated **April 2022** and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Pty Ltd's (Urbis) opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of **Land Group WA** (Instructing Party) for the purpose of a **Economic Report** (Purpose) and not for any other purpose or use. Urbis expressly disclaims any liability to the Instructing Party who relies or purports to rely on this report for any purpose other than the Purpose and to any party other than the Instructing Party who relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

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All surveys, forecasts, projections and recommendations contained in or made in relation to or associated with this report are made in good faith and on the basis of information supplied to Urbis at the date of this report. Achievement of the projections and budgets set out in this report will depend, among other things, on the actions of others over which Urbis has no control.

Urbis has made all reasonable inquiries that it believes is necessary in preparing this report but it cannot be certain that all information material to the preparation of this report has been provided to it as there may be information that is not publicly available at the time of its inquiry.

In preparing this report, Urbis may rely on or refer to documents in a language other than English which Urbis will procure the translation of into English. Urbis is not responsible for the accuracy or completeness of such translations and to the extent that the inaccurate or incomplete translation of any document results in any statement or opinion made in this report being inaccurate or incomplete, Urbis expressly disclaims any liability for that inaccuracy or incompleteness.

This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the belief on reasonable grounds that such statements and opinions are correct and not misleading bearing in mind the necessary limitations noted in the previous paragraphs. Further, no responsibility is accepted by Urbis or any of its officers or employees for any errors, including errors in data which is either supplied by the Instructing Party, supplied by a third party to Urbis, or which Urbis is required to estimate, or omissions howsoever arising in the preparation of this report, provided that this will not absolve Urbis from liability arising from an opinion expressed recklessly or in bad faith.

Urbis acknowledges the important contribution that Aboriginal and Torres Strait Islander people make in creating a strong and vibrant Australian society.

We acknowledge, in each of our offices, the Traditional Owners on whose land we stand.

Urbis staff responsible for this report were:

Director	David Cresp
Consultant	Yashwini Halai
Research Analyst	Katherine Rayner

Project code	P0039167
Report number	Final (v2)

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APPENDIX 4:
ENVIRONMENTAL ASSESSMENT REPORT (360 ENVIRONMENTAL)

360 environmental | Part of SLR

Lot 30 Soldiers Road, Cardup

Environmental Assessment Report

Prepared for:

Land Group WA

March 2022

people planet professional

Document Reference	Revision	Prepared by	Reviewed by	Admin Review	Submitted to Client	
					Copies	Date
5166AA_Rev0	Internal Draft	JM	LR			
5166AA_Rev1	Client Draft	JM	LR	LI	1 electronic	03/03/2022
5166AA_Rev2	Client Draft	JM	LR	LI	1 x electronic	14/03/2022
5166AA_Rev3	Client Final	JM	LR		1x electronic	15/03/2022

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Executive Summary

360 Environmental was commissioned by Land Group WA to prepare an Environmental Assessment Report (EAR) for Lot 30 Soldiers Road, Cardup ('the site'). The site is 56.59 ha in size and is situated in the Shire of Serpentine Jarrahdale. The site is currently zoned as 'Rural' under the *Metropolitan Region Scheme* (MRS) and the *Shire of Serpentine Jarrahdale Town Planning Scheme No. 2* (TPS2).

This EAR has been prepared to support the rezoning of the site to 'Urban' under the MRS and 'Urban Development' under the TPS2.

The key findings of the EAR are provided below:

- Flora and Vegetation: A flora and vegetation survey completed in 2016 found the site to be largely devoid of native vegetation, with almost all of the site classified as being in 'completely degraded' condition. No Threatened or Priority flora species were identified within the site. The vegetation onsite is parkland cleared and consists primarily of non-endemic Eucalyptus spp. with no understorey. Future development will retain the creek line within the site along with an appropriate setback and will aim to retain a number of the mature trees where possible.
- Fauna: A likelihood assessment found that the site is likely to offer occasional habitat for the Forest Red-tailed, Baudins and Carnaby's Black Cockatoos. The site also has the potential to offer temporary habitat for the Quenda. However due to fragmented nature of the habitat and lack of understorey the site is unlikely to provide significant habitat for any conservation significant fauna species.
- Historical and Current Land Use: The site currently contains one dwelling and various outbuildings and structures. The site lacks any native-understory vegetation, as a result of historical agricultural and rural land uses. The site currently contains livestock and horses.
- Surrounding Land Uses and Buffers:
    - The site exists within one Environmental Protection Authority (EPA) recommended industrial activity buffer for sensitive land uses. This is a cement products manufacturing facility located approximately 220 m north-east of the site. The EPA recommends a minimum separation distance of 300 to 500 m between concrete batching or cement products manufacturing and sensitive land uses (EPA 2015).
    - A recent planning approval for an extension to the existing cement facility included noise and dust emission assessments which found that all potential impacts will be contained within the premises boundary. Correspondence from the Department of Water and Environmental Regulation (DWER) in the planning approval supported these findings of the facility is unlikely to impact future development of the site.

- The site is located approximately 50 m from the adjacent Armadale Rail and 40 m from Mundijong Freight Rail. State Planning Policy No 5.4 recommends a trigger distance of 100 m between passenger railways and noise-sensitive land and 200m between freight railways and noise-sensitive land. This will be considered as part of further local structure planning.

- Surface Water and Wetlands: A minor creek line traverses the centre of the site. A Multiple Use Wetland (MUW) is mapped across most of the site. Two CCWs exist within the Railway Reserve immediately to the east of the site. One of the CCWs is located 21 m east of the site and the other is located 54 m to the east of the site. The CCWs to the east of the site are currently affected by human disturbance and is physically separated from the site due to the presence of Soldiers Road (within 7 m of the CCW closest to the site), and the railway track which separates the two CCWs. The adjacent CCWs are upstream from the site therefore surface water from the site will flow to the west of the site and away from the CCWs. It is considered unlikely that the proposed development will impact on the already disturbed CCWs. The management of surface water and groundwater will be addressed in the Local Water Management Strategy (LWMS) for the site in accordance with the DWMS that was approved by DWER in 2017. The LWMS will accompany the LSP submission.
- Conservation Areas: Bush Forever exists directly to the east and north-east of the site. Cardup Nature Reserve, which is a Department of Biodiversity, Conservation and Attractions (DBCA) managed land, exists approximately 1.25 km north of the site. Two Perth Regional Ecological Linkages extend along the eastern portion of the site. However, as the site is predominantly devoid of native vegetation, the site does not contribute to the ecological linkage. A small portion of the eastern edge of the site is classified as an Environmentally Sensitive Area (ESA) due to a generic 50 m CCW buffer extending into the site.

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1 Introduction

1.1 Background

360 Environmental was commissioned by Land Group WA to prepare an Environmental Assessment Report (EAR) for Lot 30 Soldiers Road, Cardup ('the site') (Figure 1). The site is 55.47 ha in size and is situated in the Shire of Serpentine Jarrahdale. The site is currently zoned as 'Rural' under the *Metropolitan Region Scheme* (MRS) and the *Shire of Serpentine Jarrahdale Town Planning Scheme No. 2* (TPS2).

This EAR has been prepared to support the proposed rezoning of the site to 'Urban' under the MRS and 'Urban Development' under the TPS2.

1.2 Scope

The scope of this report includes the following:

- Literature review of relevant environmental and planning documents
- A desktop assessment of the site's key environmental features, which includes flora, vegetation, fauna, conservation areas within or in close proximity to the site, wetlands of conservation significance, topography, soils, groundwater and surface water, contamination, acid sulfate soils (ASS) and heritage
- Review of the results of a site Flora and Vegetation Survey that was undertaken in 2016
- Identification of environmental constraints and opportunities associated with the proposed development
- Identification of surrounding land uses to determine whether any buffers may be required for residential development
- Development of environmental management measures to reduce any environmental impacts from future development of the site.

1.3 Objective

The objective of this EAR is to identify the environmental features and constraints within the site, any environmental impacts associated with the proposed development and measures proposed to manage these impacts.

This EAR has also been prepared to address the Shire of Serpentine Jarrahdale's TPS2 requirements.

2 Legislation

The Environmental Protection Act 1986 (EP Act) is the key legislative tool for environmental protection in Western Australia. It is administered by the Department of Water and Environmental Regulation (DWER) and the Minister for Environment.

Table 1 provides a summary of the key State legislation and regulations relevant to the site.

Table 1: Key State Legislation

Key Legislation	Responsible Government Agency	Aspect
Aboriginal Heritage Act 1972	Department of Planning, Lands and Heritage	Archaeological and ethnographic heritage
Aboriginal Heritage Regulations 1974	Department of Planning, Lands and Heritage	Archaeological and ethnographic heritage
Agricultural and Related Resources Protection Act 1976	Department of Primary Industries and Regional Development	Weeds and feral animals
Biodiversity Conservation Act 2016	Department of Biodiversity Conservation and Attractions	Listing of and protection of native species, threatened species, ecological communities, fauna, critical habitat, and threatening processes
Biosecurity and Agriculture Management Act 2007	Department of Primary Industries and Regional Development	Weeds / pests / diseases
Bush Fires Act 1954	Department of Fires and Emergency Services	Bush fire control
Conservation and Land Management Act 1984	Department of Biodiversity Conservation and Attractions Department of Agriculture	Flora and fauna / habitat / weeds / pests / diseases
Conservation and Land Management Regulations 2002	Department of Biodiversity Conservation and Attractions Department of Agriculture	Flora and fauna / habitat / weeds / pests / diseases
Contaminated Sites Act 2003	Department of Water and Environmental Regulation	Management of contaminated soils and water
Environmental Protection Act 1986	Environmental Protection Authority Department of Water and Environmental Regulation	Part IV – Environmental Impact Assessment Part V – Works Approvals and Licences, Clearing Permits
Environmental Protection (Clearing of Native Vegetation) Regulations 2004	Department of Water and Environmental Regulation	Clearing of native vegetation

Key Legislation	Responsible Government Agency	Aspect
Planning and Development Act 2005	Department of Planning, Lands and Heritage	Structure planning and subdivision approval
Rights in Water and Irrigation Act 1914	Department of Water and Environmental Regulation	Governs management of the use, service and health of water and watercourses (including beds and banks). Water licensing is required in all proclaimed areas and for all artesian groundwater wells throughout the state.

2.1 Key Standard, Guidelines and Policies

Clearing and development is subject to compliance with applicable standards, guidelines and policies developed by the State's regulators to assist proponents in understanding the minimum requirements for environmental protection. Table 2 details the key standards, guidelines, and policies relevant to future industrial development of the site.

Table 2: Relevant Policies and Guidelines

Document	Description
EPA Policies and Guidance	
Statement of Environmental Principles, Factors and Objectives	This statement communicates the EPA considers the object and principles of the EP Act, uses environmental factors and objectives to organise and systemise environmental impact assessment, taking a holistic view of the environment and considering significance of a proposal.
Environmental Factor Guideline – Flora and Vegetation	Provides guidance to protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Environmental Factor Guideline – Terrestrial Environmental Quality	Provides guidance with the objective to maintain the quality of land and soils so that environmental values are protected.
Environmental Factor Guideline – Terrestrial Fauna	Provides guidance with the objective to protect terrestrial fauna so that biological diversity and ecological integrity at maintained.
Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment	Provides technical guidance to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in environmental impact assessment.
Technical Guidance – Terrestrial Fauna Surveys	Provides technical on the direction and information on general standards and protocols for terrestrial fauna surveys for environmental impact assessment.
Guidance Statement No. 3: Separation Distances between Industrial and Sensitive Land Uses	Provides guidance on the generic separation (buffer) distances between Industrial and Sensitive land uses to avoid conflicts between these land uses.

Document	Description
Guidance Statement No. 33: Environmental Guidance for Planning and Development	Provides information and advice to assist land use planning and development processes to protect, conserve and enhance the environment.
WA Environmental Offsets Policy	Seeks to protect and conserve environmental and biodiversity values for present and future generations. The policy ensures that economic and social development may occur while supporting long term environmental and conservation values.
EPA Bulletins	
Environmental Protection Bulletin No. 1: Environmental Offsets	Clarifies how the EPA will consider offsets through the environmental impact assessment process.
Department of Water and Environmental Regulation (DWER) Guidelines	
Assessment and management of contaminated sites Guideline	Provides guidance on the assessment and management of contaminated sites in Western Australian within legislative framework of the Contaminated Sites Act 2003 and the Contaminated Sites Regulations 2006.
Identification and investigation of acid sulfate soils and acidic landscapes	Provides guidance to assist with the identification, assessment, and management of acid sulfate soils in Western Australia.
Water Quality Protection Note No. 25 Land Use Compatibility Tables for public drinking water source areas	This note provides guidance for land use planning within onshore PDWSAs. It sets out guidelines on appropriate land uses and activities within PDWSAs that represents best management practice to protect water quality and public health.
State Planning Policy	
State Planning Policy 5.4 Road and Rail Noise	Provides guidance on minimising the adverse impact of road and rail noise on noise-sensitive land-use within the specified trigger distance of freight and traffic routes. Assists in ensuring that the community is protected from unreasonable levels of transport noise, whilst also ensuring the future operations of these transport corridors

3 Site Description and Assessment

3.1 Property and Zoning Information

The site is located to the west of Soldier Road and north of Bishop Road. It is approximately 1.1 km east of Hopkinson Road and approximately 495 m south of Karbro Drive. The site is situated approximately 23 km southeast of the Rockingham Strategic Metropolitan Centre and 13 km southwest of the Armadale Strategic Metropolitan Centre.

The site is currently zoned as 'Rural' under the MRS and the *Shire of Serpentine Jarrahdale TPS2*.

3.2 On-site and Surrounding Land Uses

3.2.1 Historical Land Uses

Review of aerial photography from 1953 to November 2018 (last available) identified that the site has been historically used for agricultural and rural land uses and is still currently being used for this purpose.

3.2.2 Current Land Use

The site currently contains one dwelling and various outbuildings and structures. The site is generally void of native-understory vegetation, which is likely to be the result of historical agricultural and rural land uses. The site currently contains livestock and horses.

3.2.3 Surrounding Land Uses

The site is currently surrounded by rural properties. Bush Forever exists directly to the east and north-east of the site. Cardup Nature Reserve is a Department of Biodiversity Conservation and Attractions (DBCA) managed land, which is located approximately 1.25 km north of the site.

Located approximately 50 m to the east of the site is the Armadale Rail which services the Australind Train. The Australind is a rural passenger train that operates between Perth and Bunbury twice a day.

Located approximately 40 m south of the site is the Mundijong Freight Railway. It is part of a network of railways predominantly servicing the heavy industrial areas of Kwinana. The rail is currently in the planning stage for realignment which proposes to move the railway to the south.

Located to the east and north-east of the site is land zoned as 'Industrial' under the MRS. The closest industrial activity is a Permacast cement products manufacturing facility which is located approximately 220 m north-east of the site on Lot 60 (Figure 7). It is understood that Permacast are currently in the process of seeking approval to upgrade the capacity of the site, and recently received planning approval from the Shire of Serpentine Jarrahdale (SJ). This

approval was for a mobile batching plant to manufacture concrete on-site (up to 150,000 tonnes).

A Permapole timber preserving facility is operating on Lot 60 east and northeast of the site.

A Colli Timber and Hardware facility is operating on Lot 10 on Diagram D075640 to the northeast of the site.

An Austral Bricks brick manufacturing facility is located approximately 2.5 km north-east of the site. Austral Bricks proposes to redevelop Cardup Brickworks, which includes expansion of the existing factory and increasing the design capacity. EPA Assessment of the site is ongoing.

The Shale Road Landfill is located approximately 1.95 km east of the site. The landfill is licensed to accept Class II waste which includes most municipal, commercial, and industrial solid waste. Other activities that occur within the landfill site are hard rock extraction operations and extraction/storage of shale and clay operations.

3.3 Regional Soils and Landforms

The Department of Agriculture and Food WA (DAFWA) Soil Subsystems mapping indicates that the site falls within five soil subsystems (DAFWA 2012). These subsystems are described below and displayed in Figure 2.

- **Forrestfield F2a Phase-** 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 F2b Phase**- low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite
- **Bassendean B2 Phase**- Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with pale yellow B horizon or weak iron-organic hardpan 1-2 m
- **Pinjarra P2 Phase**- Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay
- **Pinjarra 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.

3.4 Acid Sulfate Soils

Acid Sulfate Soil (ASS) risk mapping by DWER has identified the majority of the site as having a 'moderate to low risk of ASS occurring within 3 m of natural soil surface but high to moderate risk of ASS beyond 3 m of natural soil surface' (Figure 3) (DWER 2014). The very northern portion of the site has no known ASS risk.

3.5 Topography

The elevation of the site ranges from 49 m Australian Height Datum (AHD) in the north-eastern corner of the site to 35 m ADH along the western boundary (Figure 4) (Geoscience Australia 2008).

3.6 Potential Contamination

A search of the DWER Contaminated Sites Database did not identify any contaminated sites present within the site (DWER 2016a). The closest listed contaminated site is a cluster of contaminated sites approximately 4.6 km to the south-east of the site. These are 'Contaminated-restricted use' and require remediation due to the presence of hydrocarbons in the groundwater.

It should be noted that the DWER contaminated sites database only shows three of the seven classifications that may be placed on a site. Sites that have been decontaminated, were found not to be contaminated, are possibly contaminated, and 'reports not substantiated' are not shown on the database. However, contaminated sites that require remediation, have a restricted use, or have been remediated for a restricted use are shown on the database.

3.7 Groundwater

There are no available groundwater contours across the site. Fifteen groundwater monitoring wells were installed across the site in 2016 to ensure capture of pre- and post-development groundwater levels and quality. Subsequent monitoring has identified that groundwater underlying the site flows from east to west with recorded groundwater levels ranging between 30.55 and 40.99 m AHD. Groundwater quality is slightly acidic across the site.

The site does not fall within any Priority Drinking Water Source Areas (PDWSAs).

3.8 Surface water

A minor creekline traverses the centre of the site (Figure 5). Water enters the site via a culvert under the transport corridor along the eastern boundary. No further obstructions to flow are noted through the site. It is noted the creek line is ephemeral, with water flowing only after rain events

There are no Conservation Category Wetlands (CCW), or Resource Enhancement Wetlands (REWs) mapped within the site (DBCA 2016a). A Multiple Use Wetland (MUW) is mapped across most of the site (UFI 15785). Two CCWs (UFI 15462 and UFI 15463) exist within the Railway Reserve immediately east of the site (Figure 5). One of the CCWs is located 21 m east of the site with the other located 54 m east of the site.

3.9 Flora and Vegetation

The site is largely devoid of native vegetation and has limited remaining environmental values. The vegetation onsite is parkland cleared and consists of *Eucalyptus* spp. with no understorey. A Flora and Vegetation Survey was completed in 2016 and is summarised in Section 3.9.2.

3.9.1 Broad Vegetation Associations

Mapping of the vegetation of the Perth region of WA was completed on a broad scale by Beard (1981). These vegetation units were re-assessed by Shepherd *et al*. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There is one Beard / Shepherd vegetation unit in the site. The Shepherd *et al.* (2001) vegetation type is described below, and its representation within the State, bioregion, subregion, and local government area is shown in Table 1.

- Pinjarra_968: Medium woodland, jarrah, marri and wandoo.

Table 1: Broad Vegetation Types within the Site and its State and Regional Representation (Government of WA 2018).

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current Extent Managed in DBCA Lands (%)
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the state				
968	296,877.84	95,048.82	32.02	18.45
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the Swan Coastal Bioregion				
968	136,188.20	9,017.32	6.62	1.43
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the Perth Subregion				
968	136,188.20	9,017.32	6.62	1.43
Vegetation Types (Beard 1981/ Shepherd *et al*. 2001) in the LGA				
968	24,351.49	1,121.13	4.60	0.57

Mapping by Heddle *et al.* (1980) is based on the relationship to the landform-soil units determined by Churchward and McArthur (1980). This mapping identified one vegetation complex occurring in the site which is described below and summarised in Table 2.

- Guildford Complex- A mixture of open forest to tall open forest of Corymbia calophylla – Eucalyptus wandoo – Eucalyptus marginata and woodland of Eucalyptus wandoo (with rare occurrences of Eucalyptus lane-poolei). Minor components include Eucalyptus rudis – Melaleuca rhaphiophylla.

Table 2: Representation of the Vegetation Complex in the Swan Coastal Plain (Government of WA 2018a)

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current Extent Managed in DBCA Lands (%)
Vegetation (Heddle *et al.* 1980) in the Swan Coastal Bioregion				
Guildford Complex	90,513.13	4,607.91	5.09	0.32

Within constrained areas on the Swan Coastal Plain (SCP), the Environmental Protection Authority (EPA) has set a threshold for retention of 10% of the pre-existing extent of native vegetation (EPA 2008). The site is considered to be within a constrained area on the Swan Coastal Plain as it is within the Perth MRS and adjoins urban areas, which means there is a reasonable expectation that development will be able to proceed.

The State representation of the regional vegetation type is greater than the abovementioned 10% threshold, however the bioregion, subregion and local representation is below this threshold. Representation of the mapped vegetation complex is also below the 10% threshold for the Swan Coastal Plain bioregion compared to pre-European extent.

Although the vegetation complexes mapped across the site have a low representation, the site is parkland cleared and does not have mid-storey or understorey vegetation. Therefore, the vegetation does not represent the regional vegetation complexes that are mapped across the site and development of the site will not further reduce the extent of this complex on the SCP.

3.9.2 Flora and Vegetation Survey Results

360 Environmental undertook a Flora and Vegetation Survey in December 2016 (Appendix C). Key findings are summarised below:

- Thirty taxa were identified within the Survey Area.
- No Threatened species pursuant to the *Environment Protection and Biodiversity Act* 1999 (EPBC Act) and/or gazetted as Declared Rare Flora (DRF) pursuant to the *Wildlife Conservation Act* 1950 (WC Act) were recorded during the survey. No Priority species were recorded during the survey.
- Of the 30 species, 26 were identified as introduced species.
    - One introduced species *Moraea flaccida*, listed as a Declared weed under the BAM Act
    - No Weeds of National Significance (WONS) were identified.
- No natural vegetation associations were identified.
- Nine vegetation units mapped and of these none were representative of Threatened Ecological Communities (TECs).
- Of the 56.59 ha, vegetation condition was classified as:
    - 56.61 ha Completely Degraded
    - 0.079 ha Degraded to Completely Degraded.
- Only native vegetation identified within the Survey Area consisted of scattered native trees amongst planted trees with the understory consisting predominantly a pasture of weed species.
- Many existing trees are non-epidemics planted around the perimeter for landscaping.

The results of the 2016 survey are considered current given the site has been maintained in its cleared state to support ongoing agricultural use since the 2016 survey was completed. Therefore, there has been little opportunity for the recolonisation of native flora or changes in vegetation condition.

3.10 Fauna

A DBCA NatureMap Fauna Search was undertaken with a 2 km, 5 km, and 10 km buffer of the site and a DAWE Protected Matters Search Tool (PMST) was undertaken with a 1 km buffer of the site (Appendix A) (DAWE 2022b; DAWE 2022a). The NatureMap Report identified ten Threatened fauna species, four Priority 3 fauna species, six Priority 4 fauna species and four fauna species protected under international agreements within 10 km of the site. The PMST identified eight Threatened fauna species and seven Migratory species as occurring within a 1km radius of the site.

The DBCA database search results are based on recorded occurrences of individuals and therefore, are considered more site specific and more accurate than the PMST, which often returns modelled distributions of species.

A likelihood assessment of each of the fauna species occurring within the site is shown in Appendix B. The likelihood assessment found that the site is likely to offer suitable habitat for the following fauna species:

- Forest Red-tailed Black Cockatoo
- Baudin's Cockatoo
- Carnaby's Cockatoo.

It is considered that the site may offer suitable habitat for the following species:

- Quenda.

Due to the lack of intact remnant of vegetation, the only species likely to occasionally utilise the site are the three Black Cockatoo species because of the existence of a number of mature native and non-native trees scattered across the site. The Black Cockatoos are more likely to inhabit the larger patches of vegetation which surround the site, such as the adjacent Bush Forever Site, the Cardup Nature Reserve and nearby Regional Parks (Figure 6).

As the site lacks an understorey it is unlikely to offer favourable habitat for the Quenda however individuals may pass through the site occasionally.

3.11 Conservation Areas

A Bush Forever Site (No. 350) exists directly to the east and north-east of the site (Figure 6). Cardup Nature Reserve, which is a DBCA managed reserve is situated approximately 1.25 km north of the site (Figure 6). Two Perth Regional Ecological Linkages (No. 65 and 69) extend along the eastern portion of the site (PBP 2008) (Figure 6). However, as the site is predominantly devoid of native vegetation, the site does not contribute to the ecological linkage.

Review of the DER's Clearing Permit System (CPS) identifies approximately 62% of the site as being an Environmentally Sensitive Area (ESA) (DWER 2016b). This is due to a Threatened Ecological Community (TEC) buffer which extends into the site. A small portion of the eastern edge of the site is classified as an ESA due to a generic 50 m CCW buffer extending into the site. Under the definitions of ESAs within the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, the definition of a TEC as an ESA does not include their buffer. Therefore, only a very small portion of the site is technically classified as an ESA.

3.12 Heritage

3.12.1 Aboriginal

A search of the Department of Aboriginal Affairs' (DAA) Aboriginal Heritage Inquiry System did not identify any 'Registered Aboriginal Sites' or 'Other Heritage Places' within the site (DAA 2016). The closest 'Registered Aboriginal Site': Soldiers Road, Mundijong (No. 3648) is approximately 1.1 km south of the site (Figure 6).

3.12.2 European

A search of the Heritage Council of Western Australia database of culturally significant sites in Western Australia was undertaken for the site (State Heritage Office 2016). No State Heritage Places exist within the site. The closest State Heritage site, the Whitby Falls Hostel (No. 8604) is approximately 3 km south-east of the site.

4 Impacts and Management

Potential environmental impacts that may result from development of the site are discussed below. Management measures intended to mitigate any potential impacts are also outlined.

4.1 Buffers from Surrounding Land Uses

In September 2015, the EPA released a draft Environmental Assessment Guideline (EAG) for '*Separation distances between industrial and sensitive land uses*', which outlines the EPAs expectations on the application of separation distances as part of the environmental impact assessment process as well as support the strategic and statutory land use planning and development approval process.

This EAG defines appropriate separation distances between industrial and sensitive land uses (this includes residential housing) to ensure that both intended and unintended emissions do not adversely impact on people. In the absence of investigations being undertaken or management measures being implemented, the separation distances proposed in the EAG are conservative.

Cement Products Facility

The closest industrial activity to the site is a cement products manufacturing facility (Permacast), which is located approximately 220 m from the north-eastern corner of the site. The EPA recommends a minimum separation distance of 300 to 500 m between concrete batching or cement products manufacturing and sensitive land uses (EPA 2015). It is understood that Permacast are currently in the process of seeking approval for a mobile batching plant to manufacture concrete on-site (up to 150,000 tonnes). Potential impacts to surrounding sensitive land uses were closely considered as part of the planning assessment and approval by the Shire of SJ. Supporting technical studies provided by the proponent demonstrated that potential cumulative impacts such as noise and dust (inclusive of existing operations) would be contained within the premises boundary. A number of stringent conditions were also applied on the approval, including the requirement for ongoing monitoring of air quality and dust.

DWER reviewed the supporting technical studies around noise and dust and were supportive of the methodology and the findings that all impacts would be contained on-site. Additional approvals from DWER for a Works Approval under Part V of the EP Act will also be required where a thorough assessment of any potential environmental and/or amenity impacts will be undertaken and where necessary, restrictions on operations and/or monitoring conditions will likely be applied.

Therefore, given these findings, the distance to the premise boundary (220m), and the distance to the proposed location of the batching plant (640m), it is unlikely that this facility will impact on the future development of the site.

Timber Preserving Facility

Also located on Lot 60 is a timber preserving facility. The EPA recommends a minimum separation distance of 300 to 500 m between timber preserving facilities and sensitive land uses (EPA 2015). The DWER licence issued under Part V of the EP Act was reviewed, along with DWER's impact assessment report in the preparation of this report. DWER found that the measures implemented by the proponent resulted in a negligible risk of odour or dust impacting on nearby sensitive receptors and as such the 300m buffer is more than sufficient to protect potential impacts to future residential land uses.

Hardware Warehouse

A Colli Timber and Hardware facility is operating on Lot 10 on Diagram D075640 to the northeast of the site. The TPS2 does not identify this as being a timber mill and the EPA does not recommend any buffers for this type of facility.

Brick Manufacturing Facility

An Austral Bricks brick manufacturing facility exists approximately 2.5 km north-east of the site. The DWER granted a works approval in January 2016 for the construction and commissioning of the facility. The EPA recommends a minimum separation distance of 500 - 1000 m between clay bricks manufacturing and sensitive land uses. As the site is well outside of the recommended separation distance, the future Austral Bricks facility will not constrain future development of the site.

Landfill

The Shale Road Landfill is located approximately 1.95 km east of the site. The landfill is licensed to accept Class II waste which includes most municipal, commercial, and industrial solid waste. Other activities that occur within the landfill site are hard rock extraction operations and extraction/storage of shale and clay operations. The EPA recommends a minimum separation distance of 1000 m between Class II landfills and sensitive land uses and 1500 m between hard rock quarrying and sensitive land uses. The site is well outside of the recommended separation distances for landfill and hard rock quarrying operations and therefore, future development is not constrained by this land uses (Figure 7).

Railways

Located approximately 50m east of the site is the Armadale Rail and 40 m south of the site is the Mundijong Freight Rail. In 2019 the WA Planning Commission released *State Planning Policy No 5.4 Road and Rail Noise* under the *Planning and Development Act 2005*. It aims to minimise adverse impact of road and rail noise on noise-sensitive land-use and development within the trigger distance of significant freight and traffic routes. The recommended trigger distance between passenger railways and noise-sensitive land is 100 m and the recommended trigger distance between freight railways and noise-sensitive land is 200 m. The site is within the trigger distances of both railways and will be considered as part of future local structure planning.

4.2 Acid Sulfate Soils

The majority of the site is classified as having a moderate to low risk of ASS occurring within 3 m of natural soil surface, but high to moderate risk of ASS beyond 3 m of natural soil surface. Dewatering and/or excavation for infrastructure within the site have the potential to disturb ASS, particularly as the site is within 500 m of wetland habitat (DWER 2015).

4.2.1 Management Measures

An ASS self-assessment form will be completed for the site once detailed engineering design has been undertaken. If the self-assessment determines that there is a possibility of ASS disturbance from the proposed works, then an ASS investigation will be undertaken in accordance with the DWER's '*Identification and Investigation of ASS*' guideline. The ASS investigation will determine whether ASS will require management during soil disturbance.

4.3 Groundwater and Surface Water

The development of the site has the potential to alter the hydrology and impact on the creek line as well as downstream surface water and groundwater resources, if left unmanaged.

A MUW is mapped across most of the site. Development is generally acceptable across MUWs, as they have little remaining important wetland attributes and functions. Two CCWs exist within the Railway Reserve immediately east of the site. One of the CCWs is located 21 m east of the site with the other located 54m east of the site.

The CCWs are currently affected by human disturbance due to the presence of Soldiers Road which is within 7m of the CCW closest to the site and the railway track which separates the two CCWs. The CCW's are therefore physically separated from the site via historical infrastructure barriers (roads and rail).

The adjacent CCWs are upstream from the site therefore, surface water from the site will flow to the west of the site and away from the CCWs.

Given the above, it is considered unlikely that the proposed development will impact on the mapped CCWs.

4.3.1 Management Measures

Urban development of the land will require the establishment of an improved drainage system and incorporating water management design principles and structures set out in the Department of Water's Better Urban Water Management (BUWM) guidelines (WAPC 2008).

Implementing the proposed improvements to the drainage system, in accordance with the principles and methods set out in the BUWM guidelines, is likely to significantly benefit the local and regional water quality. If agricultural uses continue within the site, it is likely to require further application of fertilisers and chemicals to sustain the land's productivity, which would further impact on the water quality in the surrounding environment.

The management of surface water and groundwater will be addressed in the Local Water Management Strategy (LWMS) for the site in accordance with the DWMS that was approved by DWER in 2017 (360 Environmental, 2017). The LWMS will accompany the LSP submission. An Urban Water Management Plan will also be prepared at subdivision approval stage when more detailed engineering design has been undertaken.

4.4 Vegetation and Fauna

The site is largely devoid of native vegetation and is considered to have limited remaining environmental value. The vegetation onsite is parkland cleared and consists primarily of *Eucalyptus* spp. with no understorey. A Flora and Vegetation Survey conducted by 360 Environmental in 2016 identified that the site:

- Contains no Threatened species pursuant to the EPBC Act and/or gazetted as Declared Rare Flora (DRF) pursuant to the *Wildlife Conservation Act* 1950 (WC Act).
- Contains 26 introduced species, of which one species was listed as a Declared weed under the BAM Act. No WONS.
- Has no natural vegetation associations remaining.
- Contains vegetation in predominantly 'completely degraded' condition (56.61 ha of the 56.59 ha of the site).

A likelihood assessment found that the site is likely to offer occasional habitat for the Forest Red-tailed, Baudins and Carnaby's Black Cockatoos. The site also has the potential to offer occasional habitat for the Quenda. Due to the fragmented nature of the habitat and lack of understorey, the site is considered unlikely to provide significant habitat for any conservation significant fauna species.

A Black Cockatoo habitat assessment will be undertaken at Structure Planning stage once potential development footprints and clearing requirements are better understood.

4.4.1 Management Measures

As part of future development of the site, the creek line will be retained along with an appropriate setback. The setback will be determined as part of local structure planning and will provide for the retention of riparian vegetation, which forms a substantial portion of the vegetation within the site.

Any trees that may be able to be retained as part of the development will be inspected by a qualified arborist prior to clearing taking place. Final tree retention opportunities will be determined at completion of detailed engineering design closer to subdivision stage.

All contractors involved in clearing activities will be inducted on the potential impacts to fauna and advised to stop works in the vicinity of any injured or shocked animals that are encountered. They will also be instructed to contact relevant environmental staff in this event.

5 Conclusion

In conclusion, none of the identified environmental features and values are likely to constrain future urban development or present an impediment to rezoning the site. It is recommended that the following environmental management measures be considered to support future more detailed planning of the site:

- Completion of an ASS self-assessment form for the site once detailed engineering design has been undertaken to determine the requirement for further ASS investigations and possible management during soil disturbance.
- Implementation of appropriate water management design through the BUWM process, including preparation of a LWMS at the LSP stage and an UWMP at the subdivision stage.
- Retain the creek line within the site and provide an appropriate setback through the LSP process.
- Undertake a Black Cockatoo habitat assessment at Structure Planning stage once potential development footprints and clearing requirements are known.
- Implementation of appropriate management measures for vegetation, flora, and fauna, such as appropriate fencing and signage during construction, and retention of trees where possible.

6 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data, and analyses ('client's information') provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive, or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness, and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive, and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions, and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions, and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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Figures

Legend

- Study Area (56.59 ha)
- Cadastre

- CADASTRE SOURCED FROM LANDGATE 2016
- STUDY AREA SOURCED HOME GROUP WA 2016
- AERIAL PHOTOGRAPHY SOURCED LANDSAT7 (© Western Australian Land Information Authority 2015)

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Meters
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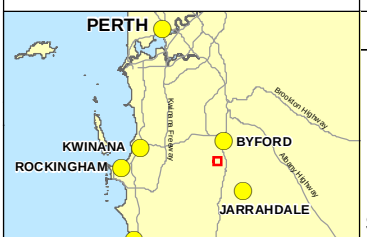
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP



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PROJECT ID	DATE
5166	25/02/2022

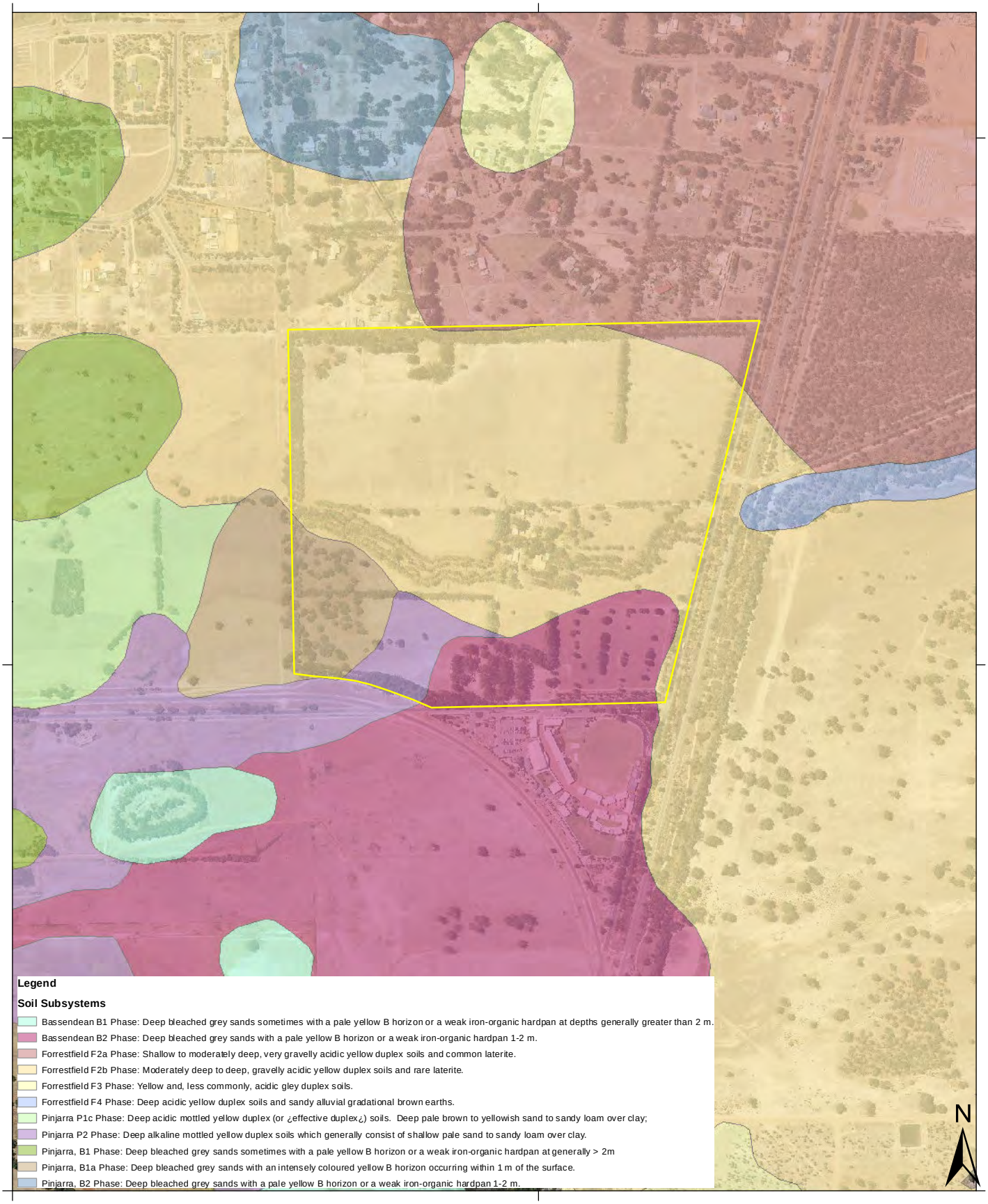
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	RHA	FJ	0

Home Group WA
Soldiers Rd, Cardup
Environmental Assessment Report

Figure 1
Site Location

K:\Projects\5166 Soldiers Rd Cardup\ESA\mxd\Home Group Figure 1 - Site Location.mxd



Legend

Study Area (56.59 ha)

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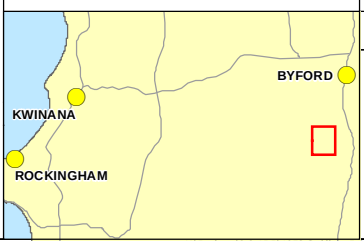
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP



- LOCALITY MAP SOURCED FROM HOMEGROUP 2016
- SOIL SUBSYSTEMS SOURCED DAFWA 2008
- AERIAL PHOTOGRAPHY SOURCED LANDSAT7
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Soldiers Rd, Cardup
Environmental Assessment Report

Figure 2
Soil Subsystems

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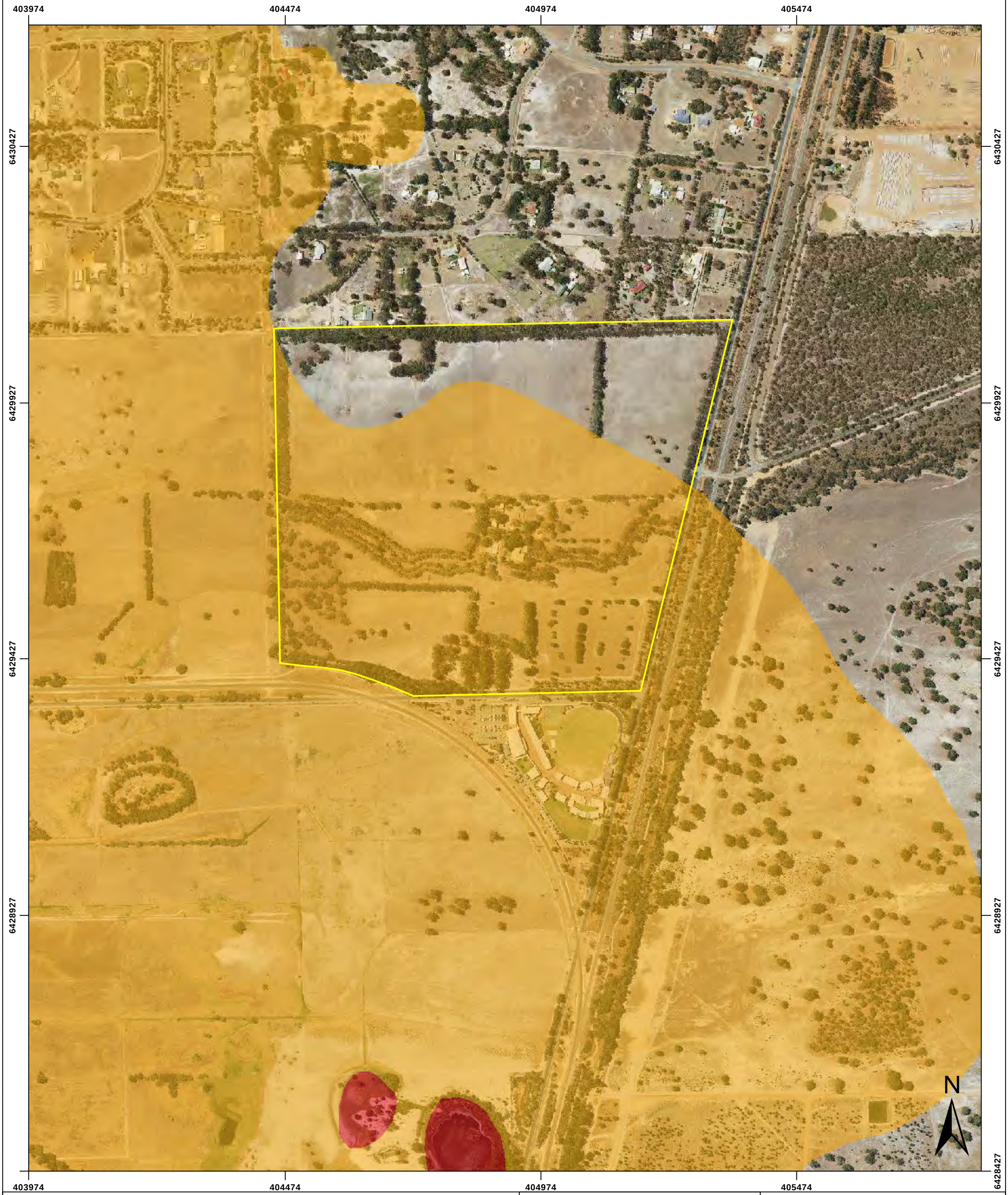
K:\Projects\5166 Soldiers Rd Cardup\GIS\Figures\5166 Cardup Figure 2 - Hydrology and Wetlands.mxd



Legend

Study Area (56.59 ha)

Acid Sulfate Soils Disturbance Risk

High to moderate risk

Moderate to low risk

- LOCALITY MAP SOURCED FROM HOMEGROUP WA 2016
- ACID SULPHATE MAP SOURCED DER 2014
- AERIAL PHOTOGRAPHY SOURCED LANDSAT7
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LOCALITY MAP

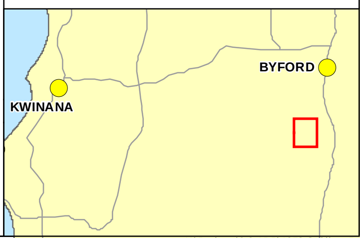

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Figure 3
Acid Sulphate Soils Risk

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Legend

- Study Area (56.59 ha)
- 1m Contours

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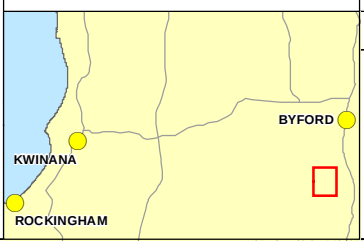
LOCALITY MAP



- LOCALITY MAP SOURCED FROM HOMEGROUP WA 2016
- TOPOGRAPHY SOURCED GEOSCIENCE AUSTRALIA 2008 (SRTM)
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Figure 4
Topographical Contours

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Legend

Study Area (56.59 ha)

Surface Water Features

- Drain - major
- Drain - minor
- Swamp - perennial
- Watercourse - minor, non-perennial

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed

- LOCALITY MAP SOURCED FROM HOMEGROUP 2016
- GEOMORHPIC WETLANDS SOURCED DPAW 2016
- EPP LAKES SOURCED EPA 1992
- HYDROGRAPHY SOURCED DOW 2015
- AERIAL PHOTOGRAPHY SOURCED LANDSAT7 (© Western Australian Land Information Authority 2015)

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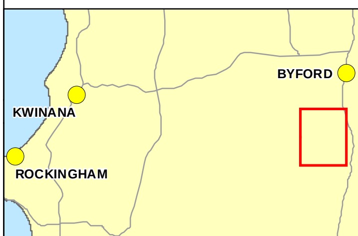

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Figure 5
Hydrology and Wetlands

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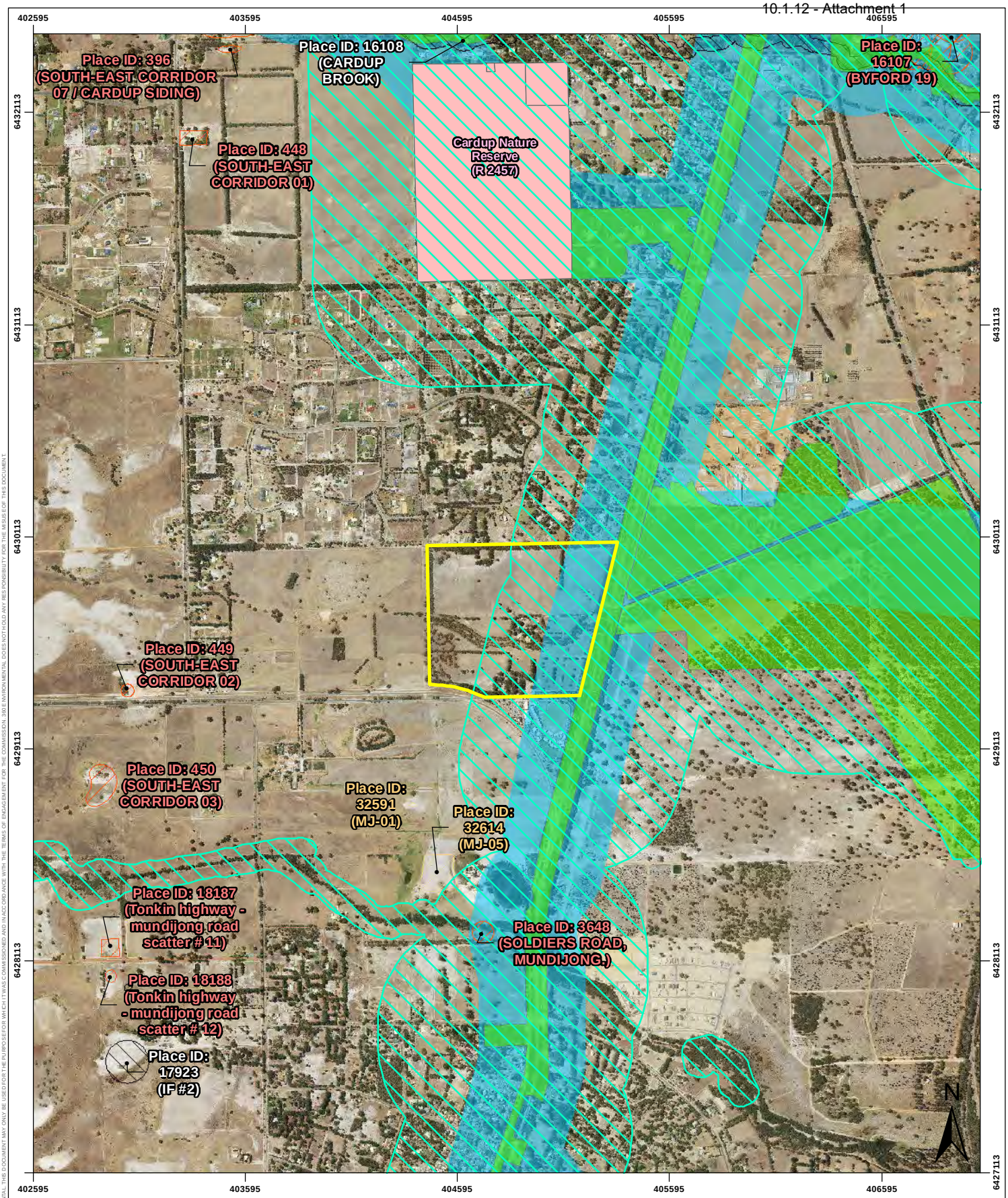

Legend

- Study Area (56.59
- Environmentally Sensitive Areas
- Nature Reserve
- Bush Forever Sites
- Perth Region Ecological Linkages

Aboriginal Heritage Sites

- Lodged
- Registered Site
- Stored Data / Not a Site

- LOCALITY MAP SOURCED FROM HOMEGROUP WA 2016
- HERITAGE SITES SOURCED AUSTRALIAN COMMONWEALTH 2015
- MANAGED LANDS SOURCED DPAW 2014
- ESA SOURCED DER 2014
- AERIAL PHOTOGRAPHY SOURCED LANDSAT7 (© Western Australian Land Information Authority 2015)

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LOCALITY MAP

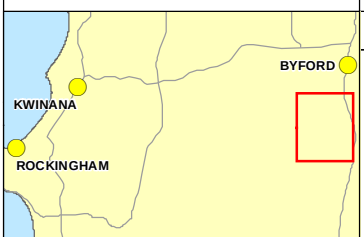

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Figure 6
Conservation and Heritage Areas

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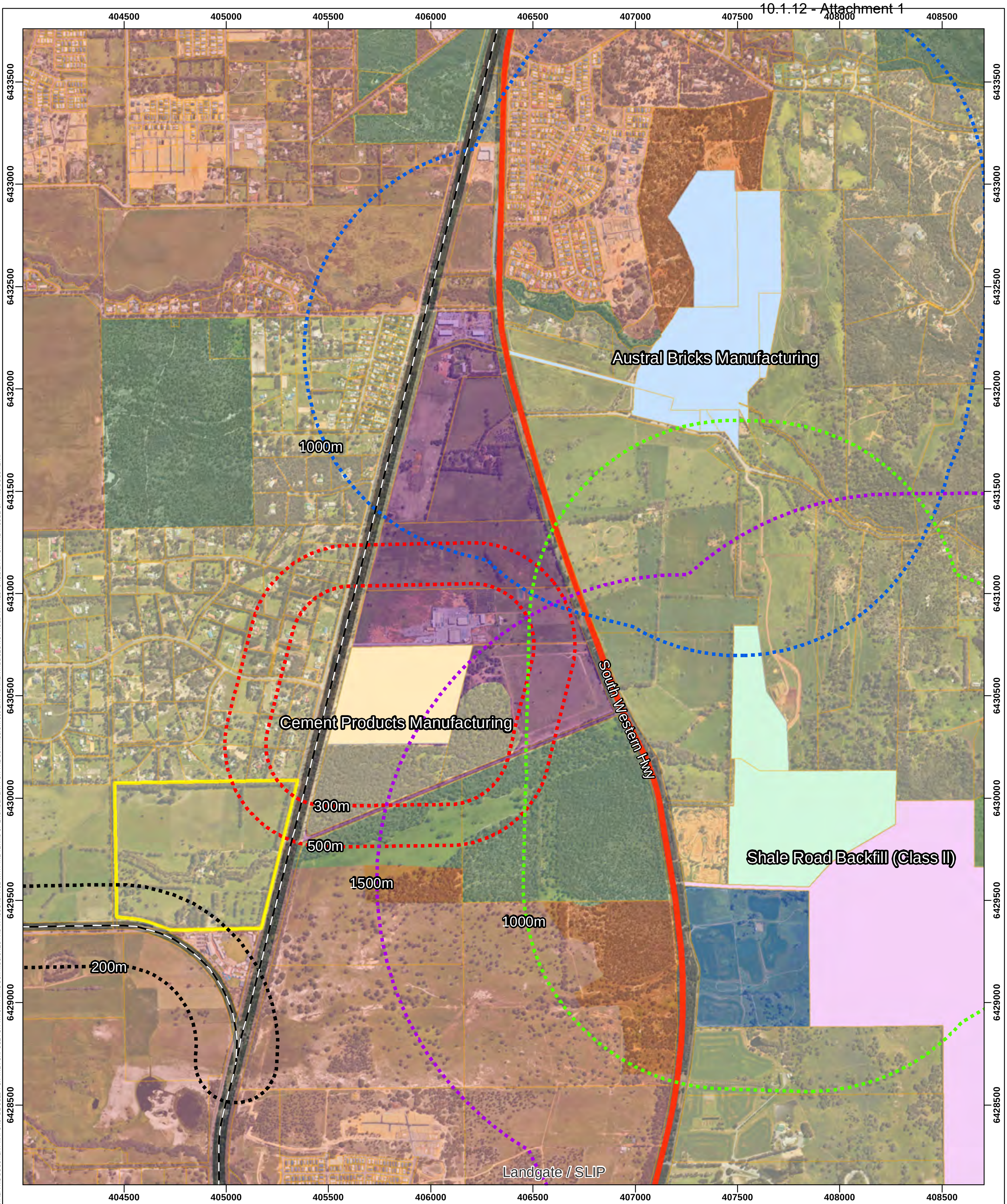

Legend

- Railway
- State Road
- Study Area (56.59 ha)
- Southern Railway 200m Noise Buffer
- Shale Road Landfill 1000m Buffer
- Shale Road Landfill 1500m Buffer
- Austral Bricks Area 1000m Buffer
- Cement Products Area 300-500m Buffer
- Shale Road Landfill (Hard Rock)
- Shale Road Landfill (Storage Shale & Clay)
- Cement Products Manufacturing
- Clay Bricks Manufacturing
- Cadastral Lines

Regional Scheme Zones

- Industrial
- Parks and recreation
- Primary regional roads
- Public purposes - special uses
- Railways
- Rural
- State forests
- Urban
- Urban deferred

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- LOCALITY MAP SOURCED FROM LANDGATE 2020
- OTHER DATA SOURCED LANDGATE 2020
- AERIAL PHOTOGRAPHY SOURCED LANDGATE 2020
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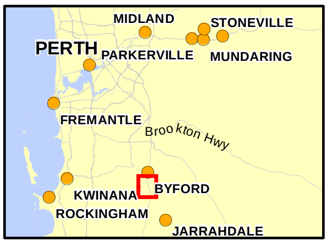
LOCALITY MAP



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Home Group WA
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Figure 7
Landuse and EPA Buffers

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Appendix A

NatureMap Fauna Searches and EPBC Protected Matters Search

Australian Government
Department of Agriculture, Water and the Environment

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. Please see the caveat for interpretation of information provided here.

Report created: 21-Feb-2022

Summary

Matters of National Environment 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 (Ramsar	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	26
Listed Migratory Species:	7

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

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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	7
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Forrestdale and thomsons lakes	Within 10km of Ramsar site	In buffer area only
Peel-yalgorup system	30 - 40km upstream from Ramsar site	In feature area

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In feature area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area	In feature area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area	In feature area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calyptorhynchus banksii naso](#)			
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Leipoa ocellata](#)			
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#)			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Rostratula australis](#)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Zanda baudinii listed as Calyptorhynchus baudinii](#)			
Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Roosting known to occur within area	In feature area
[Zanda latirostris listed as Calyptorhynchus latirostris](#)			
Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
MAMMAL			
[Bettongia penicillata ogilbyi](#)			
Woylie [66844]	Endangered	Species or species habitat known to occur within area	In feature area
[Dasyurus geoffroii](#)			
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Pseudocheirus occidentalis](#)			
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Setonix brachyurus](#)			
Quokka [229]	Vulnerable	Species or species habitat likely to occur within area	In feature area
PLANT			
[Andersonia gracilis](#)			
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area	In feature area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area	In feature area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area	In feature area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area	In feature area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area	In buffer area only
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat may occur within area	In feature area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Synaphea sp. Pinjarra Plain (A.S. George 17182) [86878]	Endangered	Species or species habitat known to occur within area	In feature area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Cardup	Nature Reserve	WA	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Tonkin Highway Extension ??? Thomas Road to South Western Highway	2019/8608	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Gold Fusion Pty Ltd /Residential development/South Western Highway 40km southeast of Perth /WA/Develop approximately 473ha of land for residential and commercial development	2014/7185	Not Controlled Action	Completed	In feature area
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Residential Development, Lots 3, 5 and 900 Taylor Rd Mundijong, WA	2019/8457	Not Controlled Action	Completed	In buffer area only
Residential development at Taylor Road and Adams Street, Mundijong, WA	2020/8780	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 08/07/2016

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 59' 23" E,32° 15' 55" S
Buffer 2km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	89	563
Presumed extinct	1	3
Priority 3	1	1
Priority 5	2	11
Protected under international agreement	1	8
Rare or likely to become extinct	5	40
TOTAL	**99**	**626**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
2.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)*		T	
3.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
4.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
5.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum)*		T	
Presumed extinct					
6.	24155	*Perameles eremiana (Desert Bandicoot)*		X	
Protected under international agreement					
7.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
Priority 3					
8.	24165	*Petropseudes dahli (Rock Ringtail Possum, Wogoit)*		P3	
Priority 5					
9.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P5	
10.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
Non-conservation taxon					
11.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
12.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
13.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
14.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
15.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
16.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
17.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
18.		*Amblyomma triguttatum*			
19.		*Aname tepperi*			
20.	24312	*Anas gracilis (Grey Teal)*			
21.	24316	*Anas superciliosa (Pacific Black Duck)*			
22.	25449	*Antechinus flavipes (Yellow-footed Antechinus)*			
23.	24561	*Anthochaera carunculata (Red Wattlebird)*			
24.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
25.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
26.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
27.		*Asadipus kunderang*			
28.		*Austracantha minax*			
29.		*Ballarra longipalpus*			
30.		*Barnardius zonarius*			
31.	25716	*Cacatua sanguinea (Little Corella)*			

NatureMap is a collaborative project of the Department of Parks and Wildlife and the Western Australian Museum.

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
32.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
33.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
34.		*Calyptorhynchus sp.*			
35.		*Camponotus terebrans*			
36.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
37.	24613	*Colluricincla harmonica subsp. rufiventris (Grey Shrike-thrush)*			
38.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
39.	24363	*Coracina novaehollandiae subsp. subpallida (Black-faced Cuckoo-shrike)*			
40.	25592	*Corvus coronoides (Australian Raven)*			
41.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
42.	24671	*Coturnix pectoralis (Stubble Quail)*			
43.	25595	*Cracticus tibicen (Australian Magpie)*			
44.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
45.	25596	*Cracticus torquatus (Grey Butcherbird)*			
46.	25400	*Crinia insignifera (Squelching Froglet)*			
47.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
48.		*Dingosa serrata*			
49.		*Eolophus roseicapillus*			
50.	24041	*Felis catus (Cat)*	Y		
51.	25530	*Gerygone fusca (Western Gerygone)*			
52.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
53.	24443	*Grallina cyanoleuca (Magpie-lark)*			
54.	25410	*Heleioporus eyrei (Moaning Frog)*			
55.	24491	*Hirundo neoxena (Welcome Swallow)*			
56.	24492	*Hirundo nigricans subsp. nigricans (Tree Martin)*			
57.		*Holconia westralia*			
58.	25131	*Lerista distinguenda*			
59.	25133	*Lerista elegans*			
60.	25661	*Lichmera indistincta (Brown Honeyeater)*			
61.	25654	*Malurus splendens (Splendid Fairy-wren)*			
62.	24583	*Manorina flavigula (Yellow-throated Miner)*			
63.	24586	*Melithreptus brevirostris subsp. leucogenys (Brown-headed Honeyeater)*			
64.	25184	*Menetia greyii*			
65.		*Missulena granulosa*			
66.	25192	*Morethia obscura*			
67.	24223	*Mus musculus (House Mouse)*	Y		
68.		*Nephila edulis*			
69.	25252	*Notechis scutatus (Tiger Snake)*			
70.		*Ozarchaea westraliensis*			
71.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
72.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
73.	25682	*Pardalotus striatus (Striated Pardalote)*			
74.	24628	*Pardalotus striatus subsp. murchisoni (Striated Pardalote)*			
75.	24409	*Phaps chalcoptera (Common Bronzewing)*			
76.	24594	*Phylidonyris melanops (Tawny-crowned Honeyeater)*			
77.	25722	*Polytelis anthopeplus (Regent Parrot)*			
78.	24771	*Porzana tabuensis (Spotless Crake)*			
79.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
80.		*Purpureicephalus spurius*			
81.	24245	*Rattus rattus (Black Rat)*	Y		
82.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
83.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
84.	30948	*Smicrornis brevirostris (Weebill)*			
85.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
86.		*Supunna funerea*			
87.		*Synothele durokoppin*			
88.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
89.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
90.	25519	*Tiliqua rugosa*			
91.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
92.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
93.	24157	*Trichosurus vulpecula subsp. arnhemensis (Northern Brushtail Possum)*			
94.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
95.		*Urodacus novaehollandiae*			
96.		*Urodacus woodwardii*			
97.		*Venator immansueta*			
98.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
99.	24856	*Zosterops lateralis subsp. gouldi (Grey-breasted White-eye)*			

NatureMap
Mapping Western Australia's biodiversity

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

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 wholely 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.

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 08/07/2016

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 59' 23" E,32° 15' 55" S
Buffer 5km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	194	6139
Other specially protected fauna	1	2
Presumed extinct	2	6
Priority 1	1	1
Priority 3	2	3
Priority 5	2	54
Protected under international agreement	3	56
Rare or likely to become extinct	9	201
TOTAL	**214**	**6462**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
2.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
3.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)*		T	
4.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
5.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
6.	24099	*Phascogale tapoatafa subsp. tapoatafa (Southern Brush-tailed Phascogale, Wambenger)*		T	
7.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum)*		T	
8.	24145	*Setonix brachyurus (Quokka)*		T	
9.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Presumed extinct					
10.	24155	*Perameles eremiana (Desert Bandicoot)*		X	
11.	24164	*Potorous platyops (Broad-faced Potoroo)*		X	
Protected under international agreement					
12.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
13.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
14.	24523	*Sterna caspia (Caspian Tern)*		IA	
Other specially protected fauna					
15.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Priority 1					
16.	33903	*Arbanitis inornatus (trapdoor spider)*		P1	
Priority 3					
17.	25242	*Acanthophis antarcticus (Southern Death Adder)*		P3	
18.	24165	*Petropseudes dahli (Rock Ringtail Possum, Wogoit)*		P3	
Priority 5					
19.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P5	
20.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P5	
Non-conservation taxon					
21.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
22.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
23.	24262	*Acanthiza inornata (Western Thornbill)*			
24.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
25.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
26.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
27.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
28.	25536	*Accipiter fasciatus (Brown Goshawk)*			
29.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
30.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
31.	24301	*Aegotheles cristatus subsp. cristatus (Australian Owlet-nightjar)*			
32.		*Aganippe rhaphiduca*			
33.		*Amblyomma triguttatum*			
34.		*Aname mainae*			
35.		*Aname tepperi*			
36.	24312	*Anas gracilis (Grey Teal)*			
37.	24316	*Anas superciliosa (Pacific Black Duck)*			
38.	25449	*Antechinus flavipes (Yellow-footed Antechinus)*			
39.	24561	*Anthochaera carunculata (Red Wattlebird)*			
40.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
41.	24599	*Anthus australis subsp. australis (Australian Pipit)*			
42.		*Antichiropus variabilis*			
43.	24990	*Aprasia pulchella (Granite Worm-lizard)*			
44.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
45.	24285	*Aquila audax (Wedge-tailed Eagle)*			
46.		*Araneus cyphoxis*			
47.		*Araneus senicaudatus*			
48.	24341	*Ardea pacifica (White-necked Heron)*			
49.	24610	*Ardeotis australis (Australian Bustard)*			
50.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
51.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
52.		*Asadipus kunderang*			
53.		*Austracantha minax*			
54.		*Backobourkia heroine*			
55.		*Ballarra longipalpus*			
56.		*Barnardius zonarius*			
57.	24319	*Biziura lobata (Musk Duck)*			
58.	25715	*Cacatua roseicapilla (Galah)*			
59.	25716	*Cacatua sanguinea (Little Corella)*			
60.		*Cacatua sp.*			
61.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
62.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
63.		*Calyptorhynchus sp.*			
64.		*Camponotus terebrans*			
65.		*Cethegus fugax*			
66.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
67.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
68.		*Chroicocephalus novaehollandiae*			
69.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
70.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
71.	24613	*Colluricincla harmonica subsp. rufiventris (Grey Shrike-thrush)*			
72.	24399	*Columba livia (Domestic Pigeon)*	Y		
73.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
74.	24363	*Coracina novaehollandiae subsp. subpallida (Black-faced Cuckoo-shrike)*			
75.	25592	*Corvus coronoides (Australian Raven)*			
76.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
77.	25593	*Corvus orru (Torresian Crow)*			
78.	24671	*Coturnix pectoralis (Stubble Quail)*			
79.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
80.	25595	*Cracticus tibicen (Australian Magpie)*			
81.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
82.	25596	*Cracticus torquatus (Grey Butcherbird)*			
83.	25398	*Crinia georgiana (Quacking Frog)*			
84.	25399	*Crinia glauerti (Clicking Frog)*			
85.	25400	*Crinia insignifera (Squelching Froglet)*			
86.	30893	*Cryptoblepharus buchananii*			
87.	25039	*Ctenotus fallens*			
88.	25047	*Ctenotus impar*			
89.	25049	*Ctenotus labillardieri*			
90.		*Cyclosa trilobata*			
91.	24322	*Cygnus atratus (Black Swan)*			
92.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
93.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
94.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
95.		*Dingosa serrata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
96.		*Egretta novaehollandiae*			
97.		*Elanus axillaris*			
98.		*Eolophus roseicapillus*			
99.	24567	*Epthianura albifrons (White-fronted Chat)*			
100.		*Eucyrtops latior*			
101.	25621	*Falco berigora (Brown Falcon)*			
102.	25622	*Falco cenchroides (Australian Kestrel)*			
103.	24476	*Falco subniger (Black Falcon)*			
104.	24041	*Felis catus (Cat)*	Y		
105.	25727	*Fulica atra (Eurasian Coot)*			
106.	24765	*Gallirallus philippensis subsp. mellori (Buff-banded Rail)*			
107.	25530	*Gerygone fusca (Western Gerygone)*			
108.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
109.	24735	*Glossopsitta porphyrocephala (Purple-crowned Lorikeet)*			
110.	24443	*Grallina cyanoleuca (Magpie-lark)*			
111.	24295	*Haliastur sphenurus (Whistling Kite)*			
112.	25410	*Heleioporus eyrei (Moaning Frog)*			
113.	25412	*Heleioporus psammophilus (Sand Frog)*			
114.	24489	*Hirundo ariel (Fairy Martin)*			
115.	24491	*Hirundo neoxena (Welcome Swallow)*			
116.	24492	*Hirundo nigricans subsp. nigricans (Tree Martin)*			
117.		*Holconia westralia*			
118.		*Hydroprogne caspia*			
119.		*Isopeda leishmanni*			
120.		*Lamponusa gleneagle*			
121.	25131	*Lerista distinguenda*			
122.	25133	*Lerista elegans*			
123.	25005	*Lialis burtonis*			
124.	25661	*Lichmera indistincta (Brown Honeyeater)*			
125.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
126.		*Lophoictinia isura*			
127.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
128.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
129.	24551	*Malurus pulcherrimus (Blue-breasted Fairy-wren)*			
130.	25654	*Malurus splendens (Splendid Fairy-wren)*			
131.	24583	*Manorina flavigula (Yellow-throated Miner)*			
132.	24586	*Melithreptus brevirostris subsp. leucogenys (Brown-headed Honeyeater)*			
133.	25184	*Menetia greyii*			
134.		*Microcarbo melanoleucos*			
135.	25693	*Microeca fascinans (Jacky Winter)*			
136.		*Missulena granulosa*			
137.	25192	*Morethia obscura*			
138.	24223	*Mus musculus (House Mouse)*	Y		
139.		*Necterosoma darwini*			
140.	25426	*Neobatrachus pelobatoides (Humming Frog)*			
141.	24738	*Neophema elegans (Elegant Parrot)*			
142.		*Nephila edulis*			
143.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
144.	25252	*Notechis scutatus (Tiger Snake)*			
145.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
146.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
147.		*Oxyopes rubicundus*			
148.		*Ozarchaea westraliensis*			
149.	25679	*Pachycephala pectoralis (Golden Whistler)*			
150.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
151.	24624	*Pachycephala rufiventris subsp. rufiventris (Rufous Whistler)*			
152.		*Paralampona marangaroo*			
153.	25253	*Parasuta gouldii*			
154.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
155.	25682	*Pardalotus striatus (Striated Pardalote)*			
156.	24628	*Pardalotus striatus subsp. murchisoni (Striated Pardalote)*			
157.		*Pediana occidentalis*			
158.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
159.	24659	*Petroica goodenovii (Red-capped Robin)*			
160.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
161.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
162.	24409	*Phaps chalcoptera (Common Bronzewing)*			
163.	25587	*Phaps elegans (Brush Bronzewing)*			
164.	24594	*Phylidonyris melanops (Tawny-crowned Honeyeater)*			
165.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
166.	25720	*Platycercus icterotis (Western Rosella)*			
167.	24747	*Platycercus spurius (Red-capped Parrot)*			
168.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
169.	25704	*Podiceps cristatus (Great Crested Grebe)*			
170.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
171.	25722	*Polytelis anthopeplus (Regent Parrot)*			
172.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
173.	24771	*Porzana tabuensis (Spotless Crake)*			
174.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
175.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
176.		*Purpureicephalus spurius*			
177.	24245	*Rattus rattus (Black Rat)*	Y		
178.		*Raveniella cirrata*			
179.		*Raveniella peckorum*			
180.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
181.	25613	*Rhipidura fuliginosa (Grey Fantail)*			
182.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
183.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
184.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
185.	30948	*Smicrornis brevirostris (Weebill)*			
186.	24426	*Strepera versicolor subsp. plumbea (Grey Currawong)*			
187.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
188.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
189.		*Supunna funerea*			
190.		*Supunna picta*			
191.	24259	*Sus scrofa (Pig)*	Y		
192.		*Synothele durokoppin*			
193.		*Synothele michaelseni*			
194.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
195.	30870	*Taeniopygia guttata (Zebra Finch)*			
196.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
197.		*Tasmanicosa leuckartii*			
198.	24844	*Threskiornis molucca (Australian White Ibis)*			
199.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
200.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
201.	25519	*Tiliqua rugosa*			
202.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
203.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
204.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
205.	24157	*Trichosurus vulpecula subsp. arnhemensis (Northern Brushtail Possum)*			
206.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
207.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
208.		*Urodacus novaehollandiae*			
209.		*Urodacus woodwardii*			
210.	24386	*Vanellus tricolor (Banded Lapwing)*			
211.		*Venator immansueta*			
212.	24040	*Vulpes vulpes (Red Fox)*	Y		
213.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
214.	24856	*Zosterops lateralis subsp. gouldi (Grey-breasted White-eye)*			

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 wholely 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.

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 21/02/2022

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 59' 24" E,32° 15' 54" S
Buffer 10km
Group By Species Group

Species Group	Species	Records
Amphibian	11	258
Bird	168	12157
Bryopsid (Moss)	7	9
Dicotyledon	584	2715
Fish	2	3
Fungus	30	93
Gymnosperm	2	11
Hepatic (Liverwort)	3	3
Invertebrate	82	287
Lichen	7	7
Mammal	33	211
Monocotyledon	366	2140
Pteridophyte (Fern)	7	15
Reptile	37	243
Slime Mould	2	2
TOTAL	**1341**	**18154**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Amphibian					
1.	25398	*Crinia georgiana (Quacking Frog)*			
2.	25399	*Crinia glauerti (Clicking Frog)*			
3.	25400	*Crinia insignifera (Squelching Froglet)*			
4.	25404	*Geocrinia leai (Ticking Frog)*			
5.	25410	*Heleioporus eyrei (Moaning Frog)*			
6.	25412	*Heleioporus psammophilus (Sand Frog)*			
7.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
8.	25388	*Litoria moorei (Motorbike Frog)*			
9.	25420	*Myobatrachus gouldii (Turtle Frog)*			
10.	25426	*Neobatrachus pelobatoides (Humming Frog)*			
11.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
Bird					
12.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
13.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
14.	24262	*Acanthiza inornata (Western Thornbill)*			
15.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
16.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
17.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
18.	25536	*Accipiter fasciatus (Brown Goshawk)*			
19.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
20.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
21.	24312	*Anas gracilis (Grey Teal)*			
22.	24315	*Anas rhynchotis (Australasian Shoveler)*			
23.	24316	*Anas superciliosa (Pacific Black Duck)*			
24.	24561	*Anthochaera carunculata (Red Wattlebird)*			
25.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
26.	25670	*Anthus australis (Australian Pipit)*			
27.	24599	*Anthus australis subsp. australis (Australian Pipit)*			
28.	24285	*Aquila audax (Wedge-tailed Eagle)*			
29.	24337	*Ardea garzetta subsp. nigripes (Little Egret)*			
30.	24340	*Ardea novaehollandiae (White-faced Heron)*			
31.	24341	*Ardea pacifica (White-necked Heron)*			
32.	24610	*Ardeotis australis (Australian Bustard)*			
33.	25566	*Artamus cinereus (Black-faced Woodswallow)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
34.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
35.	24318	*Aythya australis (Hardhead)*			
36.		*Barnardius zonarius*			
37.	24319	*Biziura lobata (Musk Duck)*			
38.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
39.	25715	*Cacatua roseicapilla (Galah)*			
40.	25716	*Cacatua sanguinea (Little Corella)*			
41.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
42.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
43.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
44.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
45.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
46.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
47.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
48.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
49.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
50.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
51.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
52.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
53.		*Chroicocephalus novaehollandiae*			
54.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
55.	25601	*Chrysococcyx lucidus (Shining Bronze Cuckoo)*			
56.	24288	*Circus approximans (Swamp Harrier)*			
57.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
58.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
59.	24613	*Colluricincla harmonica subsp. rufiventris (Grey Shrike-thrush)*			
60.	24399	*Columba livia (Domestic Pigeon)*	Y		
61.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
62.	24362	*Coracina novaehollandiae subsp. novaehollandiae (Black-faced Cuckoo-shrike)*			
63.	25592	*Corvus coronoides (Australian Raven)*			
64.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
65.	25593	*Corvus orru (Torresian Crow)*			
66.	24419	*Corvus splendens (House Crow)*			
67.	24671	*Coturnix pectoralis (Stubble Quail)*			
68.	25701	*Coturnix ypsilophora (Brown Quail)*			
69.	25595	*Cracticus tibicen (Australian Magpie)*			
70.	25596	*Cracticus torquatus (Grey Butcherbird)*			
71.	24322	*Cygnus atratus (Black Swan)*			
72.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
73.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
74.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
75.	24470	*Dromaius novaehollandiae (Emu)*			
76.		*Egretta novaehollandiae*			
77.		*Elanus axillaris*			
78.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
79.		*Eolophus roseicapillus*			
80.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
81.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
82.	24567	*Epthianura albifrons (White-fronted Chat)*			
83.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
84.	25621	*Falco berigora (Brown Falcon)*			
85.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
86.	25623	*Falco longipennis (Australian Hobby)*			
87.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
88.	24476	*Falco subniger (Black Falcon)*			
89.	25727	*Fulica atra (Eurasian Coot)*			
90.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
91.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
92.	24765	*Gallirallus philippensis subsp. mellori (Buff-banded Rail)*			
93.	42314	*Gavicalis virescens (Singing Honeyeater)*			
94.	25530	*Gerygone fusca (Western Gerygone)*			
95.	47962	*Glyciphila melanops (Tawny-crowned Honeyeater)*			
96.	24443	*Grallina cyanoleuca (Magpie-lark)*			
97.	24295	*Haliastur sphenurus (Whistling Kite)*			
98.	47965	*Hieraaetus morphnoides (Little Eagle)*			
99.	25734	*Himantopus himantopus (Black-winged Stilt)*			
100.	24491	*Hirundo neoxena (Welcome Swallow)*			
101.	48587	*Hydroprogne caspia (Caspian Tern)*		IA	

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102.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
103.	24557	*Leipoa ocellata (Malleefowl)*		T	
104.	25661	*Lichmera indistincta (Brown Honeyeater)*			
105.		*Lophoictinia isura*			
106.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
107.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
108.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
109.	24551	*Malurus pulcherrimus (Blue-breasted Fairy-wren)*			
110.	25654	*Malurus splendens (Splendid Fairy-wren)*			
111.	24552	*Malurus splendens subsp. splendens (Splendid Fairy-wren)*			
112.	24583	*Manorina flavigula (Yellow-throated Miner)*			
113.	25758	*Megalurus gramineus (Little Grassbird)*			
114.	47997	*Melanodryas cucullata (Hooded Robin)*			
115.	24586	*Melithreptus brevirostris subsp. leucogenys (Brown-headed Honeyeater)*			
116.	24598	*Merops ornatus (Rainbow Bee-eater)*			
117.		*Microcarbo melanoleucos*			
118.	25693	*Microeca fascinans (Jacky Winter)*			
119.	25610	*Myiagra inquieta (Restless Flycatcher)*			
120.	24738	*Neophema elegans (Elegant Parrot)*			
121.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
122.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
123.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
124.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
125.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
126.	24626	*Pardalotus punctatus subsp. xanthopyge (Yellow-rumped Pardalote)*			
127.	25682	*Pardalotus striatus (Striated Pardalote)*			
128.	24674	*Pavo cristatus (Common Peafowl, Indian Peafowl)*	Y		
129.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
130.	48060	*Petrochelidon ariel (Fairy Martin)*			
131.	48061	*Petrochelidon nigricans (Tree Martin)*			
132.	48066	*Petroica boodang (Scarlet Robin)*			
133.	24659	*Petroica goodenovii (Red-capped Robin)*			
134.	25697	*Phalacrocorax carbo (Great Cormorant)*			
135.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
136.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
137.	24409	*Phaps chalcoptera (Common Bronzewing)*			
138.	25587	*Phaps elegans (Brush Bronzewing)*			
139.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
140.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
141.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
142.	25720	*Platycercus icterotis (Western Rosella)*			
143.	24745	*Platycercus icterotis subsp. icterotis (Western Rosella)*			
144.	24747	*Platycercus spurius (Red-capped Parrot)*			
145.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
146.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
147.	25703	*Podargus strigoides (Tawny Frogmouth)*			
148.	25704	*Podiceps cristatus (Great Crested Grebe)*			
149.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
150.	25722	*Polytelis anthopeplus (Regent Parrot)*			
151.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
152.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
153.	24771	*Porzana tabuensis (Spotless Crake)*			
154.	24702	*Pterodroma brevirostris (Kerguelen Petrel)*			
155.		*Purpureicephalus spurius*			
156.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
157.	48096	*Rhipidura albiscapa (Grey Fantail)*			
158.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
159.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
160.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
161.	30948	*Smicrornis brevirostris (Weebill)*			
162.	24645	*Stagonopleura oculata (Red-eared Firetail)*			
163.	25643	*Sterna hybrida (Whiskered Tern)*			
164.	25597	*Strepera versicolor (Grey Currawong)*			
165.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
166.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
167.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
168.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
169.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
170.	30870	*Taeniopygia guttata (Zebra Finch)*			

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171.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
172.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
173.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
174.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
175.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
176.	48147	*Turnix varius (Painted Button-quail)*			
177.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
178.	24386	*Vanellus tricolor (Banded Lapwing)*			
179.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
Bryopsid (Moss)					
180.	32461	*Campylopus bicolor var. bicolor*			
181.	32351	*Eccremidium pulchellum*			
182.	32356	*Entosthodon subnudus*			
183.	32370	*Funaria hygrometrica*			
184.	32413	*Pleuridium ecklonii*			
185.	32417	*Ptychostomum angustifolium*			
186.	32439	*Syntrichia papillosa*			
Dicotyledon					
187.		*?Persoonia saccata*			Y
188.	15429	*Acacia alata var. alata*			
189.	15466	*Acacia applanata*			
190.	3233	*Acacia barbinervis*			
191.	15469	*Acacia barbinervis subsp. barbinervis*			
192.	3294	*Acacia dentifera*			
193.	3307	*Acacia divergens*			
194.	3310	*Acacia drewiana*			
195.	11926	*Acacia drewiana subsp. drewiana*			
196.	3374	*Acacia huegelii*			
197.	3409	*Acacia lasiocarpa (Panjang)*			
198.	11519	*Acacia lasiocarpa var. bracteolata*			
199.	14932	*Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)*		P1	
200.	3410	*Acacia lateriticola*			
201.	3442	*Acacia microbotrya (Manna Wattle, Kalyang)*			
202.	3454	*Acacia nervosa (Rib Wattle)*			
203.	14131	*Acacia oncinophylla subsp. patulifolia*		P4	
204.	17860	*Acacia podalyriifolia*	Y		
205.	3502	*Acacia pulchella (Prickly Moses)*			
206.	15481	*Acacia pulchella var. glaberrima*			
207.	15483	*Acacia pulchella var. pulchella*			
208.	15480	*Acacia pulchella var. reflexa*			
209.	3527	*Acacia saligna (Orange Wattle, Kudjong)*			
210.	30032	*Acacia saligna subsp. saligna*			
211.	3541	*Acacia sessilis*			
212.		*Acacia sp.*			
213.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
214.	3574	*Acacia teretifolia*			
215.	3591	*Acacia urophylla*			
216.	3602	*Acacia willdenowiana (Grass Wattle)*			
217.	6203	*Actinotus glomeratus*			
218.	6205	*Actinotus leucocephalus (Flannel Flower)*			
219.	1775	*Adenanthos cygnorum (Common Woollybush)*			
220.	1790	*Adenanthos meisneri*			
221.	1791	*Adenanthos obovatus (Basket Flower)*			
222.	48513	*Aizoon pubescens*	Y		
223.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
224.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
225.	1734	*Allocasuarina microstachya*			
226.	1739	*Allocasuarina thuyoides (Horned Sheoak)*			
227.	4585	*Amperea ericoides*			
228.	13267	*Amyema linophylla subsp. linophylla*			
229.	2380	*Amyema miquelii (Stalked Mistletoe)*			
230.	6300	*Andersonia aristata (Rice Flower)*			
231.	6314	*Andersonia lehmanniana*			
232.	7829	*Angianthus drummondii*		P3	
233.	7411	*Anthotium humile (Dwarf Anthotium)*			
234.	12724	*Anthotium junciforme*			
235.	3686	*Aotus cordifolia*			
236.	3688	*Aotus gracillima*			
237.	3692	*Aotus procumbens*			

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238.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
239.	6580	*Asclepias curassavica (Redhead Cottonbush)*	Y		
240.		*Astartea aff. fascicularis sthcst*			
241.	20350	*Astartea affinis (West-coast Astartea)*			
242.	20283	*Astartea scoparia (Common Astartea)*			
243.		*Asteraceae sp.*			
244.	6334	*Astroloma pallidum (Kick Bush)*			
245.	6337	*Astroloma stomarrhena (Red Swamp Cranberry)*			
246.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
247.	45402	*Babingtonia urbana (Coastal Plain Babingtonia)*		P3	
248.	32682	*Banksia armata var. armata*			
249.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
250.	32678	*Banksia bipinnatifida subsp. bipinnatifida*			
251.	32576	*Banksia dallanneyi (Couch Honeypot)*			
252.	32580	*Banksia dallanneyi subsp. dallanneyi var. dallanneyi*			
253.	1819	*Banksia grandis (Bull Banksia, Pulgarla)*			
254.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
255.	32214	*Banksia kippistiana*			
256.	32216	*Banksia kippistiana var. paenepeccata*		P3	
257.	1834	*Banksia menziesii (Firewood Banksia)*			
258.	32202	*Banksia nivea (Honeypot Dryandra, Pudjarn)*			
259.	32053	*Banksia undata (Urchin Dryandra)*			
260.	32054	*Banksia undata var. undata*			
261.	5387	*Beaufortia macrostemon (Darling Range Beaufortia)*			
262.	7046	*Bellardia trixago (Bellardia)*	Y		
263.	48868	*Bellardia viscosa*	Y		
264.	25788	*Billardiera fraseri (Elegant Pronaya)*			
265.	25798	*Billardiera fusiformis (Australian Bluebell)*			
266.	3165	*Billardiera variifolia*			
267.	4413	*Boronia crenulata (Aniseed Boronia)*			
268.	11503	*Boronia crenulata subsp. crenulata var. crenulata*			
269.	16636	*Boronia crenulata subsp. viminea*			
270.	4420	*Boronia fastigiata (Bushy Boronia)*			
271.	4429	*Boronia molloyae (Tall Boronia)*			
272.	48782	*Bossiaea angustifolia*			
273.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
274.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
275.	10915	*Brachychiton populneus (Kurrajong)*	Y		
276.	7867	*Brachyscome bellidioides*			
277.	7878	*Brachyscome iberidifolia*			
278.	7883	*Brachyscome pusilla*			
279.	2854	*Calandrinia granulifera (Pygmy Purslane)*			
280.	4717	*Callitriche stagnalis (Common Starwort)*	Y		
281.	5411	*Calothamnus hirsutus*			
282.	5415	*Calothamnus lateralis*			
283.	35797	*Calothamnus lateralis var. lateralis*			
284.	35816	*Calothamnus quadrifidus subsp. quadrifidus*			
285.	5439	*Calytrix angulata (Yellow Starflower)*			
286.	5441	*Calytrix aurea*			
287.	5458	*Calytrix flavescens (Summer Starflower)*			
288.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
289.	7909	*Carduus pycnocephalus (Slender Thistle)*	Y		
290.	2795	*Carpobrotus edulis (Hottentot Fig)*	Y		
291.	2951	*Cassytha flava (Dodder Laurel)*			
292.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
293.	2954	*Cassytha micrantha*			
294.	2956	*Cassytha pomiformis (Dodder Laurel)*			
295.	2957	*Cassytha racemosa (Dodder Laurel)*			
296.	18321	*Casuarina glauca*	Y		
297.	1742	*Casuarina obesa (Swamp Sheoak, Kuli)*			
298.	6539	*Centaurium erythraea (Common Centaury)*	Y		
299.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
300.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
301.	5498	*Chamelaucium uncinatum (Geraldton Wax)*			
302.	8971	*Chorizema cordatum*			
303.	3753	*Chorizema dicksonii (Yellow-eyed Flame Pea)*			
304.	3761	*Chorizema rhombeum*			
305.	11900	*Chrysanthemoides monilifera subsp. monilifera*	Y		
306.	6543	*Cicendia filiformis (Slender Cicendia)*	Y		
307.	7935	*Cichorium intybus (Chicory)*	Y		

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308.	7937	*Cirsium vulgare (Spear Thistle, Scotch Thistle)*	Y		
309.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
310.	4551	*Comesperma ciliatum*			
311.	4564	*Comesperma virgatum (Milkwort)*			
312.	1882	*Conospermum stoechadis (Common Smokebush)*			
313.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
314.	6348	*Conostephium pendulum (Pearl Flower)*			
315.	6349	*Conostephium preissii*			
316.	7941	*Conyza parva*	Y		
317.		*Conyza sp.*			
318.		*Conyza sp. Mud07*			Y
319.	17104	*Corymbia calophylla (Marri)*			
320.	7946	*Cotula cotuloides (Smooth Cotula)*			
321.	13354	*Craspedia variabilis*			
322.	3136	*Crassula alata*	Y		
323.	17701	*Crassula closiana*			
324.	3137	*Crassula colorata (Dense Stonecrop)*			
325.	11563	*Crassula colorata var. colorata*			
326.	3138	*Crassula decumbens (Rufous Stonecrop)*			
327.	20271	*Crassula extrorsa*			
328.	15706	*Crassula natans var. minus*	Y		
329.	3144	*Crassula peduncularis (Purple Stonecrop)*			
330.	7953	*Crepis foetida (Foetid Hawksbeard)*	Y		
331.	29054	*Crepis foetida subsp. foetida (Stinking Hawksbeard)*	Y		
332.	35838	*Cristonia biloba subsp. biloba*			
333.	4792	*Cryptandra arbutiflora (Waxy Cryptandra)*			
334.	6663	*Cuscuta epithymum (Lesser Dodder, Greater Dodder)*	Y		
335.	7420	*Dampiera alata (Winged-stem Dampiera)*			
336.	7454	*Dampiera linearis (Common Dampiera)*			
337.	7462	*Dampiera pedunculata*			
338.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
339.	5531	*Darwinia thymoides*			
340.	18193	*Darwinia thymoides subsp. thymoides*			
341.	6218	*Daucus glochidiatus (Australian Carrot)*			
342.	3799	*Daviesia cordata (Bookleaf)*			
343.	3805	*Daviesia decurrens (Prickly Bitter-pea)*			
344.	19747	*Daviesia decurrens subsp. decurrens*			
345.	3815	*Daviesia horrida (Prickly Bitter-pea)*			
346.	16585	*Daviesia nudiflora subsp. nudiflora*			
347.	3832	*Daviesia physodes*			
348.	3835	*Daviesia preissii*			
349.	3845	*Daviesia triflora*			
350.	3863	*Dillwynia dillwynioides*		P3	
351.	7054	*Dischisma arenarium*	Y		
352.	7055	*Dischisma capitatum (Woolly-headed Dischisma)*	Y		
353.	7961	*Dittrichia graveolens (Stinkwort)*	Y		
354.	3092	*Drosera bulbosa (Red-leaved Sundew)*			
355.	48751	*Drosera drummondii*			
356.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
357.	48747	*Drosera geniculata*			
358.	3097	*Drosera gigantea (Giant Sundew)*			
359.	3098	*Drosera glanduligera (Pimpernel Sundew)*			
360.	3101	*Drosera heterophylla (Swamp Rainbow)*			
361.	48769	*Drosera indumenta*			
362.	3105	*Drosera leucoblasta (Wheel Sundew)*			
363.	3106	*Drosera macrantha (Bridal Rainbow)*			
364.	3109	*Drosera menziesii (Pink Rainbow)*			
365.	3113	*Drosera neesii (Jewel Rainbow)*			
366.	3114	*Drosera nitidula (Shining Sundew)*			
367.	3115	*Drosera occidentalis (Western Sundew)*		P4	
368.	13189	*Drosera oreopodion*			
369.	3118	*Drosera pallida (Pale Rainbow)*			
370.	29178	*Drosera porrecta*			
371.	3124	*Drosera pulchella (Pretty Sundew)*			
372.	8911	*Drosera rosulata*			
373.		*Drosera sp. "climbing"*			
374.	49090	*Drosera sp. Branched styles (S.C. Coffey 193)*			
375.	13185	*Drosera spilos*			
376.	3131	*Drosera stolonifera (Leafy Sundew)*			
377.	3133	*Drosera subhirtella (Sunny Rainbow)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
378.	11756	*Epilobium billardiereanum subsp. cinereum (Variable Willow Herb)*			
379.	6132	*Epilobium ciliatum*	Y		
380.	13949	*Eremaea asterocarpa*			
381.	13950	*Eremaea asterocarpa subsp. asterocarpa*			
382.	5541	*Eremaea pauciflora*			
383.	14104	*Eremaea pauciflora var. pauciflora*			
384.	7189	*Eremophila clarkei (Turpentine Bush)*			
385.		*Eremophila sp.*			
386.	4332	*Erodium botrys (Long Storksbill)*	Y		
387.	4335	*Erodium cygnorum (Blue Heronsbill)*			
388.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
389.	5688	*Eucalyptus laeliae (Darling Range Ghost Gum)*			
390.	5690	*Eucalyptus lane-poolei (Salmon White Gum)*			
391.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
392.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
393.	13548	*Eucalyptus marginata subsp. thalassica (Blue-leaved Jarrah)*			
394.	5739	*Eucalyptus patens (Swan River Blackbutt, Dwuda)*			
395.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
396.	13511	*Eucalyptus rudis subsp. rudis*			
397.	5797	*Eucalyptus wandoo (Wandoo, Wondu)*			
398.	12906	*Eucalyptus wandoo subsp. wandoo*			
399.	13090	*Eucalyptus x balanites (Cadda Road Mallee)*		T	
400.	3872	*Euchilopsis linearis (Swamp Pea)*			
401.	13753	*Euphorbia dallachyana*			
402.	29940	*Euphorbia maculata*	Y		
403.	34757	*Euphorbia prostrata*	Y		
404.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
405.	3880	*Eutaxia virgata*			
406.	2969	*Fumaria capreolata (Whiteflower Fumitory)*	Y		
407.	7321	*Galium divaricatum*	Y		
408.	20475	*Gastrolobium capitatum*			
409.	20473	*Gastrolobium ebracteolatum*			
410.	3924	*Gastrolobium spinosum (Prickly Poison)*			
411.	4340	*Geranium retrorsum*			
412.	12624	*Gnephosis angianthoides*			
413.	7991	*Gnephosis drummondii*			
414.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
415.	3945	*Gompholobium aristatum*			
416.	10909	*Gompholobium confertum*			
417.	3950	*Gompholobium knightianum*			
418.	3951	*Gompholobium marginatum*			
419.	3954	*Gompholobium polymorphum*			
420.	3955	*Gompholobium preissii*			
421.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
422.	16746	*Gonocarpus benthamii subsp. benthamii*			
423.	6149	*Gonocarpus cordiger*			
424.	6160	*Gonocarpus paniculatus*			
425.	6161	*Gonocarpus pithyoides*			
426.	29362	*Goodenia coerulea*			
427.	12551	*Goodenia micrantha*			
428.	7538	*Goodenia pulchella*			
429.	14282	*Gratiola pubescens*			
430.	1964	*Grevillea bipinnatifida (Fuchsia Grevillea)*			
431.	19628	*Grevillea bipinnatifida subsp. bipinnatifida*			
432.	1997	*Grevillea endlicheriana (Spindly Grevillea)*			
433.	2066	*Grevillea pilulifera (Woolly-flowered Grevillea)*			
434.	2080	*Grevillea quercifolia (Oak-leaf Grevillea)*			
435.	2102	*Grevillea tenuiflora (Tassel Grevillea)*			
436.	2122	*Grevillea wilsonii (Native Fuchsia)*			
437.	2788	*Gyrostemon subnudus*			
438.	2128	*Hakea amplexicaulis (Prickly Hakea)*			
439.	2131	*Hakea auriculata*			
440.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
441.	2152	*Hakea cyclocarpa (Ramshorn)*			
442.	2166	*Hakea incrassata (Marble Hakea)*			
443.	2175	*Hakea lissocarpha (Honey Bush)*			
444.	2179	*Hakea marginata*			
445.	45333	*Hakea neospathulata*			
446.	2197	*Hakea prostrata (Harsh Hakea)*			
447.	2203	*Hakea ruscifolia (Candle Hakea)*			

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448.	2206	*Hakea stenocarpa (Narrow-fruited Hakea)*			
449.	2212	*Hakea sulcata (Furrowed Hakea)*			
450.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
451.	2215	*Hakea undulata (Wavy-leaved Hakea)*			
452.	2216	*Hakea varia (Variable-leaved Hakea)*			
453.	6839	*Hemiandra pungens (Snakebush)*			
454.	6856	*Hemigenia incana (Silky Hemigenia)*			
455.	5108	*Hibbertia acerosa (Needle Leaved Guinea Flower)*			
456.	5109	*Hibbertia amplexicaulis*			
457.	5114	*Hibbertia commutata*			
458.	20051	*Hibbertia diamesogenos*			
459.	5129	*Hibbertia glomerata*			
460.	19778	*Hibbertia glomerata subsp. darlingensis*			
461.	5134	*Hibbertia huegelii*			
462.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
463.	45534	*Hibbertia hypericoides subsp. hypericoides*			
464.	5161	*Hibbertia quadricolor*			
465.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
466.	11481	*Hibbertia spicata subsp. spicata*			
467.	5172	*Hibbertia stellaris (Orange Stars)*			
468.	48381	*Hibbertia striata*			
469.	5173	*Hibbertia subvaginata*			
470.	5176	*Hibbertia vaginata*			
471.	6222	*Homalosciadium homalocarpum*			
472.	3964	*Hovea chorizemifolia (Holly-leaved Hovea)*			
473.	3966	*Hovea pungens (Devil's Pins, Puyenak)*			
474.	3968	*Hovea trisperma (Common Hovea)*			
475.	12859	*Hovea trisperma var. trisperma*			
476.	12741	*Hyalosperma cotula*			
477.	5216	*Hybanthus calycinus (Wild Violet)*			
478.	5221	*Hybanthus floribundus*			
479.	12007	*Hybanthus floribundus subsp. floribundus*			
480.	6223	*Hydrocotyle alata*			
481.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
482.	6229	*Hydrocotyle diantha*			
483.	6236	*Hydrocotyle pilifera*			
484.	5181	*Hypericum japonicum (Matted St John's Wort)*			
485.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
486.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
487.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
488.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
489.	9352	*Hypochaeris radicata (Flat Weed, Cats-ear)*	Y		
490.	2221	*Isopogon asper*			
491.	2237	*Isopogon sphaerocephalus (Drumstick Isopogon)*			
492.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
493.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
494.	3997	*Jacksonia alata*			
495.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
496.	20462	*Jacksonia gracillima*		P3	
497.	4018	*Jacksonia lehmannii*			
498.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
499.	4037	*Kennedia coccinea (Coral Vine)*			
500.	4041	*Kennedia microphylla*			
501.	4044	*Kennedia prostrata (Scarlet Runner)*			
502.	5832	*Kunzea ericifolia (Spearwood, Pondil)*			
503.	15498	*Kunzea glabrescens (Spearwood)*			
504.	5835	*Kunzea micrantha*			
505.	17461	*Kunzea micrantha subsp. micrantha*			
506.	17785	*Kunzea micrantha subsp. petiolata*			
507.	5841	*Kunzea recurva*			
508.	3669	*Labichea punctata (Lance-leaved Cassia)*			
509.	18585	*Lagenophora huegelii*			
510.	14083	*Lambertia multiflora var. darlingensis*			
511.	5033	*Lasiopetalum floribundum (Free Flowering Lasiopetalum)*			
512.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
513.	7572	*Lechenaultia expansa*			
514.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
515.	44490	*Leontodon rhagadioloides*	Y		
516.	2342	*Leptomeria cunninghamii*			
517.	2355	*Leptomeria squarrulosa*			

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518.	5850	*Leptospermum laevigatum (Coast Teatree)*	Y		
519.	6360	*Leucopogon australis (Spiked Beard-heath)*			
520.	6367	*Leucopogon capitellatus*			
521.	6374	*Leucopogon conostephioides*			
522.	6400	*Leucopogon gracillimus*			
523.	6434	*Leucopogon polymorphus*			
524.	6436	*Leucopogon propinquus*			
525.	6439	*Leucopogon pulchellus (Beard-heath)*			
526.	28302	*Leucopogon sp. Parkerville (A. Meebold 11654)*			
527.	6445	*Leucopogon squarrosus*			
528.	6454	*Leucopogon verticillatus (Tassel Flower)*			
529.	7675	*Levenhookia pulcherrima (Beautiful Stylewort)*		P2	
530.	7676	*Levenhookia pusilla (Midget Stylewort)*			
531.	7677	*Levenhookia stipitata (Common Stylewort)*			
532.	4363	*Linum trigynum (French Flax)*	Y		
533.	7407	*Lobelia rhytidosperma (Wrinkled-seeded Lobelia)*			
534.	7408	*Lobelia tenuior (Slender Lobelia)*			
535.	9356	*Logfia gallica*	Y		
536.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
537.		*Lotus sp. Mud3*			Y
538.	8564	*Lotus subbiflorus*	Y		
539.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
540.	36373	*Lysimachia minima*	Y		
541.	6456	*Lysinema ciliatum (Curry Flower)*			
542.	6458	*Lysinema elegans*			
543.	34736	*Lysinema pentapetalum*			
544.	2839	*Macarthuria australis*			
545.	17637	*Marianthus candidus (White Marianthus)*			
546.	17630	*Marianthus tenuis*			
547.	34676	*Meionectes brownii (Swamp Raspwort)*			
548.	37580	*Melaleuca acutifolia*			
549.	36296	*Melaleuca armillaris subsp. armillaris*	Y		
550.	5925	*Melaleuca lateriflora (Gorada)*			
551.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
552.	20297	*Melaleuca osullivanii*			
553.	5946	*Melaleuca pauciflora*			
554.	5952	*Melaleuca preissiana (Moonah)*			
555.	5958	*Melaleuca radula (Graceful Honeymyrtle)*			
556.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
557.	5964	*Melaleuca seriata*			
558.	5978	*Melaleuca teretifolia (Banbar)*			
559.	5980	*Melaleuca thymoides*			
560.	5984	*Melaleuca uncinata (Broom Bush, Kwidjard)*			
561.	5987	*Melaleuca viminea (Mohan)*			
562.	13280	*Melaleuca viminea subsp. viminea*			
563.	8105	*Millotia myosotidifolia*			
564.	14337	*Millotia tenuifolia var. laevis*		P2	
565.	14344	*Millotia tenuifolia var. tenuifolia (Soft Millotia)*			
566.	4090	*Mirbelia dilatata (Holly-leaved Mirbelia)*			
567.	4100	*Mirbelia spinosa*			
568.	7085	*Misopates orontium (Lesser Snapdragon)*	Y		
569.	7410	*Monopsis debilis*	Y		
570.	37440	*Monopsis debilis var. depressa*	Y		
571.	4662	*Monotaxis grandiflora (Diamond of the Desert)*			
572.	19585	*Monotaxis grandiflora var. grandiflora*			
573.	4666	*Monotaxis occidentalis*			
574.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
575.	6137	*Oenothera affinis (Longflower Evening Primrose)*	Y		
576.	6140	*Oenothera mollissima*	Y		
577.	14292	*Oenothera stricta subsp. stricta*	Y		
578.	2365	*Olax benthamiana*			
579.	8133	*Olearia elaeophila*			
580.	32716	*Olearia lehmanniana*			
581.	8143	*Olearia paucidentata (Autumn Scrub Daisy)*			
582.	18254	*Opercularia apiciflora*			
583.	7346	*Opercularia echinocephala (Bristly Headed Stink Weed)*			
584.	18255	*Opercularia vaginata (Dog Weed)*			
585.	4113	*Ornithopus compressus (Yellow Serradella)*	Y		
586.	4114	*Ornithopus pinnatus (Slender Serradella)*	Y		
587.	4352	*Oxalis glabra*	Y		

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588.	4355	*Oxalis perennans*			
589.	4356	*Oxalis pes-caprae (Soursob)*	Y		
590.	3618	*Paraserianthes lophantha (Albizia)*			
591.	17114	*Paraserianthes lophantha subsp. lophantha*			
592.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
593.	6573	*Parsonsia diaphanophleba*		P4	
594.	4346	*Pelargonium littorale*			
595.	6245	*Pentapeltis peltigera*			
596.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
597.	16477	*Pericalymma ellipticum var. ellipticum*			
598.	16478	*Pericalymma ellipticum var. floridum*			
599.	15501	*Pericalymma spongiocaule*			
600.	2255	*Persoonia angustiflora*			
601.	2267	*Persoonia longifolia (Snottygobble)*			
602.	2273	*Persoonia saccata (Snottygobble)*			
603.	20391	*Petrophile juncifolia*			
604.	2299	*Petrophile linearis (Pixie Mops)*			
605.	2301	*Petrophile macrostachya*			
606.	2308	*Petrophile seminuda*			
607.	2311	*Petrophile squamata*			
608.	2312	*Petrophile striata*			
609.	18529	*Philotheca spicata (Pepper and Salt)*			
610.	16825	*Phyllangium divergens*			
611.	16177	*Phyllangium paradoxum*			
612.	4675	*Phyllanthus calycinus (False Boronia)*			
613.	13405	*Phyllopodium cordatum*	Y		
614.	4141	*Phyllota gracilis*			
615.	5232	*Pimelea argentea (Silvery Leaved Pimelea)*			
616.	11404	*Pimelea imbricata var. major*			
617.	11402	*Pimelea imbricata var. piligera*			
618.	5266	*Pimelea suaveolens (Scented Banjine)*			
619.	12041	*Pimelea suaveolens subsp. suaveolens*			
620.	5269	*Pimelea sylvestris*			
621.	8163	*Pithocarpa corymbulosa (Corymbose Pithocarpa)*		P3	
622.	8175	*Podolepis gracilis (Slender Podolepis)*			
623.		*Podotheca ?gnaphalioides*			
624.	8182	*Podotheca angustifolia (Sticky Longheads)*			
625.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
626.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
627.	8188	*Pogonolepis stricta*			
628.	2419	*Polygonum aviculare (Wireweed)*	Y		
629.		*Polypompholyx tenella scps*			
630.	4691	*Poranthera microphylla (Small Poranthera)*			
631.		*Poranthera microphylla/moorokatta*			
632.	13255	*Pterochaeta paniculata*			
633.	2742	*Ptilotus manglesii (Pom Poms, Mulamula)*			
634.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
635.	4181	*Pultenaea reticulata*			
636.	8195	*Quinetia urvillei*			
637.	2938	*Ranunculus trilobus (Buttercup)*	Y		
638.	6012	*Regelia ciliata*			
639.	13300	*Rhodanthe citrina*			
640.	13234	*Rhodanthe manglesii*			
641.	3191	*Rubus ulmifolius (Blackberry)*	Y		
642.	2429	*Rumex acetosella (Sorrel)*	Y		
643.	2430	*Rumex brownii (Swamp Dock)*	Y		
644.	2433	*Rumex crispus (Curled Dock)*	Y		
645.	7602	*Scaevola calliptera*			
646.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
647.	7619	*Scaevola lanceolata (Long-leaved Scaevola)*			
648.	7635	*Scaevola pilosa (Hairy Fan-flower)*			
649.	13182	*Scaevola repens var. repens*			
650.	17055	*Schinus molle*	Y		
651.	6263	*Schoenolaena juncea*			
652.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
653.	20663	*Senecio multicaulis subsp. multicaulis*			
654.	25884	*Senecio pinnatifolius var. latilobus*			
655.	8217	*Senecio quadridentatus*			
656.	2909	*Silene gallica (French Catchfly)*	Y		
657.	8224	*Siloxerus filifolius*			

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658.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
659.	14583	*Siloxerus multiflorus*			
660.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
661.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
662.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
663.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
664.	4207	*Sphaerolobium medium*			
665.	4211	*Sphaerolobium vimineum (Leafless Globe Pea)*			
666.	4716	*Stachystemon vermicularis*			
667.	4733	*Stackhousia monogyna*			
668.	9070	*Stackhousia pubescens (Downy Stackhousia)*			
669.	2918	*Stellaria media (Chickweed)*	Y		
670.	19403	*Stenopetalum gracile*			
671.	2316	*Stirlingia latifolia (Blueboy)*			
672.	18564	*Stylidium aceratum*		P3	
673.		*Stylidium aff. androsaceum*			
674.	7684	*Stylidium amoenum (Lovely Triggerplant)*			
675.	30278	*Stylidium androsaceum*			
676.	25831	*Stylidium araeophyllum (Stilt Walker)*			
677.		*Stylidium araeophyllum/neurophyllum*			
678.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
679.	7694	*Stylidium bulbiferum (Circus Triggerplant)*			
680.	7696	*Stylidium calcaratum (Book Triggerplant)*			
681.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
682.	7702	*Stylidium ciliatum (Golden Triggerplant)*			
683.	7712	*Stylidium despectum (Dwarf Triggerplant)*			
684.	7713	*Stylidium dichotomum (Pins-and-needles)*			
685.	7716	*Stylidium diuroides (Donkey Triggerplant)*			
686.	7717	*Stylidium divaricatum (Daddy-long-legs)*			
687.	7718	*Stylidium diversifolium (Touch-me-not)*			
688.	7719	*Stylidium ecorne (Foot Triggerplant)*			
689.	7736	*Stylidium hispidum (White Butterfly Triggerplant)*			
690.	7742	*Stylidium inundatum (Hundreds and Thousands)*			
691.	7749	*Stylidium leptophyllum (Needle-leaved Triggerplant)*			
692.	7752	*Stylidium lineatum (Sunny Triggerplant)*			
693.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
694.	7768	*Stylidium obtusatum (Pinafore Triggerplant)*			
695.	7773	*Stylidium petiolare (Horn Triggerplant)*			
696.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
697.	7782	*Stylidium pulchellum (Thumbelina Triggerplant)*			
698.	33106	*Stylidium recurvum*			
699.	7785	*Stylidium repens (Matted Triggerplant)*			
700.		*Stylidium roseo-alatum*			
701.	7790	*Stylidium roseoalatum (Pink-wing Triggerplant)*			
702.	7798	*Stylidium schoenoides (Cow Kicks)*			
703.		*Stylidium sp.*			
704.	45594	*Stylidium tenue subsp. majusculum (Showy Fountain Triggerplant)*			
705.	23511	*Stylidium thesioides (Delicate Triggerplant)*			
706.	7806	*Stylidium utricularioides (Pink Fan Triggerplant)*			
707.	6476	*Styphelia tenuiflora (Common Pinheath)*			
708.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
709.	2321	*Synaphea acutiloba (Granite Synaphea)*			
710.	2323	*Synaphea gracillima*			
711.	2324	*Synaphea petiolaris (Synaphea)*			
712.	16864	*Synaphea petiolaris subsp. petiolaris*			
713.	2325	*Synaphea pinnata (Helena Synaphea)*			
714.	30751	*Synaphea sp. Pinjarra Plain (A.S. George 17182)*		T	
715.	28354	*Synaphea sp. Serpentine (G.R. Brand 103)*		T	
716.	29186	*Synaphea sp. Udumung (A.S. George 17058)*			
717.	20024	*Tagetes erecta (Marigold)*	Y		
718.	20135	*Taxandria linearifolia*			
719.	4535	*Tetratheca hirsuta (Black Eyed Susan)*			
720.	48342	*Tetratheca hirsuta subsp. hirsuta*			
721.	48341	*Tetratheca hirsuta subsp. viminea*			
722.	4537	*Tetratheca nuda*			
723.	5080	*Thomasia foliosa*			
724.	19041	*Trachymene coerulea subsp. coerulea*			
725.	6280	*Trachymene pilosa (Native Parsnip)*			
726.	8251	*Trichocline spathulata (Native Gerbera)*			
727.	4289	*Trifolium angustifolium (Narrowleaf Clover)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
728.	4291	*Trifolium arvense (Hare's Foot Clover)*	Y		
729.	4292	*Trifolium campestre (Hop Clover)*	Y		
730.	17763	*Trifolium campestre var. campestre (Hop Clover)*	Y		
731.	4293	*Trifolium cernuum (Drooping Flower Clover)*	Y		
732.	4295	*Trifolium dubium (Suckling Clover)*	Y		
733.	17541	*Trifolium incarnatum var. incarnatum*	Y		
734.	4313	*Trifolium subterraneum (Subterranean Clover)*	Y		
735.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
736.	1139	*Trithuria bibracteata*			
737.	1141	*Trithuria submersa*			
738.	33418	*Trymalium odoratissimum subsp. odoratissimum*			
739.	8255	*Ursinia anthemoides (Ursinia)*	Y		
740.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
741.	7153	*Utricularia tenella*			
742.	7157	*Utricularia violacea (Violet Bladderwort)*			
743.	7665	*Velleia trinervis*			
744.	8257	*Vellereophyton dealbatum (White Cudweed)*	Y		
745.	7107	*Verbascum virgatum (Twiggy Mullein)*	Y		
746.	6070	*Verticordia acerosa*			
747.	15431	*Verticordia acerosa var. acerosa*			
748.	12388	*Verticordia acerosa var. preissii*			
749.	6076	*Verticordia densiflora (Compacted Featherflower)*			
750.	15432	*Verticordia densiflora var. densiflora*			
751.	6088	*Verticordia huegelii (Variegated Featherflower)*			
752.	15433	*Verticordia huegelii var. huegelii*			
753.	12430	*Verticordia huegelii var. stylosa*			
754.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
755.	6107	*Verticordia pennigera*			
756.	6110	*Verticordia plumosa (Plumed Featherflower)*			
757.	12449	*Verticordia plumosa var. brachyphylla*			
758.	15618	*Verticordia plumosa var. plumosa*			
759.	4320	*Vicia hirsuta (Hairy Vetch)*	Y		
760.	12070	*Vicia sativa subsp. sativa*	Y		
761.	4325	*Viminaria juncea (Swishbush, Koweda)*			
762.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
763.	7386	*Wahlenbergia gracilenta (Annual Bluebell)*			
764.	7389	*Wahlenbergia preissii*			
765.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
766.		*Xanthosia ?huegelii*			Y
767.	6284	*Xanthosia candida*			
768.	6285	*Xanthosia ciliata*			
769.	6289	*Xanthosia huegelii*			
770.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
Fish					
771.	34028	*Galaxias occidentalis (Western Minnow)*			
772.		*Nannoperca vittata*			
Fungus					
773.		*Aleurina ferruginea*			
774.	18195	*Amanita carneiphylla*		P3	
775.	43543	*Amanita fibrillopes*		P3	
776.	46334	*Amanita kalamundae (Kalamunda Lepidella)*		P3	
777.	38755	*Amanita ochroterrea*			
778.	43542	*Amanita wadjukiorum*		P3	
779.		*Boletellus obscurecoccineus*			
780.		*Boletus sp.*			
781.	38767	*Campanella gregaria*			
782.	38771	*Coltriciella dependens*			
783.		*Cortinarius australiensis*			
784.	38776	*Cortinarius phalarus*			
785.	38781	*Dacryopinax spathularia*			
786.	38785	*Descomyces angustisporus*			
787.		*Gymnopilus allantopus*			
788.	44926	*Ileodictyon gracile*			
789.	48508	*Inocybe brunneidisca*			
790.	40870	*Inocybe rufuloides*	Y		
791.		*Laccaria lateritia*			
792.	31280	*Lichenomphalia chromacea*			
793.	31333	*Lichenomphalia umbellifera*			
794.	38816	*Omphalotus nidiformis*			

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795.		*Phlebia subceracea*			
796.		*Pholiota communis*			
797.		*Phytophthora cinnamomi*			
798.	38824	*Pleurotus australis*			
799.	38825	*Pluteus pauperculus*			
800.		*Ramaria lorithamnus*			
801.		*Rickenella fibula*			
802.	38845	*Trechispora farinacea*			
Gymnosperm					
803.	36600	*Callitris pyramidalis (Swamp Cypress)*			
804.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
Hepatic (Liverwort)					
805.		*Asterella drummondii*			
806.		*Chiloscyphus semiteres var. semiteres*			
807.		*Lethocolea pansa*			
Invertebrate					
808.		*Acariformes sp.*			
809.		*Aeshnidae sp.*			
810.		*Ambicodamus marae*			
811.		*Amblyomma triguttatum*			
812.		*Aname mainae*			
813.		*Aname tepperi*			
814.		*Ancylidae sp.*			
815.		*Araneus cyphoxis*			
816.		*Araneus senicaudatus*			
817.		*Asadipus kunderang*			
818.		*Austracantha minax*			
819.		*Backobourkia brounii*			
820.		*Backobourkia heroine*			
821.		*Baetidae sp.*			
822.		*Ballarra longipalpus*			
823.		*Caenidae sp.*			
824.		*Ceratopogonidae sp.*			
825.		*Cercophonius sulcatus*			
826.		*Cethegus fugax*			
827.	33939	*Cherax cainii (Marron)*			
828.		*Cherax destructor*			
829.		*Cherax quinquecarinatus*			
830.		*Chironominae sp.*			
831.		*Corixidae sp.*			
832.		*Cormocephalus aurantiipes*			
833.		*Cormocephalus hartmeyeri*			
834.		*Crustulina bicruciata*			
835.		*Cyclosa trilobata*			
836.		*Demadiana cerula*			
837.		*Dingosa serrata*			
838.		*Dolichopodidae sp.*			
839.		*Dytiscidae sp.*			
840.		*Eriophora biapicata*			
841.		*Eucyrtops latior*			
842.	48579	*Euoplos inornatus (inornate trapdoor spider (northern Jarrah Forest))*		P3	
843.		*Gomphidae sp.*			
844.		*Gripopterygidae sp.*			
845.		*Gyrinidae sp.*			
846.		*Holconia westralia*			
847.		*Hydrobiosidae sp.*			
848.		*Hydrophilidae sp.*			
849.		*Hydropsychidae sp.*			
850.		*Hydroptilidae sp.*			
851.	48935	*Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)*		P3	
852.		*Isopeda leishmanni*			
853.		*Karaops ellenae*			
854.		*Lamponella ainslie*			
855.		*Lamponusa gleneagle*			
856.		*Leptoceridae sp.*			
857.		*Leptophlebiidae sp.*			
858.		*Libellulidae sp.*			
859.		*Megapodagrionidae sp.*			
860.		*Missulena granulosa*			

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861.		*Nephila edulis*			
862.		*Notonectidae sp.*			
863.		*Oligochaeta sp.*			
864.		*Orthocladiinae sp.*			
865.		*Oxyopes rubicundus*			
866.		*Ozarchaea westraliensis*			
867.		*Paralampona marangaroo*			
868.		*Parastacidae sp.*			
869.		*Pediana occidentalis*			
870.		*Penemideopsis pusilla*			Y
871.		*Pinkfloydia harveii*			
872.		*Raveniella cirrata*			
873.		*Raveniella peckorum*			
874.		*Richardsonianidae sp.*			
875.		*Scolopendra laeta*			
876.		*Simuliidae sp.*			
877.		*Supunna funerea*			
878.		*Supunna picta*			
879.		*Synothele durokoppin*			
880.		*Synothele michaelseni*			
881.		*Tabanidae sp.*			
882.		*Tanypodinae sp.*			
883.		*Tasmanicosa leuckartii*			
884.		*Tipulidae sp.*			
885.		*Urodacus novaehollandiae*			
886.		*Urodacus woodwardii*			
887.		*Veliidae sp.*			
888.		*Venator immansueta*			
889.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Lichen					
890.	48177	*Cladia muelleri*			
891.	28208	*Cladonia cervicornis subsp. verticillata*			
892.	27748	*Flavoparmelia rutidota*			
893.	27892	*Pannoparmelia wilsonii*			
894.	27947	*Pertusaria gibberosa*			
895.	28224	*Ramalina inflata subsp. australis*			
896.	28227	*Usnea scabrida subsp. scabrida*			
Mammal					
897.	25449	*Antechinus flavipes (Yellow-footed Antechinus)*			
898.	24088	*Antechinus flavipes subsp. leucogaster (Yellow-footed Antechinus, Mardo)*			
899.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
900.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
901.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
902.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
903.	24041	*Felis catus (Cat)*	Y		
904.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
905.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
906.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
907.	24223	*Mus musculus (House Mouse)*	Y		
908.	24042	*Mustela putorius (European Polecat, Ferret)*	Y		
909.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
910.	48024	*Notamacropus eugenii subsp. derbianus (Tammar Wallaby, Tammar)*		P4	
911.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
912.	24195	*Nyctophilus gouldi (Gould's Long-eared Bat)*			
913.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
914.	24155	*Perameles eremiana (Desert Bandicoot, walilya)*		X	
915.	24165	*Petropseudes dahli (Rock Ringtail Possum, Wogoit)*		P3	
916.	25508	*Phascogale tapoatafa (Brush-tailed Phascogale)*		S	
917.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	
918.	24164	*Potorous platyops (Broad-faced Potoroo)*		X	
919.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum, ngwayir)*		T	
920.	24245	*Rattus rattus (Black Rat)*	Y		
921.	24145	*Setonix brachyurus (Quokka)*		T	
922.	24108	*Sminthopsis crassicaudata (Fat-tailed Dunnart)*			
923.	24111	*Sminthopsis gilberti (Gilbert's Dunnart)*			
924.	24259	*Sus scrofa (Pig)*	Y		
925.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
926.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			

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927.	24157	*Trichosurus vulpecula subsp. arnhemensis (northern brushtail possum (Kimberley))*		T	
928.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
929.	24040	*Vulpes vulpes (Red Fox)*	Y		

Monocotyledon

930.		*?Hypolaena exsulca*			Y
931.	23474	*Agrostocrinum hirsutum*			
932.	1261	*Agrostocrinum scabrum (Blue Grass Lily)*			
933.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
934.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
935.	187	*Aira praecox (Early Hairgrass)*	Y		
936.	13380	*Amphibromus nervosus*			
937.	197	*Amphipogon debilis*			
938.	198	*Amphipogon laguroides*			
939.	199	*Amphipogon strictus (Greybeard Grass)*			
940.	200	*Amphipogon turbinatus*			
941.	1058	*Anarthria gracilis*			
942.	1059	*Anarthria humilis*			
943.	1060	*Anarthria laevis*			
944.	1409	*Anigozanthos humilis (Catspaw)*			
945.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
946.	11261	*Anigozanthos manglesii subsp. manglesii*			
947.	29487	*Anigozanthos manglesii var. x angustifolius*			
948.	1416	*Anigozanthos viridis (Green Kangaroo Paw, Kurulbardang)*			
949.	11566	*Anigozanthos viridis subsp. viridis*			
950.	202	*Anthoxanthum odoratum (Sweet Vernal Grass)*	Y		
951.	1117	*Aphelia cyperoides*			
952.	1119	*Aphelia nutans*			
953.	17845	*Apodasmia ceramophila*			
954.	207	*Aristida contorta (Bunched Kerosene Grass)*			
955.	210	*Aristida holathera*			
956.		*Aristida sp.*			
957.	1264	*Arnocrinum preissii*			
958.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
959.	17233	*Austrostipa campylachne*			
960.	17234	*Austrostipa compressa*			
961.	17237	*Austrostipa elegantissima*			
962.	17253	*Austrostipa semibarbata*			
963.		*Austrostipa semibarbata/campylachne*			Y
964.	17257	*Austrostipa variabilis*			
965.	231	*Avellinia michelii*	Y		
966.	233	*Avena barbata (Bearded Oat)*	Y		
967.	235	*Avena sativa (Common Oat)*	Y		
968.	18279	*Babiana angustifolia*	Y		
969.	18280	*Babiana nana*	Y		
970.	739	*Baumea acuta (Pale Twig-rush)*			
971.	740	*Baumea arthrophylla*			
972.	743	*Baumea juncea (Bare Twigrush)*			
973.	748	*Baumea vaginalis (Sheath Twigrush)*			
974.	1272	*Borya scirpoidea*			
975.	1273	*Borya sphaerocephala (Pincushions)*			
976.	8661	*Brachypodium distachyon (False Brome)*	Y		
977.	244	*Briza maxima (Blowfly Grass)*	Y		
978.	245	*Briza minor (Shivery Grass)*	Y		
979.	249	*Bromus diandrus (Great Brome)*	Y		
980.	1366	*Bulbine semibarbata (Leek Lily)*			
981.	1383	*Burchardia bairdiae*			
982.	12770	*Burchardia congesta*			
983.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
984.	1276	*Caesia micrantha (Pale Grass Lily)*			
985.	1277	*Caesia occidentalis*			
986.		*Caesia sp.*			
987.	1586	*Caladenia discoidea (Dancing Orchid)*			
988.	1592	*Caladenia flava (Cowslip Orchid)*			
989.	15348	*Caladenia flava subsp. flava*			
990.	1602	*Caladenia longicauda (Common White Spider Orchid)*			
991.	15365	*Caladenia longicauda subsp. longicauda*			
992.	1605	*Caladenia marginata (White Fairy Orchid)*			
993.	1613	*Caladenia reptans (Little Pink Fairy Orchid)*			
994.	15379	*Caladenia serotina*			
995.	1213	*Calectasia cyanea (Blue Tinsel Lily)*			

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				T	
996.	1214	*Calectasia grandiflora (Blue Tinsel Lily)*			
997.	19309	*Calectasia narragara*			
998.	43241	*Carex thecata*			
999.	1162	*Cartonema philydroides*			
1000.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
1001.	1123	*Centrolepis caespitosa*			
1002.	13122	*Centrolepis cephaloformis subsp. cephaloformis*			
1003.	1125	*Centrolepis drummondiana*			
1004.	1130	*Centrolepis humillima (Dwarf Centrolepis)*			
1005.	1131	*Centrolepis inconspicua*			
1006.	1132	*Centrolepis mutica*			
1007.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
1008.	17685	*Chaetanthus aristatus*			
1009.	1280	*Chamaescilla corymbosa (Blue Squill)*			
1010.	11299	*Chamaescilla corymbosa var. corymbosa*			
1011.	8788	*Chamaescilla versicolor*			
1012.	267	*Chloris gayana (Rhodes Grass)*	Y		
1013.	17706	*Chordifex sinuosus*			
1014.	763	*Chorizandra enodis (Black Bristlerush)*			
1015.	1418	*Conostylis aculeata (Prickly Conostylis)*			
1016.	11826	*Conostylis aculeata subsp. aculeata*			
1017.	12109	*Conostylis aculeata subsp. preissii*			
1018.	1420	*Conostylis androstemma (Trumpets)*			
1019.	1423	*Conostylis aurea (Golden Conostylis)*			
1020.	1429	*Conostylis caricina*			
1021.	1436	*Conostylis juncea*			
1022.	1454	*Conostylis setigera (Bristly Cottonhead)*			
1023.	11597	*Conostylis setigera subsp. setigera*			
1024.	1455	*Conostylis setosa (White Cottonhead)*			
1025.	1285	*Corynotheca micrantha (Sand Lily)*			
1026.	768	*Cyathochaeta avenacea*			
1027.	40661	*Cycnogeton lineare*			
1028.	283	*Cynodon dactylon (Couch)*	Y		
1029.	815	*Cyperus tenellus (Tiny Flatsedge)*	Y		
1030.	10964	*Cyrtostylis robusta*			
1031.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
1032.	1220	*Dasypogon obliquifolius*			
1033.	17663	*Desmocladus asper*			
1034.	17691	*Desmocladus fasciculatus*			
1035.	16595	*Desmocladus flexuosus*			
1036.	46362	*Desmocladus lateriflorus*			
1037.	1259	*Dianella revoluta (Blueberry Lily)*			
1038.	11636	*Dianella revoluta var. divaricata*			
1039.	306	*Dichelachne crinita (Longhair Plumegrass)*			
1040.	1287	*Dichopogon capillipes*			
1041.	17838	*Dielsia stenostachya*			
1042.	1509	*Dioscorea hastifolia (Warrine, Wararn)*			
1043.	19649	*Disa bracteata*	Y		
1044.	12943	*Diuris brumalis*			
1045.	10791	*Diuris carinata (Bee Orchid)*			
1046.	11049	*Diuris corymbosa*			
1047.	1632	*Diuris emarginata (Tall Donkey Orchid)*			
1048.	1634	*Diuris laxiflora (Bee Orchid)*			
1049.	1635	*Diuris longifolia (Common Donkey Orchid)*			
1050.	12939	*Diuris magnifica*			
1051.	46859	*Diuris ostrina*			
1052.	1637	*Diuris purdiei (Purdie's Donkey Orchid)*		T	
1053.	1638	*Diuris setacea (Bristly Donkey Orchid)*			
1054.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
1055.	1640	*Drakaea glyptodon (King-in-his-carriage)*			
1056.	11156	*Drakaea livida*			
1057.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
1058.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
1059.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
1060.	1644	*Elythranthera emarginata (Pink Enamel Orchid)*			
1061.	376	*Eragrostis curvula (African Lovegrass)*	Y		
1062.	379	*Eragrostis elongata (Clustered Lovegrass)*			
1063.	1646	*Eriochilus dilatatus (White Bunny Orchid)*			
1064.	15413	*Eriochilus dilatatus subsp. undulatus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1065.	835	*Evandra pauciflora*			
1066.	18392	*Freesia alba x leichtlinii*	Y		
1067.	899	*Gahnia ancistrophylla (Hooked-leaf Saw Sedge)*			
1068.	900	*Gahnia aristata*			
1069.	434	*Gastridium phleoides (Nitgrass)*	Y		
1070.	1518	*Gladiolus angustus (Long Tubed Painted Lady)*	Y		
1071.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
1072.	1464	*Haemodorum brevisepalum*			
1073.	1465	*Haemodorum discolor*			
1074.	1468	*Haemodorum laxum*			
1075.	1472	*Haemodorum simplex*			
1076.	1474	*Haemodorum sparsiflorum*			
1077.	1475	*Haemodorum spicatum (Mardja)*			
1078.	438	*Hainardia cylindrica (Common Barbgrass)*	Y		
1079.	1293	*Hensmania turbinata*			
1080.	445	*Holcus setiger (Annual Fog)*	Y		
1081.	449	*Hordeum leporinum (Barley Grass)*	Y		
1082.	450	*Hordeum marinum*	Y		
1083.	1070	*Hypolaena exsulca*			
1084.	1071	*Hypolaena fastigiata*			
1085.	910	*Isolepis cernua (Nodding Club-rush)*			
1086.	20200	*Isolepis cernua var. setiformis*			
1087.	912	*Isolepis cyperoides*			
1088.	14540	*Isolepis hystrix*	Y		
1089.	917	*Isolepis marginata (Coarse Club-rush)*			
1090.	919	*Isolepis oldfieldiana*			
1091.	924	*Isolepis stellata (Star Club-rush)*			
1092.	1534	*Ixia polystachya (Variable Ixia)*	Y		
1093.	1298	*Johnsonia pubescens (Pipe Lily)*			
1094.	19272	*Johnsonia pubescens subsp. cygnorum*		P2	
1095.	19632	*Johnsonia pubescens subsp. pubescens*			
1096.	1178	*Juncus bufonius (Toad Rush)*	Y		
1097.	1180	*Juncus capitatus (Capitate Rush)*	Y		
1098.	1184	*Juncus holoschoenus (Jointleaf Rush)*			
1099.	1186	*Juncus microcephalus*	Y		
1100.	1188	*Juncus pallidus (Pale Rush)*			
1101.	1195	*Juncus subsecundus (Finger Rush)*			
1102.	1221	*Kingia australis (Kingia, Pulonok)*			
1103.	13562	*Lachenalia aloides*	Y		
1104.	20019	*Lachnagrostis filiformis*			
1105.	19955	*Lachnagrostis plebeia*			
1106.	1307	*Laxmannia ramosa (Branching Lily)*			
1107.	11911	*Laxmannia ramosa subsp. ramosa*			
1108.	11464	*Laxmannia sessiliflora subsp. australis*			
1109.	1309	*Laxmannia squarrosa*			
1110.	1075	*Lepidobolus preissianus*			
1111.	18074	*Lepidobolus preissianus subsp. preissianus*			
1112.		*Lepidosperma aff. coastale (#134)*			Y
1113.		*Lepidosperma aff. pubisquameum (#166)*			
1114.		*Lepidosperma aff. resinosum*			
1115.	925	*Lepidosperma angustatum*			
1116.	42741	*Lepidosperma apricola*			
1117.	41620	*Lepidosperma asperatum*			
1118.	929	*Lepidosperma carphoides (Black Rapier Sedge)*			
1119.	930	*Lepidosperma costale*			
1120.		*Lepidosperma eastern terete scps (BJK&NG 232)*			
1121.	936	*Lepidosperma leptostachyum*			
1122.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
1123.	940	*Lepidosperma pubisquameum*			
1124.		*Lepidosperma pubisquameum "flat form"*			
1125.	941	*Lepidosperma resinosum*			
1126.	942	*Lepidosperma rostratum*		T	
1127.	944	*Lepidosperma scabrum*			
1128.		*Lepidosperma sp.*			
1129.	29141	*Lepidosperma sp. Gosnells (A. Markey 1145)*			
1130.	29150	*Lepidosperma sp. Margaret River (B.J. Lepschi 1841)*			
1131.		*Lepidosperma sp. Mud3*			Y
1132.	945	*Lepidosperma squamatum*			
1133.	948	*Lepidosperma tetraquetrum*			
1134.	1653	*Leporella fimbriata (Hare Orchid)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1135.	1077	*Leptocarpus canus (Hoary Twine-rush)*			
1136.	1078	*Leptocarpus coangustatus*			
1137.	46375	*Leptocarpus decipiens*			
1138.	46380	*Leptocarpus kraussii*			
1139.	46382	*Leptocarpus roycei*			
1140.	1085	*Lepyrodia glauca*			
1141.	1088	*Lepyrodia macra (Large Scale Rush)*			
1142.	1090	*Lepyrodia muirii*			
1143.	476	*Lolium perenne (Perennial Ryegrass)*	Y		
1144.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
1145.		*Lolium sp.*			
1146.		*Lomandra ?caespitosa*			
1147.	1222	*Lomandra brittanii*			
1148.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
1149.	1228	*Lomandra hermaphrodita*			
1150.	1229	*Lomandra integra*			
1151.	1232	*Lomandra micrantha (Small-flower Mat-rush)*			
1152.	1234	*Lomandra nigricans*			
1153.	1236	*Lomandra odora (Tiered Matrush)*			
1154.	1239	*Lomandra preissii*			
1155.	1240	*Lomandra purpurea (Purple Mat Rush)*			
1156.	1243	*Lomandra sericea (Silky Mat Rush)*			
1157.		*Lomandra sp.*			
1158.	1245	*Lomandra spartea*			
1159.	1246	*Lomandra suaveolens*			
1160.	1092	*Loxocarya cinerea*			
1161.	1198	*Luzula meridionalis (Field Woodrush)*			
1162.	1097	*Lyginia barbata*			
1163.		*Lyginia barbata/imberbis*			
1164.	18049	*Lyginia imberbis*			
1165.	14985	*Melinis repens*	Y		
1166.	955	*Mesomelaena pseudostygia*			
1167.	956	*Mesomelaena stygia*			
1168.	11473	*Mesomelaena stygia subsp. stygia*			
1169.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
1170.	485	*Microlaena stipoides (Weeping Grass)*			
1171.	1658	*Microtis atrata (Swamp Mignonette Orchid)*			
1172.	10954	*Microtis media (Tall Mignonette Orchid)*			
1173.	15419	*Microtis media subsp. media*			
1174.	19179	*Moraea flaccida (One-leaf Cape Tulip)*	Y		
1175.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
1176.	1542	*Patersonia babianoides*			
1177.	1546	*Patersonia juncea (Rush Leaved Patersonia)*			
1178.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
1179.	30476	*Patersonia occidentalis var. latifolia*			
1180.	30472	*Patersonia occidentalis var. occidentalis*			
1181.	1551	*Patersonia pygmaea (Pygmy Patersonia)*			
1182.	43760	*Pauridia occidentalis*			
1183.	40424	*Pentameris airoides subsp. airoides*	Y		
1184.	547	*Phalaris angusta*	Y		
1185.	552	*Phalaris paradoxa (Paradoxa Grass)*	Y		
1186.	1172	*Philydrella drummondii*			
1187.	1173	*Philydrella pygmaea (Butterfly Flowers)*			
1188.	14306	*Philydrella pygmaea subsp. pygmaea*			
1189.	1478	*Phlebocarya ciliata*			
1190.	1479	*Phlebocarya filifolia*			
1191.	554	*Phleum pratense (Timothy)*	Y		
1192.	571	*Poa annua (Winter Grass)*	Y		
1193.	573	*Poa drummondiana (Knotted Poa)*			
1194.	577	*Poa poiformis (Coastal Poa)*			
1195.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
1196.	583	*Polypogon tenellus*			
1197.	110	*Potamogeton drummondii*			
1198.	111	*Potamogeton ochreatus (Blunt Pondweed)*			
1199.	1669	*Prasophyllum cyphochilum (Pouched Leek Orchid)*			
1200.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
1201.	1672	*Prasophyllum fimbria (Fringed Leek Orchid)*			
1202.	1676	*Prasophyllum hians (Yawning Leek Orchid)*			
1203.	1680	*Prasophyllum parvifolium (Autumn Leek Orchid)*			
1204.		*Pterostylis aff. nana*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1205.	48675	*Pterostylis atrosanguinea*			
1206.	10875	*Pterostylis concava*			
1207.	1693	*Pterostylis recurva (Jug Orchid)*			
1208.	12217	*Pterostylis sanguinea*			
1209.	18655	*Pterostylis sp. crinkled leaf (G.J. Keighery 13426)*			
1210.	1698	*Pterostylis vittata (Banded Greenhood)*			
1211.	1556	*Romulea rosea (Guildford Grass)*	Y		
1212.	11544	*Romulea rosea var. australis (Guildford Grass)*	Y		
1213.	40431	*Rytidosperma acerosum*			
1214.	40425	*Rytidosperma caespitosum*			
1215.	40426	*Rytidosperma occidentale*			
1216.	40430	*Rytidosperma pilosum*			
1217.	40427	*Rytidosperma setaceum*			
1218.		*Schoenus aff. brevisetis (Mud2, #135)*			
1219.	975	*Schoenus bifidus*			
1220.	978	*Schoenus brevisetis*			
1221.	979	*Schoenus caespititius*			
1222.	980	*Schoenus capillifolius*		P3	
1223.	982	*Schoenus clandestinus*			
1224.	984	*Schoenus curvifolius*			
1225.	986	*Schoenus efoliatus*			
1226.	991	*Schoenus grammatophyllus*			
1227.	1002	*Schoenus nanus (Tiny Bog Rush)*			
1228.	1006	*Schoenus odontocarpus*			
1229.	1007	*Schoenus pedicellatus*			
1230.	1008	*Schoenus pennisetis*		P3	
1231.	17614	*Schoenus plumosus*			
1232.	1011	*Schoenus rigens*			
1233.	1013	*Schoenus sculptus (Gimlet Bog-rush)*			
1234.	17731	*Schoenus sp. Waroona (G.J. Keighery 12235)*		P3	
1235.		*Schoenus sp. aff. breviculmis sthcst*			Y
1236.	1016	*Schoenus subbarbatus (Bearded Bog-rush)*			
1237.	1017	*Schoenus subbulbosus*			
1238.	1019	*Schoenus subflavus (Yellow Bog-rush)*			
1239.	1020	*Schoenus sublateralis*			
1240.	1023	*Schoenus tenellus*			
1241.	1026	*Schoenus unispiculatus*			
1242.	613	*Setaria verticillata (Whorled Pigeon Grass)*	Y		
1243.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
1244.	1558	*Sparaxis bulbifera*	Y		
1245.	1260	*Stypandra glauca (Blind Grass)*			
1246.	1033	*Tetraria australiensis*		T	
1247.	1034	*Tetraria capillaris (Hair Sedge)*			
1248.	1036	*Tetraria octandra*			
1249.	667	*Tetrarrhena laevis (Forest Ricegrass)*			
1250.		*Thelymitra aff. pauciflora*			
1251.	1701	*Thelymitra antennifera (Vanilla Orchid)*			
1252.	1702	*Thelymitra campanulata (Shirt Orchid)*			
1253.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
1254.	1707	*Thelymitra flexuosa (Twisted Sun Orchid)*			
1255.	11053	*Thelymitra macrophylla*			
1256.	673	*Themeda triandra*			
1257.	1318	*Thysanotus arbuscula*			
1258.	1319	*Thysanotus arenarius*			
1259.	1328	*Thysanotus dichotomus (Branching Fringe Lily)*			
1260.	1330	*Thysanotus fastigiatus*			
1261.	1338	*Thysanotus manglesianus (Fringed Lily)*			
1262.		*Thysanotus manglesianus/patersonii complex*			
1263.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
1264.	1343	*Thysanotus patersonii*			
1265.	46055	*Thysanotus sp. Coastal plain (N.H. Brittan 66/63)*			
1266.	1351	*Thysanotus sparteus*			
1267.	1354	*Thysanotus tenellus*			
1268.	1357	*Thysanotus thyrsoideus*			
1269.	1358	*Thysanotus triandrus*			
1270.	1481	*Tribonanthes australis (Southern Tiurndin)*			
1271.	1482	*Tribonanthes brachypetala (Nodding Tiurndin)*			
1272.	1483	*Tribonanthes longipetala (Branching Tiurndin)*			
1273.	1485	*Tribonanthes violacea (Violet Tiurndin)*			
1274.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1275.	1362	*Tricoryne humilis*			
1276.	1363	*Tricoryne tenella*			
1277.	1038	*Tricostularia neesii*			
1278.	18587	*Triglochin nana*			
1279.	1561	*Tritonia crocata*	Y		
1280.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		
1281.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
1282.	33101	*Vulpia myuros forma myuros*	Y		
1283.	17910	*Washingtonia filifera*	Y		
1284.	13103	*Watsonia borbonica*	Y		
1285.	1566	*Watsonia marginata*	Y		
1286.	1567	*Watsonia meriana (Bulbil Watsonia)*	Y		
1287.	18108	*Watsonia meriana var. bulbillifera*	Y		
1288.	18118	*Watsonia meriana var. meriana*	Y		
1289.		*Watsonia sp. Mud09*			Y
1290.	12072	*Wurmbea dioica subsp. alba*			
1291.	1253	*Xanthorrhoea gracilis (Graceful Grass Tree, Mimidi)*			
1292.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
1293.		*Xanthorrhoea sp.*			
1294.	15819	*Xyris atrovirida*			
1295.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		

Pteridophyte (Fern)

1296.	25	*Adiantum aethiopicum (Common Maidenhair)*			
1297.	31	*Cheilanthes austrotenuifolia*			
1298.	12818	*Cheilanthes sieberi subsp. sieberi*			
1299.	11	*Isoetes drummondii (Quillwort)*			
1300.	4	*Phylloglossum drummondii (Pigmy Clubmoss)*			
1301.	78	*Pilularia novae-hollandiae (Austral Pillwort)*			
1302.	6	*Selaginella gracillima (Tiny Clubmoss)*			

Reptile

1303.	25242	*Acanthophis antarcticus (Southern Death Adder)*		P3	
1304.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
1305.	24990	*Aprasia pulchella (Granite Worm-lizard)*			
1306.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
1307.	30893	*Cryptoblepharus buchananii*			
1308.	24883	*Ctenophorus ornatus (Ornate Crevice-Dragon)*			
1309.	25035	*Ctenotus delli (Dell's skink, Darling Range southwest Ctenotus)*		P4	
1310.	25039	*Ctenotus fallens*			
1311.	25047	*Ctenotus impar*			
1312.	25049	*Ctenotus labillardieri*			
1313.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
1314.	24939	*Diplodactylus polyophthalmus*			
1315.	25096	*Egernia kingii (King's Skink)*			
1316.	25100	*Egernia napoleonis*			
1317.	24959	*Gehyra variegata*			
1318.	25115	*Hemiergis initialis subsp. initialis*			
1319.	25119	*Hemiergis quadrilineata*			
1320.	25131	*Lerista distinguenda*			
1321.	25133	*Lerista elegans*			
1322.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
1323.	25005	*Lialis burtonis*			
1324.	25184	*Menetia greyii*			
1325.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
1326.	25191	*Morethia lineoocellata*			
1327.	25192	*Morethia obscura*			
1328.	25252	*Notechis scutatus (Tiger Snake)*			
1329.	25253	*Parasuta gouldii*			
1330.	25255	*Parasuta nigriceps*			
1331.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
1332.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
1333.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
1334.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
1335.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
1336.	25519	*Tiliqua rugosa*			
1337.	24983	*Underwoodisaurus milii (Barking Gecko)*			
1338.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
1339.	25526	*Varanus tristis (Racehorse Monitor)*			

Slime Mould

1340.	39038	*Leocarpus fragilis*			

NatureMap
Mapping Western Australia's biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1341.	39103	*Tubifera ferruginosa*			

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 wholely 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 B
Fauna Likelihood Assessment

Conservation Significant Fauna Species Likelihood Assessment

Species	State Status	EPBC Act Status	Likelihood	Likelihood justification*
BIRD				
Apus pacificus (Fork-tailed Swift)	IA	MI	Unlikely	This species is almost exclusively aerial.
Calidris ruficollis (Red-necked Stint)	MI	MI	Unlikely	The Red-necked Stint requires coastal habitat that is not present within or near the site.
Calyptorhynchus banksii subsp. *naso* (Forest Red-tailed Black Cockatoo)	VU	VU	Likely	Identified on site by Environmental Scientist in 2016. Suitable habitat present (Eucalyptus trees), in species known distribution.
Calyptorhynchus baudinii (Baudin's Cockatoo)	EN	EN	Likely	Found within a 2 km NatureMap Search. Suitable habitat present (Eucalyptus trees) and in species known distribution.
Calyptorhynchus latirostris (Carnaby's Cockatoo)	EN	EN	Likely	Found within a 2 km NatureMap Search. Suitable habitat present (Eucalyptus trees) and in species known distribution.
Hydroprogne caspia (Caspian Tern)	MI	MI	Unlikely	The Caspian Tern requires coastal habitat that is not present within or near the site.
Leipoa ocellata (Malleefowl)	VU	VU	Unlikely	Not found within the 2km NatureMap search. The Malleefowl favours dense undergrowth that is not present within the site.
Motacilla cinerea (Grey Wagtail)	IA	MI	Unlikely	The species is a rare visitor to northern Australia. Not found in 10 km NatureMap searches.
MAMMAL				
Bettongia penicillata subsp. ogilbyi (Woylie)	EN	-	Unlikely	The Woylie requires dense understorey habitat that is not present within the site.
Dasyurus geoffroii (Chuditch)	VU	VU	Unlikely	The Chuditch favours dense undergrowth that is not present within the site.

Species	State Status	EPBC Act Status	Likelihood	Likelihood justification*
Isoodon fusciventer (Quenda)	P4	-	Possible	The southern portion of the site contains sandy soils that may offer suitable habitat for the Quenda. However, the majority of the site consists of gravelly and laterite soils not suitable for the Quenda. The site also lacks a forest or woodland.
Setonix brachyurus (Quokka)	VU	VU	Unlikely	The Quokka favours dense riparian vegetation that is not present within the site.
Pseudocheirus occidentalis (Western Ringtail Possum)	CR	CR	Unlikely	The site is outside of the species known distribution.
INVERTEBRATE				
Westralunio carteri (Carter's Freshwater Mussel)	VU	VU	Unlikely	The Carter's Freshwater Mussel inhabits freshwater preferring slower flowing waters. No suitable habitat exists within the site.
REPTILE				
Acanthophis antarcticus (Southern death adder)	P3	-	Unlikely	Vegetation is almost completely degraded at the site and is unlikely to provide the habitat of deep leaf litter the Southern Death Adder prefers.

Note. EPBC Act= Environment Protection and Wildlife Conservation Act 1986

* Likelihood justification sourced from DAWE (2016b) Species Profile and Threats Database (SPRAT) and the Atlas of Living Australia (2022) for Priority species.

Appendix C
Flora and Vegetation Survey

360 environmental

Lot 30 Soldiers Road, Cardup

Level 2 Flora and Vegetation Survey

Prepared for:
HomeGroup WA

December 2016

people • planet • professional

Document Reference	Revision	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
1725 AB	A INTERNAL DRAFT	AD/NW	MR	1 Electronic (email)	01/12/16
1725 AB	B CLIENT DRAFT	AD/NW	-	1 Electronic (email)	00/00/16
1725 AB	C CLIENT FINAL	-	-	1 Electronic (CD)	00/00/16

Executive Summary

HomeGroup WA commissioned 360 Environmental Pty Ltd (360 Environmental) to undertake a Level 2 flora and vegetation survey of Lot 30 Soldiers Road, Cardup, Western Australia (the Survey Area). The purpose of the survey was to provide supporting documentation for the future development of the Survey Area.

A total of 30 taxa (including species, subspecies, varieties and forms) from 27 genera and 11 families were recorded from relevés and opportunistic collections in the Survey Area. The most commonly occurring families were Poaceae (7 taxa), Asteraceae (6 taxa) and Myrtaceae (6 taxa).

No Threatened species pursuant to the *Environment Protection and Biodiversity Act* 1999 (EPBC Act) and/or gazetted as Declared Rare Flora (DRF) pursuant to the *Wildlife Conservation Act* 1950 (WC Act) were recorded during the survey. No Priority species were recorded during the survey.

The Department of Parks and Wildlife (DPaW) Geomorphic Wetlands Dataset identifies one Conservation Category Wetland (CCW) buffer occurring within the Survey Area. Two CCWs (UFI 15462 and UFI 15463) exist within the Railway Reserve immediately east of the site.

Bush Forever exists directly to the east and north-east of the site. Cardup Nature Reserve, which is Department of Parks and Wildlife (DPaW) managed land, exists approximately 1.25 km north of the site. Two Perth Regional Ecological Linkages extend along the eastern portion of the site.

The review of the DPaW database, NatureMap and Environment Protection and Biodiversity Conservation Protected Matters Search Tool (PMST) searches identified 23 conservation significant flora as potentially occurring in the Survey Area. All of which are considered unlikely to occur within the Survey Area.

A search of the DPaW database and the EPBC PMST for Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) identified 7 TECs, three (3) of which are listed under the EPBC Act and two PECs as occurring within five kilometers of the Survey Area. None of these are thought to occur in the Survey Area.

A total of nine (9) vegetation units were mapped in the Survey Area, and the majority of the Survey Area was assessed as being Completely Degraded, with a small portion being assessed as Degraded to Completely Degraded. Historical vegetation clearing, weeds and grazing by livestock within the survey area were the most frequent impacts observed on native vegetation.

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1 Introduction

1.1 The Project

HomeGroup WA commissioned 360 Environmental Pty Ltd (360 Environmental) to conduct a Level 2 flora and vegetation survey at Lot 30 Soldiers Road, Cardup, Western Australia (Survey Area). The Survey Area is approximately 56.59 ha in size and is located approximately 50 kilometres south of Perth's CBD, within the Swan Coastal Plain (SCP) biogeographic region of Western Australia (WA). The purpose of the survey was to provide supporting documentation for the future development of the Survey Area.

1.1.1 Objectives

The objectives of the Level 2 flora and vegetation survey were to:

- Conduct a desktop assessment of relevant literature, databases and spatial datasets to determine the environmental values and any potential issues, such as conservation significant species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), that may be present in the Survey Area and surrounds;
- Recording the presence of Declared Rare, Priority Flora and Significant Flora including the locations and size of populations;
- Identify introduced flora species and discuss their significance, including mapping Declared weed species;
- Compile a comprehensive vascular flora inventory of the Survey Area;
- Document, describe and map the vegetation associations present in the Survey Area;
- Identify, accurately map and discuss the significance of any TECs, PECs and any other areas of ecological importance (e.g. National Parks, wetlands and Environmentally Sensitive Areas [ESAs]); and
- Map vegetation condition consistent with the Keighery (1994) condition scale.

Legend

- Study Area (56.59 ha)
- Cadastre

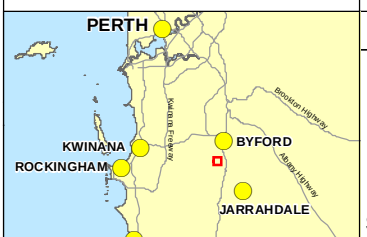
- CADASTRE SOURCED FROM LANDGATE 2016
- STUDY AREA SOURCED HOME GROUP WA 2016
- AERIAL PHOTOGRAPHY SOURCED LANDSAT7
(© Western Australian Land Information Authority 2015)

Powered by SLIP ENABLER

0 50 100 200 300 400
Meters
1:10,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP



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PROJECT ID	DATE
1725	5/10/2016

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	AD	RF	0

Home Group WA
Soldiers Rd, Cardup

Level 2 Flora Survey

Figure 1
Site Location

K:\Projects\1725\GIS\mxd\Flora and Veg Survey\Cardup\GIS\mxd\1725_Cardup Figure 1 - Site Location.mxd

1.2 Background to the Protection of Flora and Vegetation

Western Australian (WA) flora is protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative measures:

- *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act);
- *Wildlife Conservation Act* 1950 (WC Act);
- *Environmental Protection Act* 1986 (EP Act); and
- *Biosecurity and Agriculture Management Act* 2007 (BAM Act).

Non-legislative measures:

- Western Australian Department of Parks and Wildlife (DPaW) Priority lists for flora, ecological communities;
- Weeds of National Significance (WONS); and
- Recognition of locally significant populations by the DPaW.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix A. Conservation categories for ecological communities are provided in Appendix B.

1.2.1 EPBC Act

The EPBC Act aims to protect matters of national environmental significance (MNES). Under the EPBC Act, the Commonwealth Department of the Environment and Energy (DEE) lists threatened species and communities in categories determined by criteria set out in the Act (www.environment.gov.au/epbc/index.html) (Appendix A and B).

Projects likely to cause a significant impact on MNES should be referred to the DEE for assessment under the EPBC Act.

1.2.2 WC Act

The WA DPaW lists flora under the provisions of the WC Act as protected according to their need for protection (Appendix A & B).

Flora is given Declared Rare status when populations are geographically restricted or are threatened by local processes. In addition, under the WC Act, by Notice in the WA Government Gazette of 9 October 1987, all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) is protected throughout the State.

1.2.3 EP Act

Declared Rare Flora (DRF) and TECs are given special consideration in environmental impact assessments, and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Exemptions for a clearing permit do not apply in an ESA.

1.2.4 BAM Act

Plants may be 'Declared' by the Agriculture Protection Board (APB) under the BAM Act 2007 (WA). Declared Plants are gazetted under three categories (C1, C2 and C3), which define the action required. Details of the definitions of these categories are provided in Appendix C. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties (Department of Agriculture and Food Western Australia [DAFWA] 2014).

1.2.5 Weeds of National Significance

The Australian Government along with the State and Territory governments have endorsed 32 Weeds of national Significance. Four major criteria were used in determining WONS:

- The invasiveness of a weed species;
- A weed's impacts;
- The potential for spread of a weed; and
- Socio-economic and environmental values.

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts (Thorp and Lynch 2000).

1.2.6 DPAW Priority Lists

The DPaW lists 'Priority' flora that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act, but which are under consideration for declaration as DRF. Flora assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora requires monitoring every 5 -10 years and Priority 5 flora is subject to a specific conservation program (Appendix A).

The DPaW maintains a list of PECs which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status. Once listed, a community is a PEC, and when endorsed by the WA Minister of Environment becomes a TEC, and protected as an ESA under *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004 (Appendix B).

1.2.7 Informal Recognition of Flora

Certain populations or communities of flora may be of local significance or interest because of their patterns of distribution and abundance. For example, specific locations of flora may be locally significant because they are range extensions to the previously known distribution, or are newly discovered taxa (and have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (e.g. land clearing, grazing and changed fire regimes), and relict populations of such species assume local importance for the DPaW. It is not uncommon for the DPaW to make comment on these species of interest.

2 Biophysical Environment

2.1 Climate

The closest official Bureau of Meteorology (BoM) weather station currently operating near to the Survey Area is the Medina Research Centre WA (Station number 009194), approximately 20 km from the Survey Area. The climate for Medina Research Centre has a mean minimum temperature of approximately 12.4°C and a mean maximum of 24.5°C. The average annual rainfall is 745.9mm (Figure 2) (BoM 2016).

The Medina Research Centre WA recorded 950 mm of rain in the 12 months prior to the survey (August 2015 – September 2016) which is 204.1 mm above the long term average rainfall of 745.9 mm for the same period (BoM 2016). The three months prior to survey (June 2016 – August 2016), Perth recorded 343.1 mm of rainfall, 13.8% below the 398 mm average rainfall for the same period (BoM 2016).

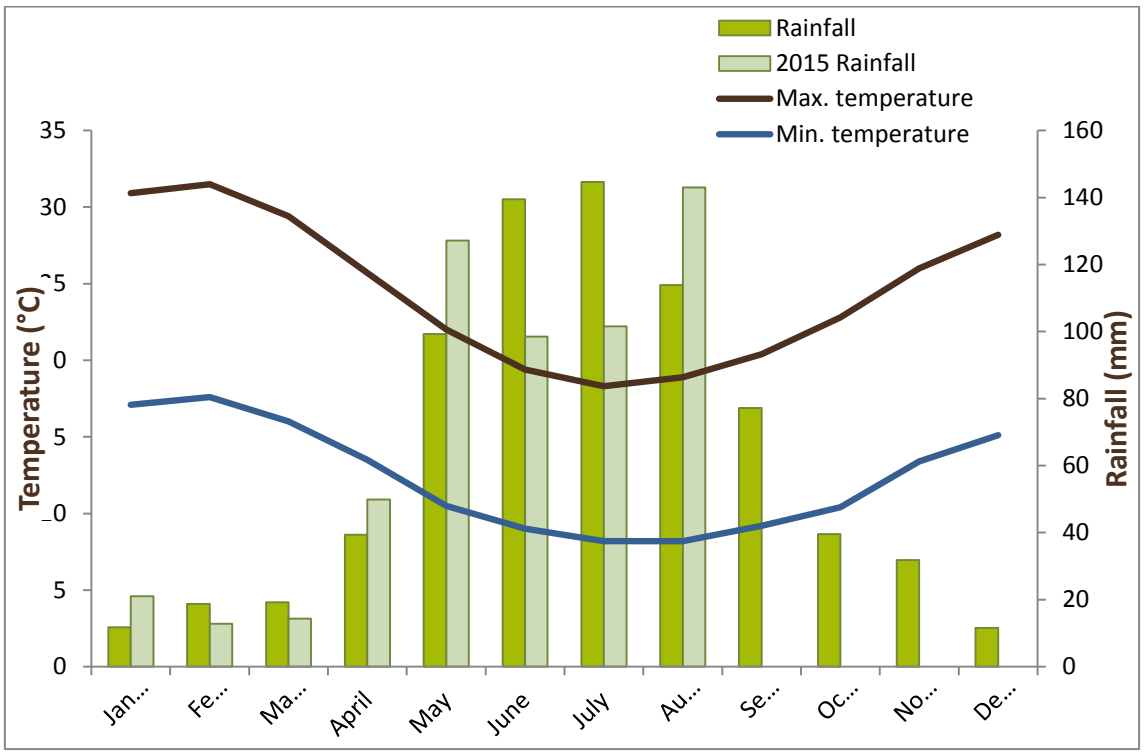

Figure 2: 2016 rainfall and mean rainfall for Medina Research Centre Station (009194) from 1983 to 2016 (BoM 2016).

2.2 Geology and Soils

Soil-landscape mapping of South West WA has been captured at scales ranging from 1:20 000 to 1:250 000. Soil-landscape mapping describes broad soil and landscape characteristics from regional to local scales.

The Survey Area contains the following Systems;

Forrestfield F2b Phase: Shallow to moderately deep, very gravelly acidic yellow duplex soils and common laterite;

Forrestfield F2b Phase: Moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite;

Pinjarra, B1a Phase: Deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface;

Pinjarra P2 Phase: Deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay;

Bassendean B2 Phase: Deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2m

2.3 Geomorphic Wetlands

The Geomorphic Wetlands dataset is identified and utilised by the Environmental Protection Authority (EPA), Department of Environment Regulation (DER) and the Department of Planning as a basis for planning and decision making.

There are no Conservation Category Wetlands (CCW) or Resource Enhancement Wetlands (REWs) mapped within the Survey Area. A Multiple Use Wetland (MUW) is mapped across most of the Survey Area (UFI 15785). Two CCWs (UFI 15462 and UFI 15463) exist within the Railway Reserve immediately east of the Survey Area (Figure 3). One of the CCWs is located 21 m east of the Survey Area and the other is located 54 m to the east.

There are nine other geomorphic wetlands in close proximity to the Survey Area (Table 1).

Table 1: Geomorphic Wetlands in the Survey Area

Management Category	Wetland UFI	Distance from Survey Area
Conservation Wetland	14945	1.0 km
Conservation Wetland	15446	1.2 km
Conservation Wetland	7835	1.1 km
Multiple Use Wetland	7834	1.0 km
Multiple Use Wetland	15448	1.2 km
Multiple Use Wetland	15447	1.2 km

Management Category	Wetland UFI	Distance from Survey Area
Multiple Use Wetland	15015	0.2 km
Multiple Use Wetland	15185	0.8 km
Multiple Use Wetland	14543	1.2 km

2.4 Bush Forever

Bush Forever is a State Government Policy and programme that identifies 51,200 ha of regionally significant vegetation for protection, covering 26 vegetation complexes. This amounts to approximately 18% of the original vegetation on the SCP biogeographic region of the Perth metropolitan area.

Regionally significant vegetation has been identified based on criteria relating to its conservation value. Important criteria in the identification process include the achievement, where possible, of a comprehensive representation of all the ecological communities originally occurring in the region, principally through protecting a target of at least 10% of each vegetation complex in the Bush Forever project boundary (Government of WA 2000).

Two Bush forever sites No. 354 and No. 361 exist directly to the east and north-east of the Survey Area. The Survey Area encroaches into Bush Forever site No.350. The inclusion of this section of the Survey Area as a Bush Forever site may be an error due to the broad scale nature of the Bush Forever Mapping. Lot 30 does not warrant inclusion as a Bush Forever site due to the lack of natural vegetation remaining and the highly degraded condition of the present vegetation. Cardup Nature Reserve, which is a DPaW managed land, exists approximately 1.25km north of the Survey Area (Figure 4).

2.5 Ecological Linkages

The Survey Area forms part of the Perth Biodiversity Project's Draft Regional Ecological linkage network presented in Figure 4. The purpose of the Regional Ecological Linkages identified by the Perth Biodiversity Project was to link protected natural areas with other areas of mapped native vegetation. Priority was given to identifying linkages through those areas having the greatest assumed protection and to those areas that maximised opportunities to form continuous corridors of native vegetation. Two Perth Regional Ecological Linkages (No. 65 and 69) extend along the eastern portion of the Survey Area.

Ecological linkages are not legislatively protected, however, the EPA expects that in preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of an ecological linkage.

2.6 Environmentally Sensitive Areas

Two thirds of the Survey Area is identified as being an Environmentally Sensitive Area (ESA) (Figure 4). This is most likely due to a Threatened Ecological Community (TEC) buffer which extends into the site as well as the buffer of a CCW (Figure 5).

2.7 Broad Vegetation Types

Vegetation across the State has been mapped at different scales by various people. The Survey Area has been mapped by both Beard (1979) which was later reassessed by Shepherd *et al*. (2001). Heddle *et al.* (1980) also undertook vegetation mapping for the region and therefore both these studies have been used to demonstrate the broad vegetation types in the Survey Area (Tables 2 and 3).

The Shepherd *et al.* (2001) and Heddle *et al.* 1980) studies have been used to estimate how much vegetation is currently present in comparison to the pre-European extent of the same vegetation types. From these comparisons, it can be determined what vegetation types have been extensively cleared and therefore in need of protection. This is discussed in Section 5.5.

Mapping of the vegetation of the Perth region of WA was completed on a broad scale (1:250,000) by Beard (1979). These vegetation units were re-assessed by Shepherd *et al*. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There is one Beard / Shepherd vegetation unit in the Survey Area. The Shepherd *et al.* (2001) vegetation types (along with the corresponding Beard [1979] type in brackets), is described below, and its representation within the Survey Area, subregion, region and State is shown in Table 2.

- **Pinjarra_968:** Medium woodland; jarrah, marri & wandoo

Table 2: Broad Vegetation Types within the Survey Area and its State and Regional Representation (Government of Western Australia 2014).

	Pre-European area (ha)	Current extent (ha) 1	Remaining (%)	Current extent % in IUCN Class I-IV Reserves1
Vegetation Types (Beard 1979/ Shepherd *et al.* 2001) in the state				
968	296,877.84	95,732.25	32.25	11.10
Vegetation Types (Beard 1979/ Shepherd *et al.* 2001) in the Swan Coastal Bioregion				
968	136,188.20	9.052.48	6.65	1.17
Vegetation Types (Beard 1979/ Shepherd *et al.* 2001) in the Perth Subregion				
968	136,188.20	9,052.48	6.65	1.17
Vegetation Types (Beard 1981/Shepherd *et al.* 2001) in the LGA				

968	24,351.49	1,083.89	4.45	0.54

Mapping by Heddle *et al.* (1980) based in relation to the landform-soil units determined by Churchward and McArthur (1978) identified one vegetation complex occurring in the Survey Area which is summarised in Table 3. The delineation of vegetation complexes is based on the concept of series of plant communities forming regularly repeating complexes associated with a particular soil unit. The Heddle *et al.* (1980) vegetation complexes that occur across the Survey Area are described below:

- **Guildford Complex** – A mixture of open forest to tall open forest of *Corymbia calophylla – Eucalyptus wandoo – Eucalyptus marginata* and woodland of *Eucalyptus wandoo* (with rare occurrences of *Eucalyptus lane-poolei*). Minor components include *Eucalyptus rudis – Melaleauca rhaphiophylla.*

Table 3: Vegetation Complexes within the Survey Area and its State and Regional Representation.

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current extent % Secure Tenure Reserves
Vegetation (Heddle *et al*. 1980) in the Swan Coastal Bioregion (PBP 2013)				
Guildford Complex	92,281.43	5,412.79	5.87	0.27

3 Methods

3.1 Background

The flora survey was consistent with a single season Level 2 survey as per the EPA requirements for environmental surveying and reporting for flora and vegetation in WA where practical and relevant, as set out in the following documents:

- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004a); and
- EPA Guidance for the Level of Assessment for Proposals affecting Natural Areas within the System 6 Region and Swan Coastal Plain Portion of the System 1 region. Guidance Statement No. 10 (EPA 2006); and
- Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA-DPaW 2015).

3.2 Flora and Vegetation Survey Methods

3.2.1 Flora and Vegetation Database Review

The desktop study provided background information on the flora and vegetation of the Survey Area. This involved a search of the following sources:

- DPaW Threatened and Priority Flora database (DPaW 2016a);
- DPaW Threatened and Priority Ecological Communities database (DPaW 2016b); and
- DEE Protected Matters Search Tool (PMST) (DEE 2016a).

A request for a database search was submitted to the DPaW on the 16th August 2016 (five kilometre radial search around the Survey Area) (Appendix F) to obtain a list of Declared Rare Flora/Threatened or Priority flora, and TECs and PECs in and near the Survey Area (Figure 5). These sources were used to compile a list of expected DRF or Priority species and TECs and PECs that may occur based on the landforms in the Survey Area.

3.2.2 Flora and Vegetation Field Survey

The field survey was conducted on the 8th of September 2016. The field survey included an assessment of three relevés, opportunistic observations and mapping notes. Due to the highly degraded condition of the vegetation, quadrats that are typically required in Level 2 surveys were not considered practical for the survey.

Relevés are unbounded vegetation survey plots with information recorded including landscape features, surface soil colour and texture, bare ground, litter cover, disturbance, fire age, aspect and vegetation condition. Each species of dominant plant at each relevé was recorded, including information on height and percentage cover.

The Survey Area was found to be mostly cleared with isolated native trees with non-endemic species and weed species.

Permits

This flora survey was conducted under the following licences issued by DPaW; Licence to take Flora for Scientific or other Prescribed Purposes: SL011882 and Permit to take Declared Rare Flora: 28-1617 issued to 360 Environmental's Botanist, Amy Dalton.

3.2.3 Searches for Conservation Species

In addition to the information collected from the relevés, opportunistic searches for conservation significant flora and any other conservation significant species likely to occur in the Survey Area based on database searches, habitat present and the botanist's previous experience were undertaken.

3.2.4 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification utilising resources of the Western Australian Herbarium (WAH).

The species list was checked against FloraBase (WAH 2015) to determine the species conservation status. Threatened and Priority Flora were verified against the EPBC Act listing of threatened species to determine Commonwealth listing.

Introduced species were checked against the DPaW Weed Prioritisation Process (WPP) (DPaW 2013), to determine their ranking in terms of environmental impact. The BAM Act Declared Plants list was consulted to determine if any are Declared Plants, and the WONS list to determine the presence of any WONS (Thorp and Lynch 2000).

3.2.5 Vegetation Mapping

The vegetation mapping units were described based on their structure and species composition, as defined by relevé data and field observations. Vegetation was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs, which in the office were digitised using GIS software.

Vegetation condition was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs, which in the office were digitised using GIS software. Vegetation condition was assessed based on Keighery B.J (1994) from Bush Forever (Government of WA 2000).

4 Results

4.1 Flora and Vegetation Survey Limitations and Constraints

It is important to note the specific constraints imposed on surveys. Constraints are often difficult to predict, as is the extent to which they influence survey effort. Survey constraints of the flora survey are detailed in Table 4.

Table 4: Limitations and Constraints Associated with the Survey Area.

VARIABLE	IMPACT ON SURVEY OUTCOMES
Access	Majority of the Survey Area was accessed and traversed. Particular focus was given to areas expected to be impacted that may potentially have species of conservation significance.
Experience	The personnel who executed these surveys were practitioners suitably qualified in their respective fields: ● Field Staff: Amy Dalton (Botanist); ● Data Interpretation and Reporting: Amy Dalton and Narelle Whittington; and ● Report Review: Michelle Rhodes.
Timing, weather, season	The survey was undertaken during the recommended spring period for the South West botanical region, in Spring after three months of below average rainfall (refer to Section 2.1). Flora composition changes with time, particularly across the seasons and with seasonal conditions. Fire history also affects the composition of flora. Therefore, botanical surveys completed at different times of the year will have varying results.
Scope: Life forms sampled	The scope of this project included the detailed surveying of flora and vegetation and searching for conservation significant species or communities.
Sources of information	Relevant DPaW searches with a five kilometer radius were undertaken for the Survey Area. The desktop analysis used several sources to produce a list of flora species previously recorded in the vicinity of the Survey Area. This includes records from the EPBC Protected Matters Search Tool (DoE 2016a&b), and DPaW Threatened flora (DPaW 2016a), TECs and PECs (DPaW 2016b) NatureMap (DPaW 2016d) as well as field guides and other scientific literature.
Completeness	The majority of the Survey Area was accessible; however, access was restricted were cattle were present on the site. The vegetation units were sufficiently surveyed; with three relevés and additional vegetation mapping notes recorded.

VARIABLE	IMPACT ON SURVEY OUTCOMES
Disturbances	The Survey Area has been severely altered by clearing and grazing. With the majority of the site in use for grazing by cattle and horses. No intact native vegetation remains on the site. The majority of the vegetation consists of mature planted non-endemic Eucalyptus species with isolated native trees over weed species and garden variety species.

4.2 Flora Results

4.2.1 Database Results

The review of the database searches identified 23 conservation significant flora as potentially occurring in the vicinity of the Survey Area. Of these, nine are classed as Threatened, three as Priority 2, three as Priority 3 and two as Priority 4.

The likelihood of these 23 conservation significant flora occurring in the Survey Area is shown in Appendix H.

A search of the DPaW TEC and PEC database and EPBC PMST identified seven TECs, three of which are listed under the EPBC Act, and two PECs as occurring within five kilometers of the Survey Area (Figure 5). The TEC and PEC communities are:

- FCT SCP3a – *Eucalyptus calophylla – Kingia australis* woodlands (Critically Endangered [EPBC]);
- FCT SCP3b – *Eucalyptus calophylla – Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (Vulnerable [DPaW]);
- FCT SCP3c – *Eucalyptus calophylla – Xanthorrhoea preissii* woodlands and shrublands (Critically endangered [EPBC]);
- FCT SCP20b – *Banksia attenuata* and/or *Eucalyptus marginata* woodlands (Endangered [DPaW]);
- FCT SCP08 – Herb rich shrublands in clay pans (Vulnerable [EPBC]);
- FCT SCP02 – Southern wet shrublands (Endangered [DPaW]);
- FCT SCP09 – Dense shrublands on clay flats (Vulnerable [DPaW]);
- FCT *Casuarina obesa* association – *Casuarina obesa* association (Priority 1 [DPaW]); and
- FCT SCP1a - *Eucalyptus haematoxylon – Eucalyptus marginata* woodlands (Priority 3 [DPaW]).

4.2.2 Overview of Flora

A total of 30 taxa (including species, subspecies, varieties and forms) from 27 genera and 11 families were recorded in the Survey Area, of these, 26 were introduced species. The commonly occurring families were Poaceae (7 taxa) and Asteraceae and Myrtaceae (both with 6 taxa). The flora inventory is provided in Appendix I and the Survey Area data sheets in Appendix J.

4.2.3 Flora of Conservation Significance

No Threatened species pursuant to the EPBC Act and/or gazetted as DRF pursuant to the WC Act were recorded during the survey. No Priority species were recorded during the survey.

4.2.4 Introduced Flora

A total of 26 introduced species were recorded during the survey (Table 5). One species, **Moraea flaccida* (Figure 5 [Plate 1]), is listed as Declared under the BAM Act. None of the species are listed as a WONS.

Table 5: Introduced Flora Recorded in the Survey Area.

TAXON	COMMON NAME
**Arctotheca calendula*	Capeweed
**Brassica tournefortii*	Wild Turnip, Mediterranean Turnip
**Conyza bonariensis*	Flaxleaf Fleabane
**Cotula turbinata*	Funnel Weed
**Eragrostis curvula*	African Lovegrass
**Ehrharta calycina*	Perennial Veldt Grass
**Ehrharta longiflora*	Annual Veldt Grass
**Erodium botrys*	Long Storksbill
**Hordeum leporinum*	Barley Grass, Barley, Wall Barley, Mouse Barley, Hare Barley, Foxtail, Farmer's Foxtail, Common Foxtail
**Hypochaeris radicata*	Spotted Cat's Ear, Smooth Cat's Ear, Hairy Wild Lettuce, Flatweed, Cats Ear
**Lolium perenne x rigidum*	Perennial Ryegrass
**Lotus sp.*	Lotus
**Lupinus angustifolius*	Narrow Leaf Lupin
**Moraea flaccida*	One-leaf Cape Tulip
**Oxalis purpurea*	Perennial Ryegrass
**Poaceae sp.*	Poaceae
**Romulea rosea*	Guildford Grass, Onion Grass
**Solanum nigrum*	Blackberry Nightshade, Glossy Nightshade, Garden Huckleberry, Black Nightshade
**Sonchus oleraceus*	Common Sowthistle

**Stachys arvensis*	Staggerweed
**Trifolium repens*	White Clover
**Ursinia anthemoides*	Ursinia

Plate 1: **Moraea flaccida* a listed weed under the BAM Act, located within the Survey Area.

4.2.5 Vegetation Associations

No natural vegetation associations were described for the Survey Area. There were nine vegetation units mapped, which included mature trees in isolation over garden and weed species. Descriptions of these are provided in Table 7 and Figure 6.

Table 6: Vegetation Unit Descriptions and their Extent in the Survey Area.

UNIT CODE	DESCRIPTION	SITE	AREA
CcAs	*Corymbia calophylla, over Acacia saligna over *Ehrhrarta calycina and *Eragrostis curvula over *Sonchus oleraceus*	SRR-1	0.787
NeCcLa	*Non-endemic Eucalyptus and Corymbia calophylla over *Lupinus angustifolius over *Ehrhrarta calycina, *Lolium perenne and *Arctotheca calendula*	SRR-2	3.312
CcMq	*Corymbia calophylla, *Melaleuca quinquenervia,* Non-endemic *Eucalyptus* sp. *over *Romulea rosea, *Ehrharta longiflora and *Arctotheca calendula*	SRR-3	1.066

UNIT CODE	DESCRIPTION	SITE	AREA
CcNe	*Corymbia calophylla*, Non-endemic *Eucalyptus sp.*, **Solanum nigrum*, **Eragrostis curvula*, **Ehrharta calycina*	NA	4.158
EmCc	*Eucalyptus marginata*, *Corymbia calophylla*, *Non-endemic *Eucalyptus* sp. over **Ehrharta calycina*, **Poaceae* sp. and **Arctotheca calendula*	NA	1.348
Ka	*Kingia australis*	NA	0.006
Ne	*Non-endemic *Eucalyptus sp.*	NA	6.190
Cc	*Corymbia calophylla*	NA	0.659
GD	Garden/Homestead	NA	2.790

4.2.6 Vegetation Condition

The Vegetation Condition for the majority of the Survey Area was classed as completely degraded (Table 7 and Figure 7). Clearing associated with agriculture and weeds, along with grazing from cattle were the most frequently observed disturbance. The majority of the Survey Area consists of non-endemic trees, weed species and garden varieties (Plate 2). Some native tree stands remain, while the majority of the trees in the Survey Area have been planted.

Plate 2: The degraded nature of the Survey Area.

Table 7: Vegetation Condition and Extent in the Survey Area.

CONDITION	EXTENT (HA)
Completely Degraded	56.51
Degraded to Completely Degraded	0.079

4.2.7 Threatened and Priority Ecological Communities

Due to the altered and degraded state of the vegetation within the Survey Area, none of the vegetation units recorded during the survey are considered to represent a TEC or PEC.

4.2.8 Regional Representation

Vegetation mapping units described in the Survey Area were correlated with the Beard (1978) and Shepherd *et al*. (2001) broad vegetation types as much as possible by examining similarities in vegetation descriptions. Differences exist with the terminology used in the descriptions as they are based on different methods of categorising and characterising vegetation types, and the different spatial scale of the analysis (i.e. region vs. local scale). Due to the lack of native vegetation and the highly degraded condition of the vegetation within the Survey Area, no correlation was found with the vegetation units in the Survey Area and the Beard (19780 and Shephard *et al.* (2001) broad vegetation types.

5 Discussion

5.1 Flora Context

The Survey Area is highly fragmented and degraded due to large scale clearing for the grazing of livestock and the presence of weeds. The survey resulted in 30 taxa (including species, subspecies, varieties and forms) from 27 genera and 11 families being recorded in the Survey Area, of these, 26 were introduced species. The majority of the original vegetation in the Survey Area has been cleared with the only native vegetation remaining consisting of scattered native trees amongst planted trees with the understorey being predominantly a pasture of weed species. Many of the existing trees within the Survey Area are non-endemic *Eucalyptus* sp. which have been planted around the perimeter of the property for landscaping.

5.1 Recorded Flora of Conservation Significance

No Threatened species listed under the EPBC Act or gazetted as T/DRF (Threatened) pursuant to the WC Act were recorded during the survey. No Priority flora were recorded during the survey.

5.1.1 Likelihood of Conservation Significance Flora

The desktop assessment identified 23 conservation significant flora potentially occurring in the vicinity of the Survey Area. Of these, nine are classed as Threatened, three as Priority 2, three as Priority 3 and two as Priority 4. All of these are considered unlikely to occur within the Survey Area. This is due to the majority of the Survey Area being historically cleared for livestock, resulting in a lack of natural understorey occurring within the Survey Area.

5.2 Vegetation of Conservation Significance

A search of the DPaW database and EPBC PMST for TECs and PECs identified seven TECs, three of which are listed under the EPBC Act and two PECs as occurring within five kilometers of the Survey Area (Figure 5). None of these are thought to occur in the Survey Area.

PECs are known as ecologically valuable communities that need further investigation before possible nomination for TEC status. Priority communities listed by DPaW have no formal protection. There is no written policy on how to respond to the presence of PECs within proposed development sites and the presence of these communities is dealt with by DPaW on a case by case basis.

Given the highly degraded condition of the vegetation in the Survey Area, none of the identified vegetation units are considered to be representative of any floristic community types (FCTs). As such none of the described vegetation units are considered to

represent any described TECs or PECs despite the DPaW database search identifying seven TECs and two PECs as occurring within five kilometres of the Survey Area.

5.3 Environmentally Sensitive Areas

A large portion of the Survey Area is located within an ESA, with these ESAs likely to be the CCWs, Bush Forever sites and the buffer zones of the TECs and PECs in close proximity to the Survey Area. ESAs are declared to prevent degradation of important environmental values such as T/DRF, TECs or significant wetlands. Exemptions contained in the *Environmental Protection (Clearing of Native vegetation) Regulations* 2004 for low impact land clearing do not apply in ESAs and a native vegetation clearing permit is required.

5.4 Vegetation Condition and Introduced Flora

Vegetation condition ranged from Completely Degraded to Degraded to Completely Degraded (Figure 7). The majority of the Survey Area is considered to be in a Completely Degraded condition (56.51 ha), the extent of each vegetation condition units are presented in Table 7. Clearing associated with the presence of livestock and weeds were the most frequently observed disturbance (Plate 1).

Land use in the survey area has resulted in the degradation of the native vegetation, with any of the remaining mature native trees having being integrated with gardens, paddocks and non-endemic species. In these instances the vegetation no longer has a natural structure, with an absence of native understorey and is mapped as Completely Degraded. The remaining vegetation is marked as Degraded to Completely Degraded and occurs in the South-Eastern portion of the Survey Area.

A total of 22 introduced species were recorded during the survey. One species, **Moraea flaccida* (Plate 2 [Figure 5]) is listed as Declared under the BAM Act. None of the species are listed as a WONS. The land-use in the Survey Area has been a source of extensive weed infestations and pasture grasses and therefore is a dominant feature of the Survey Area. The majority of these weeds are common bushland and agricultural weeds (Hussey *et al.* 2007).

5.5 Regional Representation

The Perth Biodiversity Project (PBP 2013) has mapped native vegetation extent by vegetation complex on the Swan Coastal Plain. It is estimated that the Guildford Complex – Swan Coastal Plain is estimated to have 5.87% native vegetation remaining based on the pre-European extent.

The EPA recognises vegetation complexes that are not well represented as being significant. Vegetation complexes which have 10%-30% remaining may be considered regionally significant. Proposals that would affect a vegetation complex with 10% or less remaining are likely to be formally assessed by the EPA (EPA 2006).

These levels may be modified for 'Constrained Areas'. Such areas include the Swan Coastal Plain portion of the Perth Metropolitan Region (in which the Survey Area lies), and may include urban, urban deferred and industrial zoned lands, and lands with development approvals.

The modified objectives for Constrained Areas are to:

- Retain at least 10% of the pre-clearing extent of the ecological community where >10% of the ecological community remains, or
- Retain all remaining areas of each ecological community where <10% of this ecological community remains.

Due to the Completely Degraded and highly altered nature of the Survey Area, it is thought that the Guildford Complex – Swan Coastal Plain vegetation complex is not represented within the Survey Area.

5.6 Ecological Linkages

The Survey Area forms part of the Perth Biodiversity Project's Draft Regional Ecological linkage network. The Survey Area is part of a non-continuous linkage of bushland that connects parcels of bushland, undeveloped land and private properties. Two linkages dissect the Survey Area, Linkage 65 and 69 extend along the eastern portion of the site. At this location there was minimal native vegetation present. Bush Forever exists directly to the east and north-east of the site (Bush Forever Site 350).

Recognised by the EPA, DPaW and local government, the retention of native vegetation and fauna habitat within the Regional Ecological Linkages aims to reduce the loss of biodiversity and key ecological functions across the south-west. Ecological linkages are not legislatively protected, however, the EPA expects that in preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of linkages.

6 Conclusions

The flora assessment was undertaken at a time considered suitable for the species of conservation significance considered likely to occur (they would also be identifiable if they are present), within the recommended season and flowering period for the South West botanical province.

The following conclusions can be drawn:

- No Threatened species pursuant to the *Environment Protection and Biodiversity Act* 1999 (EPBC Act) and/or gazetted as Declared Rare Flora (DRF) pursuant to the *Wildlife Conservation Act* 1950 (WC Act) were recorded during the survey. No Priority species were recorded during the survey;
- One introduced species **Moraea flaccida*, listed as a Declared weed under the BAM Act was recorded within the Survey Area;
- The DPaW Geomorphic Wetlands Dataset identifies one Multiple Use Wetland as occurring in the Survey Area;
- One Bush Forever Site (BF350) encroaches along the eastern portion of the Survey Area;
- An ESA occurs within the Survey Area along the Eastern Portion (Conservation Category Wetland buffer); and
- The majority of the site is Completely Degraded due to high levels of disturbance associated with clearing, grazing by livestock and weeds;

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It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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FIGURES

Legend

Study Area (56.59 ha)

Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed

- LOCALITY MAP SOURCED FROM HOMEGROUP 2016
- GEOMORHPIC WETLANDS SOURCED DPAW 2016
- EPP LAKES SOURCED EPA 1992
- HYDROGRAPHY SOURCED DOW 2015
- AERIAL PHOTOGRAPHY SOURCED LANDSAT7 (© Western Australian Land Information Authority 2015)

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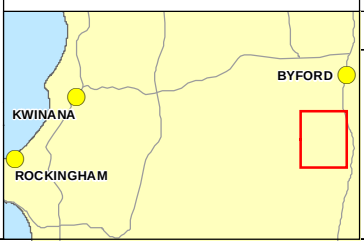
LOCALITY MAP



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Home Group WA
Soldiers Rd, Cardup

Level 2 Flora Survey

Figure 3
Geomorphic Wetlands

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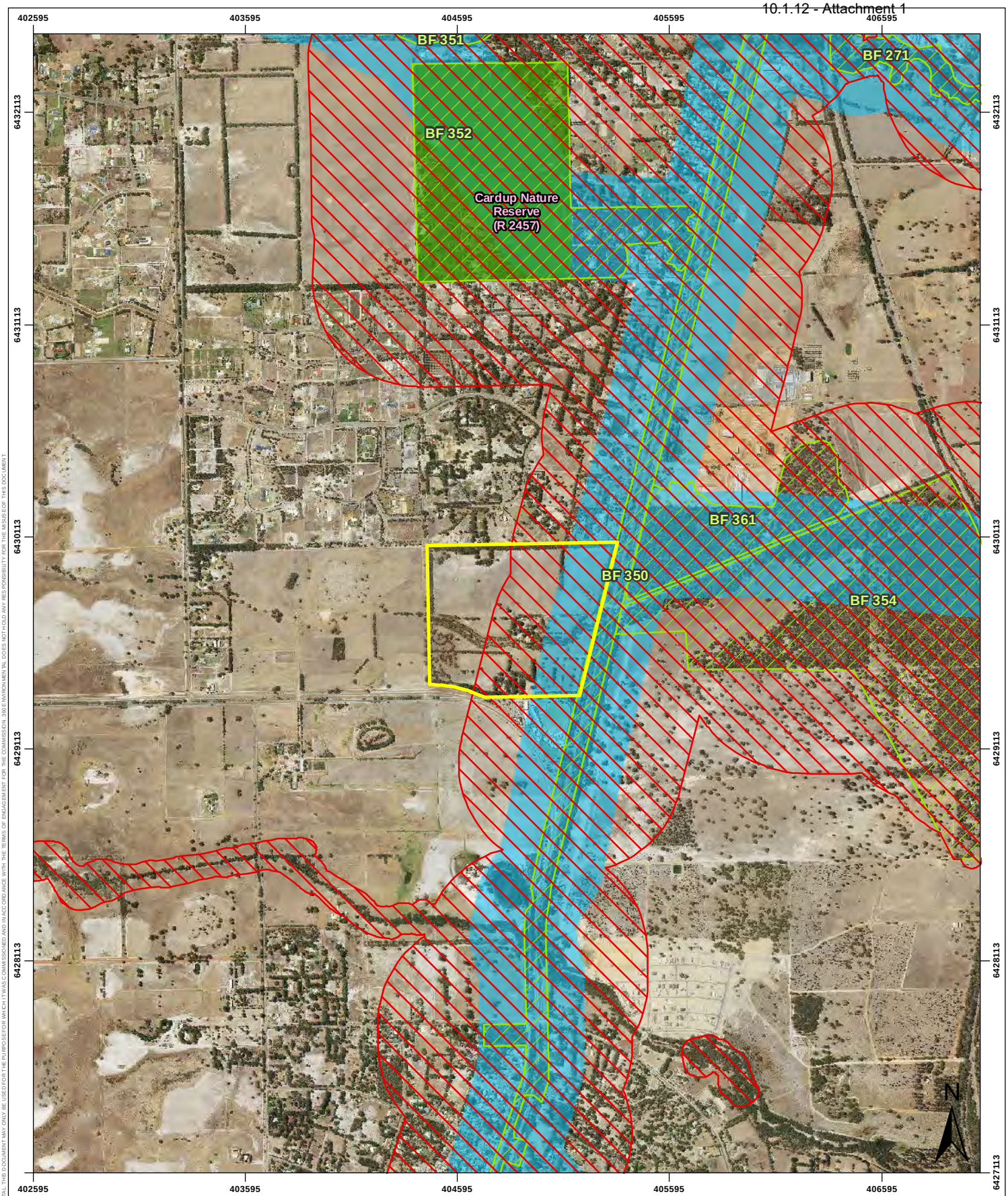

Legend

- Study Area (56.59 ha)
- Environmentally Sensitive Areas
- Bush Forever Sites
- Nature Reserve
- Perth Region Ecological Linkages

- LOCALITY MAP SOURCED FROM HOMEGROUP WA 2016
- HERITAGE SITES SOURCED AUSTRALIAN COMMONWEALTH 2015
- MANAGED LANDS SOURCED DPAW 2014
- ESA SOURCED DER 2014
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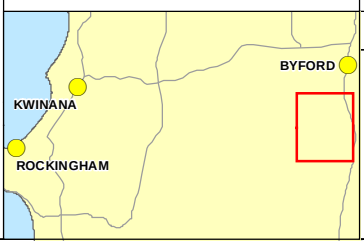

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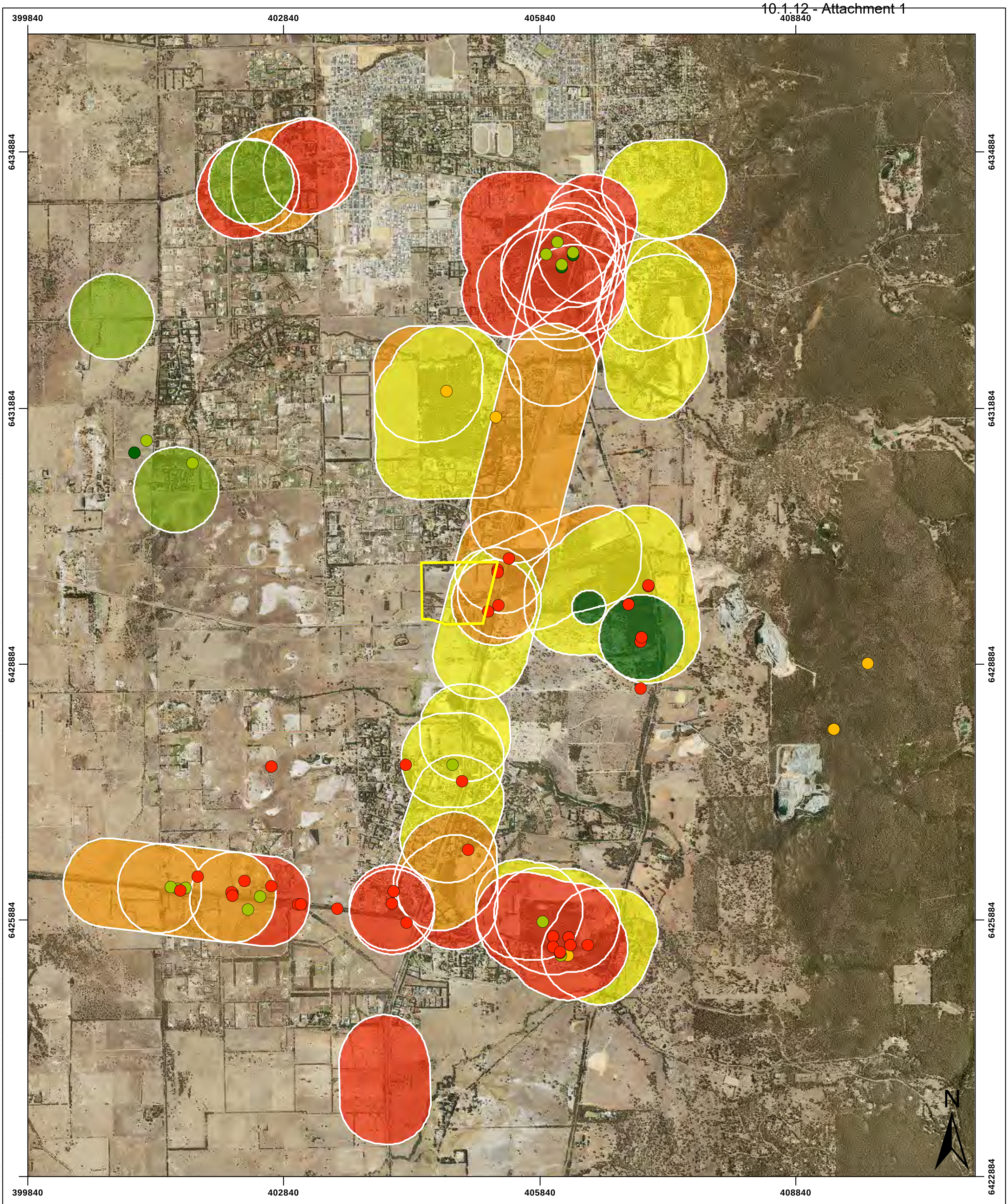
Level 2 Flora Survey

Figure 4
Conservation Areas



Legend

Study Area (56.59 ha)

Rare and Priority Flora

- Priority 4
- Priority 3
- Priority 2
- Threatened

TEC/PEC Search Results

- Priority 3
- Priority 1
- Endangered
- Vulnerable
- Critically Endangered

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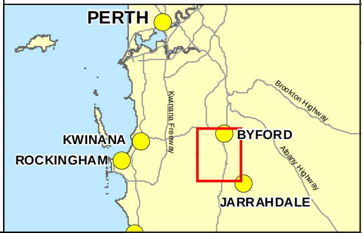
LOCALITY MAP



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- STUDY AREA SOURCED HOME GROUP WA 2016
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Level 2 Flora Survey

Figure 5

Rare and Priority Flora and TECs/PECs

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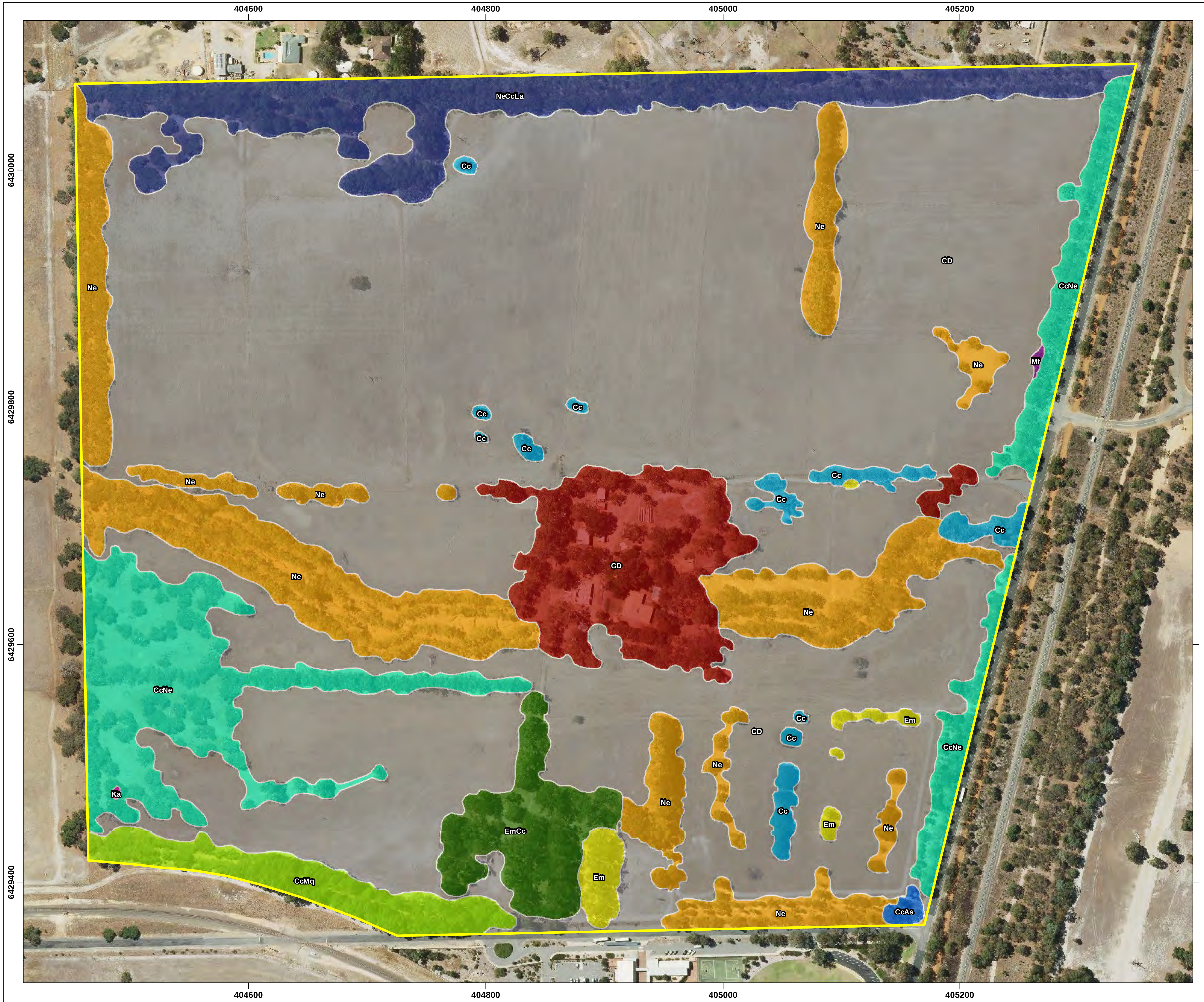

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- Study Area (56.59 ha)

Vegetation Associations

- **Mf:** *Moraea flaccida*
- **Cc:** *Corymbia calophylla*
- **Em:** *Eucalyptus marginata*
- **Ka:** *Kingia australis*
- **CcAs:** *Corymbia calophylla*, over *Acacia saligna* over **Ehrhrarta calycina and *Eragrostis curvula* over **Sonchus oleraceus*
- **CcMq:** *Corymbia calophylla*, **Melaleuca quinquenervia*, Non-endemic *Eucalyptus sp.* over **Romulea rosea*, **Ehrharta longiflora and *Arctotheca calendula*
- **CcNe:** *Corymbia calophylla*, Non-endemic *Eucalyptus sp.*, **Solanum nigrum*, **Eragrostis curvula*, **Ehrharta calycina*
- **EmCc:** *Eucalyptus marginata*, *Corymbia calophylla*
- **NeCcLa:** Non-endemic *Eucalyptus* and *Corymbia calophylla* over **Lupinus angustifolius* over **Ehrhrarta calycina*, **Lolium perenne and *Arctotheca calendula*
- <bol>Ne: Non-endemic <ita>Eucalyptus sp</ita>
- **GD:** Garden species
- **CD:** Completely Degraded

- CADASTRAL BOUNDARY SOURCED FROM LANDGATE 2009
- LOCALITY MAP SOURCED FROM LANDGATE 2006
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LOCALITY MAP

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Home Group WA
Lot 30 Soldiers Road,
Cardup

Level 2 Flora and Vegetation Survey

Figure 6
Vegetation Associations

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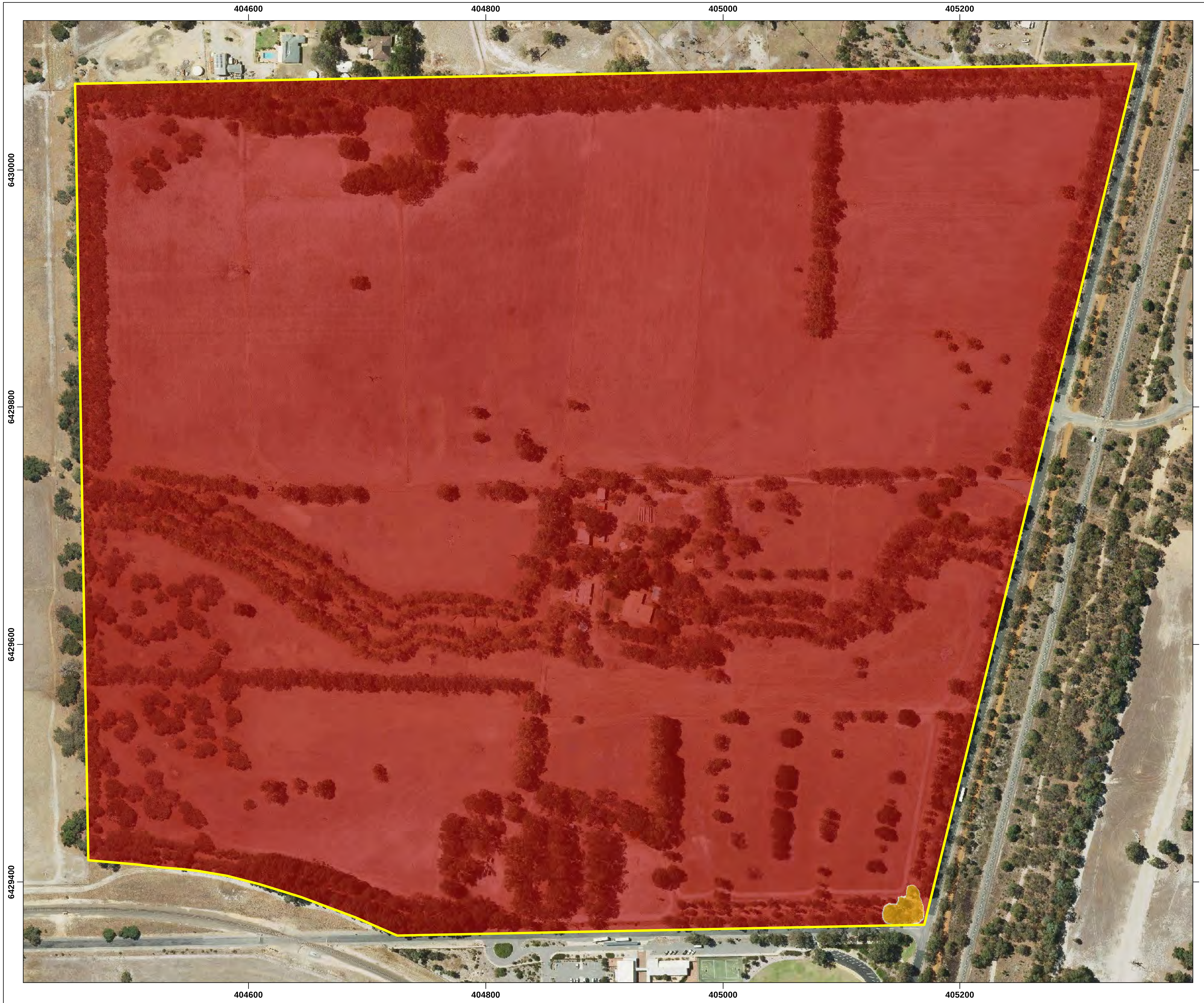

Legend

Study Area (56.59

Vegetation Associations

CD: Completely Degraded (56.51 ha)

CD-D: Completely Degraded - Degraded (0.079 ha)

- CADASTRAL BOUNDARY SOURCED FROM LANDGATE 2009
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LOCALITY MAP

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Level 2 Flora and Vegetation Survey

Figure 7
Vegetation Condition

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APPENDIX A

Definition of Declared Rare / Priority / Threatened Flora

Categories of Declared Rare Flora (WC act) and Priority listings (DPaW)

Conservation Code	Description
X	**Presumed Extinct Flora (Declared Rare Flora – Extinct)** "Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*)."
T	**Threatened Flora (Declared Rare Flora – Extant)** "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*)." "Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild; EN: Endangered – considered to be facing a very high risk of extinction in the wild; VU: Vulnerable – considered to be facing a high risk of extinction in the wild."
P1	**Priority One: Poorly-known taxa** "Taxa which are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes."
P2	**Priority Two: Poorly-known taxa** "Taxa which are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes."
P3	**Priority Three: Poorly-known taxa** "Taxa which are known from collections or sight records from several localities not under imminent threat, or few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them."

P4	**Priority Four: Rare, Near Threatened and other taxa in need of monitoring** a. Rare. "Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands." b. Near Threatened. "Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable." c. "Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy."
P5	**Priority Five: Conservation Dependent taxa** "Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years."

Source: Department of Parks and Wildlife (2013). Online: http://florabase.dpaw.wa.gov.au.

Categories of Threatened Flora Species under the EPBC Act

CONSERVATION CODE	DESCRIPTION
Ex	**Extinct** Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the

	species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Source: *Environment Protection and Biodiversity Conservation Act 1999*

APPENDIX B

Definition of Threatened and Priority Ecological Communities

Definitions of Threatened Ecological Communities as Endorsed by the Western Australian Minister for the Environment

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B);

A) Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years)

ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years)

Endangered (EN)

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years)

ii) modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years)

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

Vulnerable (VU)

An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Source: Department of Environment and Conservation (2010). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, Western Australia. Online: www.naturebase.net/

Definitions of Priority Ecological Communities as listed DPaW

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.

Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list.

These communities require regular monitoring.

(a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities.

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Source: Department of Parks and Wildlife (2013). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Department of Environment and Conservation, Perth, Western Australia. Online: www.naturebase.net/

APPENDIX C

Environmental Weeds and Declared Plant Categories

Criteria used for Ranking Environmental Weeds

The Weed Prioritisation Process for DPaW contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity. These criteria are as follows:

- **Potential Distribution** – Area of potential habitat in the Region that could be occupied or the area at risk of invasion by the weed.
- **Current Distribution** - Area of habitat in the Region currently occupied by the weed, in relation to the habitat that it could invade.
- **Ecological Impact** - Impact of species within the Region, from low impact (causes minimal disruption to ecological processes or loss of biodiversity) to high (causes acute disruption of ecological processes, dominates and/or significantly alters vegetation structure, composition and function of ecosystems).
- **Invasiveness** – rate of spread of a weed in native vegetative, encompassing factors of establishment, reproduction and long distance dispersal (>100m).
- **Feasibility of Control** - The longer a coordinated control program takes to achieve its desired goal, the more expensive and less feasible it becomes. Is it feasible to eradicate or at least contain the infestation?

Source: DPaW (2013). Weed Prioritisation Process for DPaW (formerly DEC) – "An integrated approach to Weed Management on DPaW-managed lands in WA"

Standard Meanings of Declared Plant Categories

Under the Biosecurity and Agriculture Management Act 2007 (the BAM Act), all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management).

C1 category (Exclusion) - Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.

C2 category (Eradication) – Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.

C3 category (Management) – Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Source: Department of Agriculture and Food, Western Australia. Online: http://www.biosecurity.wa.gov.au/western-australian-organism-list-waol

APPENDIX D

Vegetation Condition Scale

CONDITION SCALE CODE	CONDITION SCALE
P	**Pristine (1)** Pristine or nearly so, no obvious signs of disturbance
E	**Excellent (2)** Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
VG	**Very Good (3)** Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
G	**Good (4)** Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
D	**Degraded (5)** Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
CD	**Completely Degraded (6)** The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Source: Bush Forever Vegetation Condition Scale as developed by Keighery (1994) and summarized in Bush Forever (Government of Western Australia (2000b)

APPENDIX E

Flora Likelihood Table

Assessment of the Likely Occurrence of DRF and Priority Flora (as per DPaW and EPBC Database Searches) in the Survey Area

[1]Closest record to Survey Area based on DPaW 2015.Likely = Suitable habitat present and records less than 5 km from the Survey Area, Possible = Suitable habitat present and records between 5 km and 10 km from the Survey Area, and Unlikely = No suitable habitat present and/or records greater than 10 km from the Survey Area. En = Listed as Endangered under the EBPC Act, Vu = Listed as Vulnerable under the EBPC, Ce= Critically Endangered under the EBPC Act, P = Listed as Priority by the DPaW DRF = Declared Rare Flora as listed by the State.

Source	Conservation Status		Species	Habitat Information	Distance to Nearest Record	Suitable Habitat Present	Likelihood of Occurrence in the Survey Area
	EPBC	DPaW					
EPBC PMST	Endangered	DRF/T	*Andersonia gracilis*	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	30 km	Yes	Unlikely
EPBC PMST	Endangered	DRF/T	*Caladenia huegelii*	Grey or brown sand, clay loam.	2.2 km	Yes	Unlikely
NatureMap	Threatened	DRF/T	*Calectasia cyanea*	White, grey or yellow sand, gravel.	5 km	Yes	Unlikely
EPBC PMST	Vulnerable	DRF/T	*Diuris micrantha*	Brown loamy clay. Winter-wet swamps, in shallow water.	60 km	No	Unlikely
DPaW EPBC PMST	Endangered	DRF/T	*Diuris purdei*	Grey-black sand, moist. Winter-wet swamps.	3.5 km	No	Unlikely
EPBC PMST DPaW	Endangered	DRF/T	*Drakaea elastica*	White or grey sand, Low lying situations adjoining winter-wet swamps.	1.7 km	No	Unlikely

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
EPBC PMST	Vulnerable	DRF/T	*Drakaea micrantha*	White-grey sand.	60 km	Yes	Unlikely
EPBC PMST	Endangered	DRF/T	*Eucalyptus balanites*	Sandy soils with lateritic gravel.	12 km	No	Unlikely
EPBC PMST	Endangered	DRF/T	*Grevillea curviloba* subsp. *incurva*	Winter-wet heath.	23 km	No	Unlikely
EPBC PMST	Endangered	DRF/T	*Lasiopetalum pterocarpum*	Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines.	10 km	No	Unlikely
EPBC PMST	Critically Endangered	DRF/T	*Synaphea sp.* Fairbridge Farm	Sandy lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	-	No	Unlikely
DPaW NatureMap	Critically Endangered	DRF/T	*Synaphea sp. Pinjarra*	Grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite. Flats, seasonally wet areas, railroad reserves often with wet	<1 km	Yes	Unlikely

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
				areas, railroad reserves often with wet depressions or drains.			
DPaW NatureMap	Critically Endangered	DRF/T	*Synaphea sp. Serpentine*	Information unavailable.	< 1 km	Unknown	Unlikely
EPBC PMST	Vulnerable	DRF/T	*Tetraria australiensis*	Information unavailable	2 km	Unknown	Unlikely
EPBC PMST	Endangered	DRF/T	*Thelymitra stellata*	Sand, gravel, lateritic loam.	76 km	No	Unlikely
DPaW	-	P2	*Johnsonia pubescens*	Grey-white-yellow sands. Flats, seasonally-wet sites.	2 km	Yes	Unlikely
DPaW	-	P2	*Johnsonia pubescens* subsp. *cygnorum*	Grey-white-yellow sand. Flats, seasonally-wet sites.	1.8 km	Yes	Unlikely
DPaW	-	P2	*Millotia tenuifolia* var. *laevis*	Granitic or lateritic soils.	4.3 km	No	Unlikely
DPaW	-	P3	*Babington urbana*	Information unavailable.	3 km	Unknown	Unlikely

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
DPaW	-	P3	*Jacksonia gracillima*	Unknown.	4.3 km	Unknown	Unlikely
DPaW	-	P3	*Schoenus pennisetis*	Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	3.6 km	Yes	Unlikely
DPaW	-	P4	*Drosera occidentalis* subsp. *occidentalis*	Sandy and clayey soils. Swamps and wet depressions.	1.2 km	Yes	Unlikely
DPaW	-	P4	*Verticordia linleyi* subsp. *lindleyi*	Sand, sandy clay. Winter-wet depressions.	3.7 km	Yes	Unlikely

APPENDIX F

Flora Inventory

FAMILY	TAXON
Asteraceae	**Arctotheca calendula*
	**Conyza bonariensis*
	**Cotula turbinata*
	**Hypochaeris radicata*
	**Sonchus oleraceus*
	**Ursinia anthemoides*
Brassicaceae	**Brassica tournefortii*
Dasypogonaceae	*Kingia australis*
Fabaceae	**Lotus sp.*
	Acacia saligna
	**Lupinus angustifolius*
	**Trifolium repens*
Geraniaceae	**Erodium botrys*
Iridaceae	**Romulea rosea*
	**Moraea flaccida*
Lamiaceae	**Stachys arvensis*
Myrtaceae	**Eucalyptus* sp.
	**Corymbia maculata*
	Eucalyptus marginata
	Corymbia calophylla
	**Melaleuca quinquenervia*
Oxalidaceae	**Oxalis purpurea*
Poaceae	**Eragrostis curvula*
	**Ehrharta calycina*
	**Ehrharta longiflora*
	**Hordeum leporinum*
	**Lolium perenne x rigidum*
	**Poaceae sp.*
	**Solanum nigrum*
Solanaceae	**Solanum nigrum*

APPENDIX G

Flora Survey Area Data Sheets

Opportunistic Collections

Kingia australis
**Lotus sp.*
**Romulea rosea*
**Oxalis purpurea*
**Stachys arvensis*
**Hordeum leporinum*
**Lolium perenne*
**Brassica tournefortii*
**Melaleuca quinquenervia*
**Conyza bonariensis*
**Cotula turbinata*
**Trifolium repens*
**Brassica tournefortii*
**Moraea flaccida*

Soldiers Road, Cardup **Site** SRR1
Described by AD **Date** 08/09/2016 **Type** Relevé
Location Close to the corner of Soldiers Road and Bishop Road
MGA Zone 50 405166 **mE** 6429383 **mN**
Habitat Flat plain
Soil Yellow/Brown Clay

Vegetation *Corymbia calophylla, over Acacia saligna over Ehrhrarta calycina and Eragrostis curvula over Sonchus oleraceus*
Veg Condition Completely Degraded - Degraded
Fire Age Very Old (>12)
Notes
Disturbance: Cattle, grazing and close to roadside
Ground Cover: 1% Bareground, 0% Logs, 1% Twigs, 2% Leaves

SPECIES LIST:

Name	Cover	Height
Corymbia calophylla	5%	1000
Acacia saligna	30%	300
* *Ehrharta calycina*	50%	70
* *Eragrostis curvula*	30%	100
* *Sonchus oleraceus*	+	20
* *Lupinus angustifolius*	+	15

Soldiers Road, Cardup **Site** SRR2
Described by AD **Date** 08/09/2016 **Type** Relevé
Location Close to northern fenceline
MGA Zone 50 404758 **mE** 6429988 **mN**
Habitat Damp plain
Soil Grey Sand

Vegetation *Non-endemic Eucalyptus sp. and Corymbia calophylla over *Lupinus angustifolius over *Ehrharta calycina, *Lolium perenne (AD7) and *Arctotheca calendula.*
Veg Condition Completely Degraded
Fire Age Very Old (>12)
Notes
Disturbance: Weeds, Cattle, grazing and clearing for paddock
Ground Cover: 1% Bareground, 0% Logs, 2% Twigs, 1% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen
**Eucalyptus sp.*	40%	1200	nc
Corymbia calophylla	30%	300	nc
** Lupinus angustifolius*	30%	60	nc
** Lolium perenne*	30%	70	AD7
** Arctotheca calendula*	+	20	nc
** Ehrharta calycina*	+	50	nc

Soldiers Road, Cardup **Site** SRR3
Described by AD **Date** 08/09/2016 **Type** Relevé
Location Close to Bishop Road and Railway Line
MGA Zone 50 404534 **mE** 6429416 **mN**
Habitat Flat plain
Soil Brown loam

Vegetation *Corymbia calophylla, Melaleuca quinquenervia over Romulea rosea, Ehrharta longiflora and Arctotheca calendula*
Veg Condition Completely Degraded
Fire Age Very Old (>12)
Notes Planted non-endemic *Melaleuca,* Cattle present at time of survey
Disturbance: Cattle, Weeds, Railway Line
Ground Cover: 2% Bareground, 0% Logs, 5% Twigs, 15% Leaves

SPECIES LIST:

Name	Cover	Height
Corymbia calophylla	5%	1800
* *Melaleuca quinquenervia*	20%	1000
* *Romlea rosea*	60%	10
* *Ehrharta longiflora*	30%	50
* *Arctotheca calendula*	+	15

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APPENDIX 5:
INFRASTRUCTURE SERVICING REPORT (KCTT)

INFRASTRUCTURE SERVICING REPORT

Lot 30 Soldiers Road

Cardup

Shire of Serpentine-Jarrahdale

August

Rev B

HISTORY AND STATUS OF THE DOCUMENT

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
Rev A	17/08/16	C. Clay	C. Kleyweg	17/08/16	Issued for Information (Draft)
Rev B	31/08/16	C. Clay	C. Kleyweg	31/08/16	Additional information re sewerage catchments added

DISTRIBUTION OF COPIES

Revision	Date of issue	Quantity	Issued to
Rev A	17/08/16	1 PDF	Mr Anthony Silvestro (Land Group WA)
Rev B	31/08/16	1 PDF	Mr Anthony Silvestro (Land Group WA); Ms Zarina MacDonald (Burgess Design Group)

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Project Director	Colin Kleyweg
Project Manager	Christopher Clay
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Table of Contents

1. KCTT Infrastructure Servicing Report

1.1 Location

Size (ha)	Lot Number	House Number	Road Name	Suburb	Locality (Shire, City etc.)
55.47	30	496	Soldiers Road	Cardup	Serpentine - Jarrahdale

Brief Description of Site: The subject site is bounded by Soldiers Road and the Perth to Bunbury rail alignment to the east, Bishop Road and the Alcoa Freight Rail alignment to the south, the future Bett Road Reservation to the west and several lifestyle lots to the north which mainly front Little Place. The site is predominately covered by Multiple Use Wetlands as a non-perennial watercourse traverses entire site centrally from east to west.

1.2 Proposed Development Type

Development Type: Urban Residential

1.3 Proposed Yield

TYPE: (Residential, Commercial, Industrial and Other)	Number of Lots:
Urban Residential	898

In accordance with the Burgess Design Group proposed Concept Plan – Option 2 dated 27th of April 2016.

1.4 Remediation

Does the subject site feature existing buildings? If YES nominate.	YES
Number of buildings?	Four (4)
Approximate age of buildings?	20-30 years
Is asbestos likely to be an issue? YES / NO	A review of Department of Environmental Regulation Contaminated Sites mapping has revealed there is no record of contamination. The house is

	likely to have been constructed with some asbestos materials due to its age. The demolition contractor shall adhere to a management plan for the handling of asbestos.
Are septic tanks present? YES / NO	Yes
Did the site store, or have a history of storage of chemicals?	No
Likely costs associated with demolition $?	$60,000.00, assumed $30,000.00 for the dwelling and $10,000.00 for each of the sheds (includes allowance for management of asbestos).
Likely costs associated with remediation $?	Nil

1.5 Earthworks

Describe the general levels across the site	49.0m AHD in the north east corner grading downwards to 35.0m AHD on the western boundary. This is a variable grade of approximately 1.5%.
Describe AAMGL levels across the site	The Perth Groundwater atlas does not contain data for lot 30 as the contours finish halfway along lot 103 Soldier Road. We have however interpolated that the AAMGL 34.0m AHD contour is on the western boundary, rising to 36.0m AHD on the eastern boundary. This means depth to groundwater is lower in the west with greater depth to groundwater in the east.
Describe MGL levels across the site	The Perth Groundwater Atlas depicts the MGL 0.5m above the AAMGL.
Are there any groundwater bores present?	The Mundijong Whitby DWMS groundwater bores indicate 34.0m AHD on the western boundary (north-south direction) rising gradually to 35.0m AHD centrally and flattening off and remaining 35.0m AHD on the eastern boundary. This information is in line with the assumptions above.
Is Groundwater an issue on this site? **If YES, is fill likely to be required?** **If YES, what is the quantum of fill?**	Yes, only in immediate vicinity of the watercourse. Minor, subject to wastewater design.
Can cut to fill techniques be utilised? **If YES, provide quantity m³**	Yes, working the material in the outer edges of the site, particularly the north east due to the greater depth to groundwater.
What is the likely depth of topsoil (mm)?	100mm to 150mm
Are Wetlands Present? If YES describe.	YES, Multiple-Use Wetlands encompass all but the north east corner of the site and a small pocket on the northern boundary adjacent to lot 50 Little Place.
Describe the natural vegetation on the site? **Dense / Moderate / Sparse / Cleared**	Moderate, with trees flanking the watercourse and surrounding the boundary of the lot, particularly the northern and southern boundaries. Large portions of the site have been cleared.
Are there significant trees that need to be kept?	YES, along the boundary of the railway, flanking the water course and along the northern boundary as a buffer to rural residential.
What is the likely soil profile?	Guildford Clay covers the majority of the site with a pocket in the north east corner consisting of Yoganup Formation (Beach Sand) and the south west corner consisting of Bassendean sand.
Risk of acid sulphate soils? **High / Moderate / Low**	The majority of the site is moderate to low with no known risk along the northern boundary and north east corner.

Is there peat or other unsuitable materials? If YES nominate the following;	Yes, Guildford Clay
-Location	Guildford Clay covers most of the subject site with Bassendean Sand in the north east.
-Approximate Area	Guildford Clay – 40ha Bassendean Sand – 5ha Yoganup Formation – 8ha
-Likely Depth	Unknown, to be confirmed by geotechnical report.

We expect standard engineering conditions of development to require a 1m offset to clay. KCTT believe this could be reduced in areas of the site with building pads and footings designed to suit site conditions and to minimise the volume of import fill.

1.6 Roadworks

Do existing roads require upgrade?	Yes

If YES, provide details below:

Road Name	Length (Fronting site)	Road Width	Road Reserve Width	Vehicles per Day*	Speed limit
Bett Road	680m	Not formed	20m	Not applicable	Not applicable
Bishop Road	520m	6m	20m	442	50kph
Soldiers Road	740m	8m	20m	445	80kph

Note*: Vehicles per day is Monday – Friday with traffic flow in both directions.

Bett Road is currently road reserve only and it is expected the full length of the reserve adjoining lot 30 be constructed as part of this development. Bishop Road (west of Serpentine Jarrahdale Grammar school) and Soldiers Road are both existing unkerbed roads that may require further upgrade subject to review by Shire of Serpentine-Jarrahdale.

1.7 Stormwater Drainage

Does the site feature on-site drainage?	YES, a watercourse flows westward centrally through the site
If YES, is the location suitable for existing overland flow?	YES, land falls away to the west
Can infiltration drainage techniques be used?	Not likely as geological mapping suggests higher percentages of clay which limits potential for infiltration. However, some infiltration may be possible in the north east and south west corners where sand is present (assuming sand is greater than 2m depth).
How many lots are less than 300m²?	106. These lots may require stormwater drainage lot connections due to the limited space within the lot for soakwells and geological conditions adversely affecting infiltration. Stormwater drainage

	calculations will take this into consideration in the overall modelling.

The watercourse, central to the lot, provides a natural drain (living stream) for the development. Stormwater drainage modelling and cut to fill techniques will be required to ensure roads and lots at the extremities of the site can reach the designated outfall.

The key objectives for stormwater design are:

- Retention of the 1 year 1 hour ARI event at the source though the use of soakage and/or storage areas.
- Post development flows be consistent with the pre development flows for the critical 1 year and 100 year ARI events in the following locations:
    - Discharge points of all sub-catchments into waterways
    - Discharge points from the Structure Plan area
- Cross -sectional area of existing waterways must be maintained.
- Public Open Space retention basins should operate as dry basins with a minimum clearance of 0.3m between basin invert level and controlled groundwater level.
- Minor Roads should remain passable in the 5 year ARI event.
- Emergency evacuation areas given at least 2m clearance to the 100 year ARI event.

KCTT will continue to review stormwater drainage requirements, however at this early phase of the project we work on the following drainage requirements as a holistic retention requirement for the total 55.47 hectares of land (based on it all being developable): -

- 1 in 1-year event – 2% @ 300mm average depth or 1.11 hectares
- 1 in 5-year event – 5% @ 500mm average depth or 2.77 hectares
- 1 in 100-year event – 8% @ 650mm average depth or 4.44 hectares

The 1 in 100 treatment area includes all roadways and existing watercourses.

1.8 Water

Are suitable water services located adjacent to the site?	No

Provide details of the nearest possible connection points:

Material	Pipe Diameter	Location	Distance from Site (If NO)
Polyethylene	315mm	Intersection of Soldiers Road & Keirnan Street	1550m
Polyvinyl Chloride	500mm	Intersection of Soldiers Road & Watkins Road	3600m

Water Corporation planning indicates the extension of a 500mm distribution main 1km and 300mm distribution main 3km from Watkins Road. A 250mm reticulation main would then require a 1km extension to the intersection of Soldiers Road and Bishop to which a 200mm reticulation main would then traverse westbound 300m to the proposed entrance of the development. This is in accordance with Water Corporation Planning with portions of the distribution main already scheduled for extension in the near future.

An alternative and temporary arrangement is also available by extending a DN250 reticulation main 1.1km north from Lang Road of which could service 50-70 lots in an initial stage. This will be confirmed with Water Corporation such that any temporary extension of infrastructure does not prejudice final planning outcomes.

1.9 Wastewater

Are suitable wastewater services located adjacent to the site?	No

Is the development BROWNFIELD / GREENFIELD?		Greenfield. Planning exists.		
Road Name	**Pipe Diameter**	**Location**	**Depth**	**Distance from Site (If NO)**
Scott Road, Mundijong	225PVC-U	South west of subject site	Unknown, design in progress	2500m

Initial Water Corporation planning currently indicates Lot 30 Soldiers Road is split into two catchments. The northern half of the site was to be serviced by proposed pumping station B which will be connected to the main Byford WWPS. The southern half of the site falls within the proposed pumping station Mundijong A, which Water Corporation has issued information to Cossill and Webley in order to prepare the scoping report.

The following email was received by KCTT from Mr Russell Nelson of the Water Corporation on Thursday 25th August 2016: -

"This land is currently not zoned for urban development and has not been included into our considerations for the Scott Rd WWPS, that being said it does not preclude the possibility of this being included if the area can be connected via gravity sewers and it does not adversely affect the depth of the incoming sewers to the Scott Rd WWPS.

The maximum depth of the inlet sewer to the WWPS is set at approx. 6m below NS, if as per your email below this is to increase to 11m this would not be acceptable.

Have you designed final lot levels as yet? If so can you please provide this information as well as any prelim sewer design info."

KCTT have forwarded plans showing calculations for the preliminary sewer design across the whole of the current layout for Lot 30 Soldiers Road which comply with the above requirements. KCTT will continue our early liaison and negotiation with the Water Corporation.

Can the development be serviced adequately without the need for import fill? If NO, describe the requirements;	Yes
Is groundwater likely to be an issue? **Is dewatering required?**	Groundwater is unlikely to generate a requirement for import fill, however is likely to be present in deeper excavations. The presence of groundwater in excavations may have implications for treatment of ASS materials. This

	will be reviewed by an experienced and competent environmental consultant.

1.10 Gas

Are suitable gas services located adjacent to the site?		Yes
Road Name	**Pipe Diameter**	**Location**
Soldiers Road	150 ST PVC – 5.3HP 1900kPa	Development side in service road
Bishop Road	150 ST – 6.2HP 1900kPa	Development side in service road

Gas services will be designed in conjunction with ATCO Gas.

1.11 Power

Existing Services Location	**Underground/Overhead**	**Location**	**Type**
Bishop Road	Overhead	South side of service road.	HV
Soldiers Road	Overhead	East side of road reserve.	LV
Little Road	Overhead	East & south side of road reserve south.	LV, HV

Power services immediately adjacent to the site are likely to be suitable for connection. An experienced electrical consultant will be used for all liaison with Western Power. For future servicing of this site, a network of underground HV and LV is expected with transformer/switchgear sites provided approximately for every 50 to 60 residential lots (or their load equivalent for other land uses).

1.12 Telecommunications

	YES/NO	If YES/NO nominate type (NBN / Velocity Fibre Optic / Standard Telstra Copper / Other) and location?	If NO, distance from site (m)?
Are existing underground services available and suitable for connection immediately adjacent to the site?	YES	Telstra	Bishop Road, South Side of Road Reserve

Telecommunication services will be designed by and experienced communications consultant and liaised with either NBN or Telstra depending on the nearest fibre exchange. The Whitby Town development has been serviced by NBN giving reasonable cause for lot 30 Soldiers Road.

1.13 Retaining Walls

Does the site have topography requirements that increase the general retaining requirements?	**YES**
What is the average lot size (m^2)?	$225m^2$ – $450m^2$
How many lots are less than $300m^2$?	106 These lots may require stairs in front of their lot depending on the earthworks design.
Grade of the natural surface?	1.5% as the overall site is relatively flat.
Average height of walls?	370mm – 740mm typically

KCTT will review the designs for retaining walls to minimise the usage of 370mm height limestone walls in 100mm height steps.

1.14 Summary

Key Points for Discussion	Risk for Developer	Mitigation Strategy
Geology – Guildford Clay	Clay grading and excess fill. Depth to clays should be modelled to a minimum of 1.5m.	Delineated Geotechnical testing to check depths to clays. If reactive clays are near to the surface, clay grading may be required.
Acid Sulphate Soils	Remediation cost and potential health hazard	Detailed ASS management report
Sewer strategy for central catchment	Insufficient depth leading to excess fill. Delays in WWPS construction.	Establish sewer strategy early in order to integrate our development with Water Corporation planning and design.
Water strategy for central catchment	Delays in extension of distribution main.	Engage with Water Corporation early to monitor the progress of water mains extension.
Management of 1 in 100 year ARI flood and stormwater retention	Areas required for drainage storage adjacent to existing water course alignment.	Review requirements for stormwater drainage retention offline from the existing watercourse alignment.

APPENDIX 6:
INFRASTRUCTURE SERVICING LETTER (STANTEC)

Stantec Australia Pty Ltd
Ground Floor, 226 Adelaide Terrace
Perth WA 6000
Tel: +61 8 6222 7000
Email: enquiries.pth@stantec.com www.stantec.com

7 April 2021

Enquiries: Jermayne Fabling
Project No: 32970

Burgess Design Group
PO Box 374
Northbridge WA 6003

Attention: Mr. Mark Szabo

Dear Mark

RE: LOT 30 SOLDIERS ROAD, CARDUP
INFRASTRUCTURE SERVICING

We refer to the MRS amendment criteria outlined within correspondence from the Department of Planning, Lands and Heritage dated 17 April 2018 and providing the following information.

Wastewater Servicing

The Water Corporation have advised that Lot 30 Soldiers Road and Lot 102 Bishop Road would be served by the proposed Scott Road WWPS to be located in Scott Road, Mundijong. The Water Corporation have advised that funding for the construction of this WWPS is included within their current 5 Year Capital Works Programme and that the scoping report for the WWPS has been endorsed. Please see the attached catchment plan by Cossill & Webley.

It is anticipated that approximately 500m of DN375 and 1,800m of DN300 gravity sewer lines would be required to be extended to provide a wastewater outfall to Lot 30 Soldiers Road following completion of the WWPS, in the event that other development fronts have not progressed in this vicinity. It is estimated that the cost of extending the gravity sewer mains from the proposed WWPS to Lot 30 Soldiers Road would be in the order of $1,800,000 and would likely be reimbursable by Water Corporation under their usual arrangements. The timing of reimbursement of the DN375 component would be subject to its timing on the Capital Works Programme.

Water Servicing

The Water Corporation have advised that the water reticulation servicing of the development will be based on the timing the development proceeds, timing of adjacent development fronts and timing of Water Corporation water tank and reservoir upgrades. The Water corporation have advised that the development will be either serviced by extension of distribution mains north from the Mundijong Reservoir system or extension of distribution mains south from the Byford Gravity zone. We anticipate both options to be in the order of $3,000,000 with this cost likely to be reimbursable by Water Corporation under their usual arrangements.

In the interim, it is anticipated that retic connections for initial stages would be possible from water reticulation mains in the adjacent Whitby development.

Power Servicing

The Western Power DFIS system suggests that the existing Western Power network surrounding the site consists of 22kV Overhead High Voltage Distribution in Bishop Road, with this HV feeder also running along the eastern side of Soldiers Road. It is estimated that the total Maximum demand required for the proposed subdivision will be 4.21MVA

and accordingly the HV distribution system will be required to be reticulated via 22kV cables within the subdivision to switchgears at various points throughout the subdivision.

The capacity within the existing HV network to provide for the forecast load will need to be determined closer to the commencement of construction in consultation with Western Power to establish if network reinforcements are required. Should a new feeder be required from the Byford Zone Substation to service the development it is estimated that the cost of installing this would be in the order of $1,900,000 and the developer would need to negotiate with Western Power regarding any funding reimbursement terms, subject to adjacent development fronts at that time. At this time the Western Power Network Mapping Capacity tool does not indicate any future network capacity upgrades are proposed.

We confirm that the proposal for development of Lot 30 Soldiers Road will not detrimentally impact upon the staging timeframes of other urban land and confirm that servicing of adjacent developments is being considered within the Water Corporation's planning for servicing of this development.

Please contact the undersigned should you have any further queries.

Yours sincerely

Stantec Australia Pty Ltd

Jermayne Fabling
Principal, Civil Project Engineer

Encl (Interim Type 90 Mundijong PS – Catchment Plan)

PARAMETER	INITIAL	INTERIM	ULTIMATE
PUMPING FLOW RATE(S):	30 L/s	50 L/s	90 L/s
MAXIMUM INFLOW TO PUMP STATION: GSDF(L/S)	22.6 L/s	37.6 L/s	67.7 L/s
NETT DEVELOPMENT AREA	84.4 Ha	140.6 Ha	253.2 Ha
GROSS DEVELOPMENT AREA	101.7 Ha	169.5 Ha	305.1 Ha
STORAGE VOLUME			
– SYSTEM STORAGE			247.6 m^3
– STORAGE TANK VOLUME			232.8 m^3
TOTAL			480.4 m^3
ODOUR CONTROL BUFFER (TYPE 90)			30m

LEGEND

- EXISTING GRAVITY SEWER
- PROPOSED GRAVITY SEWER
- GRAVITY SEWER CONTROL LINE
- PROPOSED DN375 SEWER PRESSURE MAIN ROUTE
- 2.31 DESIGN FLOW (L/s)
- WWPS CATCHMENT AREA BOUNDARY
- SUB-CATCHMENT AREA BOUNDARY
- CATCHMENT AREA WITH DEVELOPMENT ANTICIPATED TO COMMENCE WITHIN 10 YEARS.
- CATCHMENT AREA WITH DEVELOPMENT ANTICIPATED TO OCCUR AFTER 10 YEARS.
- NS 27.0 NATURAL SURFACE LEVEL ie RL 27.0

NOTES

1. FLOW REDUCTIONS BASED ON THE EXPECTED FLOWS ENTERING THE INTERIM TYPE 90 / ULTIMATE TYPE 180 ARE: 95% OF TOTAL FLOWS FROM THE NORTH OF THE CATCHMENT, 35% OF THE TOTAL FLOWS FROM THE EAST OF THE CATCHMENT, AND 40% OF THE TOTAL FLOWS FROM THE SOUTHERN PORTION OF THE CATCHMENT.
2. THE REMAINDER OF THE FLOWS AND DISCHARGE OF 2 DN600 PRESSURE MAINS WILL BE PART OF THE ULTIMATE TYPE 1000 WWPS FOR THE ENTIRE CATCHMENT, AND AT THIS TIME FLOWS WILL BYPASS THE WWPS SITE.
3. NODE NUMBERS ARE AS PER WC SEWER PLANNING SHEET SD086 - BYFORD

0m 200 400 600m
1:10000

REV	DATE	DRN	CKD	APP	AMENDMENT
C	10.10.18	JBA	MW		INVERTS REVISED, SCOPING REPORT REV 2 SUBMISSION
B	14.06.18	JBA	PV	M WALLIS	REVISED AS PER WC COMMENTS, SCOPING REPORT RE-SUBMISSION
A	06.03.18	JBA	PV	M WALLIS	INITIAL SCOPING REPORT SUBMISSION

Cossill & Webley CONSULTING ENGINEERS
Mailing Address: PO Box 680, Subiaco WA 6904
Street Address: B12 (Level 2) 431 Roberts Road, Subiaco WA 6008
T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: GOLDEN RIVER DEVELOPMENTS (WA) PTY. LTD.
APPROVED: 10.10.18
DESIGNED: JBA
SCALE: 1:10000
PROJECT: BYFORD - SCOTTS ROAD INTERIM WWPS (CS01408)
TITLE: INTERIM TYPE 90 MUNDIJONG PS CATCHMENT PLAN
WAPC No.
DRAWING No.: 6265-PS-01
REVISION: C
ORIGINAL SIZE: A1

P:\6265 Scott Road Pump Station\Acad\6265-PS-01 catchment.dwg, 10/10/2018 8:04:37 AM, jeffa, Digital Signing PDF.pc3, 1:1, - CW Reference

APPENDIX 7:
BUSHFIRE MANAGEMENT PLAN (BUSHFIRE SAFETY CONSULTING)

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: Lot 30 (#496) Soldiers Road, Cardup

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 22 Month February Year 2022

Report author or reviewer: Rohan Carboon (BPAD 23160)

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☐ Level 3 practitioner ☑

If accredited please provide the following.

BPAD accreditation number: 23160 Accreditation expiry: Month January Year 2023

Bushfire management plan version number: 2.0

Bushfire management plan date: Day 9 Month March Year 2022

Client/business name: Landgroup WA

	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)?		✔
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 bushfire protection criteria elements)?		✔

Is the proposal any of the following (see SPP 3.7 for definitions)?

	Yes	No
Unavoidable development (in BAL-40 or BAL-FZ)		✔
Strategic planning proposal (including rezoning applications)	✔	
High risk land-use		✔
Vulnerable land-use		✔

None of the above ☐

Note: Only if one (or more) of the above answers in the tables is yes should the decision maker (e.g. local government or the WAPC) refer the proposal to DFES for comment.

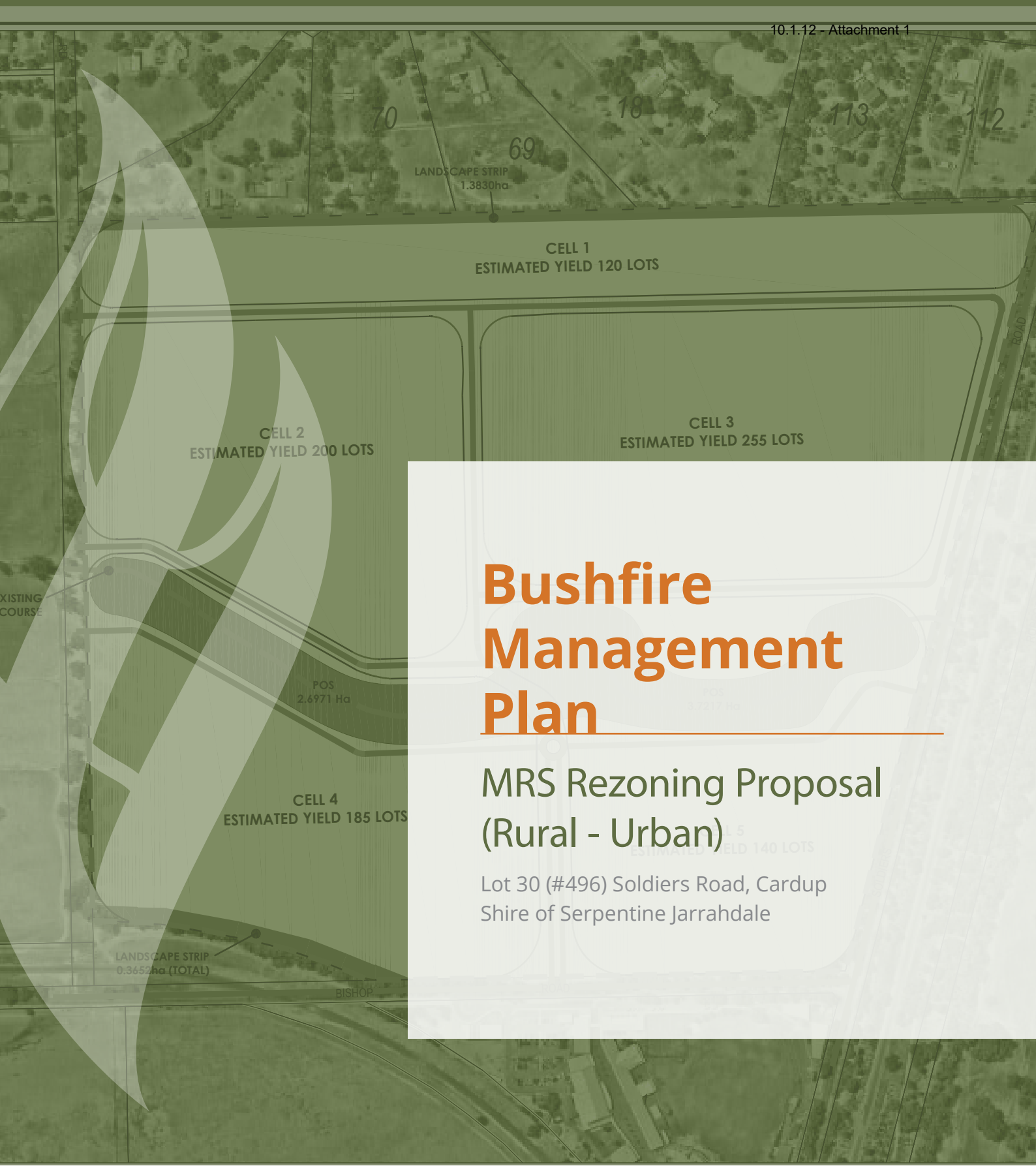
Why has it been given one of the above listed classifications (E.g. Considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

BMP supports a strategic MRS rezoning proposal - (Rural - Urban)

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

Signature of report author or reviewer 

Date 9/3/2023



Bushfire Management Plan

MRS Rezoning Proposal (Rural - Urban)

Lot 30 (#496) Soldiers Road, Cardup
Shire of Serpentine Jarrahdale

bushfiresafety CONSULTING
Science. Culture. Solutions.

Prepared For:
Landgroup WA
9 March 2022
Version 2.0

bushfiresafetyconsulting.com.au

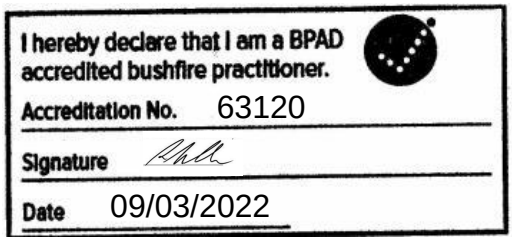
Document Information

Prepared for: Landgroup WA

Project Name: MRS Re-zoning Proposal (Rural – Urban)

Address: Lot 30 (#496) Soldiers Road, Cardup WA 6122

Prepared by: Rohan Carboon, Bushfire Safety Consulting Pty Ltd



Document Control

Bushfire Management Plan – MRS Re-zoning Proposal (Rural – Urban)			
REPORT VERSION	**PURPOSE**	**AUTHOR/REVIEWER AND ACCREDITATION DETAILS**	**DATE SUBMITTED**
V1.0	Draft for Review	Rohan Carboon (BPAD 23160)	4/03/2022
V2.0	Final for submission	Rohan Carboon (BPAD Level 3 - 23160)	9/03/2022

Front cover photo: Post development bushfire hazard level assessment

Bushfire Safety Consulting Pty Ltd
PO Box 84
STONEVILLE WA 6081

Tel: 0429 949 262
Email: hello@bushfiresafetyconsulting.com.au
Web: www.bushfiresafetyconsulting.com.au

EXECUTIVE SUMMARY

This Bushfire Management Plan (BMP) has been prepared to support an MRS amendment proposal (zoning change from rural to urban) at Lot 30 (#496) Soldiers Road, Cardup. The landholding is currently zoned 'Rural' under the Metropolitan Region Scheme (MRS). It is proposed to rezone the landholding to 'Urban' to facilitate the urban development of the site. The site is approximately 40km south-east of the Perth CBD.

The study area includes Lot 30 Soldiers Road Cardup and is herein referred to as "the site". The site is dominated by rural paddocks supporting pasture grasses and livestock grazing. Eucalypt trees occur in the drainage line that transects east-west through the middle of the site and in shelterbelts around the perimeter. Rural land lies to the west and south and rural residential lots occur to the north. The Serpentine-Jarrahdale Grammar School is located on Bishop Road immediately south of the site.

The initial broad concept for the site shows potential residential cell areas and two major road connections to the existing public road network. Minimal detail is confirmed, the concept will be finalised and confirmed to support a Local Structure Plan (LSP) at the next stage in the planning process.

The entire site is declared bushfire prone on the Map of Bushfire Prone Areas of WA. The existing bushfire hazard level rating is predominantly moderate over the site and surrounding it to the north, west and south reflecting the rural landscaped and pasture paddocks. Extreme hazard occurs in the corridors of eucalypt forest and woodlands and east of the site in Soldiers Road Reserve and the Railway Reserve.

At post development, the site is exposed to bushfire attack predominantly from the west, east and south. An Asset Protection Zone (APZ) on perimeter roads and landscaped parklands can be readily accommodated within the site to ensure future development consistent with the rezoning can achieve acceptable standards. Some Public Open Space (POS) areas are likely to be developed and more details will be outlined in the LSP process with landscape and maintenance plans.

The BMP addresses Policy measure 6.2, 6.3 and 6.9 of SPP 3.7 because it demonstrates that compliance with the bushfire protection criteria in the Guidelines for Planning in Bushfire Prone areas can be complied with at subsequent planning stages.

A further, more comprehensive Bushfire Management Plan complying with these policy clauses will be developed at LSP stage.

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TABLES

FIGURES

APPENDICES

1 PROPOSAL DETAILS

This Bushfire Management Plan (BMP) has been prepared to support an MRS amendment proposal at Lot 30 (#496) Soldiers Road. It is proposed to rezone the landholding from 'Rural' to 'Urban' to facilitate future urban development of the site

Figure 1 outlines how the site could potentially be developed with residential development and road connectivity to existing public roads. The specific detail will outline in the Local Structure Plan stage and the BMP will be updated to respond when more detail is provided.

At present, the lot contains rural paddocks and one residential dwelling. The site is bordered by Soldiers Road to the east and Bishop Road to the south. Historically the site has been used for agricultural purposes, much of the native under-story vegetation has been removed and eucalypt trees are generally retained only in the drainage lines and perimeter of the site. There are also some livestock shelterbelts of eucalypt trees.

To the north, the land is developed into a rural-residential estate (Figure 2). And rural landscapes occur west and south of the site. A road and railway reserve interfaces with the eastern side of the site which contains the intact native vegetation. Public roads interface with the east and south perimeters.

This Bushfire Management Plan (BMP) has been prepared to support the re-zoning proposal and addresses conditions relevant to this and responds to the performance criteria in the *Guidelines for Planning in Bushfire Prone Areas* V1.4 (WAPC et.al. 2021). When a final LSP proposal is drafted, an amended BMP will be required to address conditions relevant to the final proposal and to provide detailed responses to the performance criteria in the *Guidelines for Planning in Bushfire Prone Areas* V1.4 (WAPC et.al. 2021).

Location details:	Lot 30 (No. 496) Soldiers Road Cardup
Assessment date:	February, 2022
Prepared by:	Bushfire Safety Consulting
Accreditation level:	Level 3 BPAD Practitioner
Accreditation number:	BPAD 23160
Accreditation expiry date:	31st January, 2023
Date aerial photo:	January 2022

FIGURE 1
CONCEPT PLAN

0 50 100 150 200m
SCALE 1:4500 @ A3
DATE: MARCH 2022
NORTH

LEGEND:
SUBJECT LAND

SOURCE OF PHOTOGRAPHY: NEARMAP

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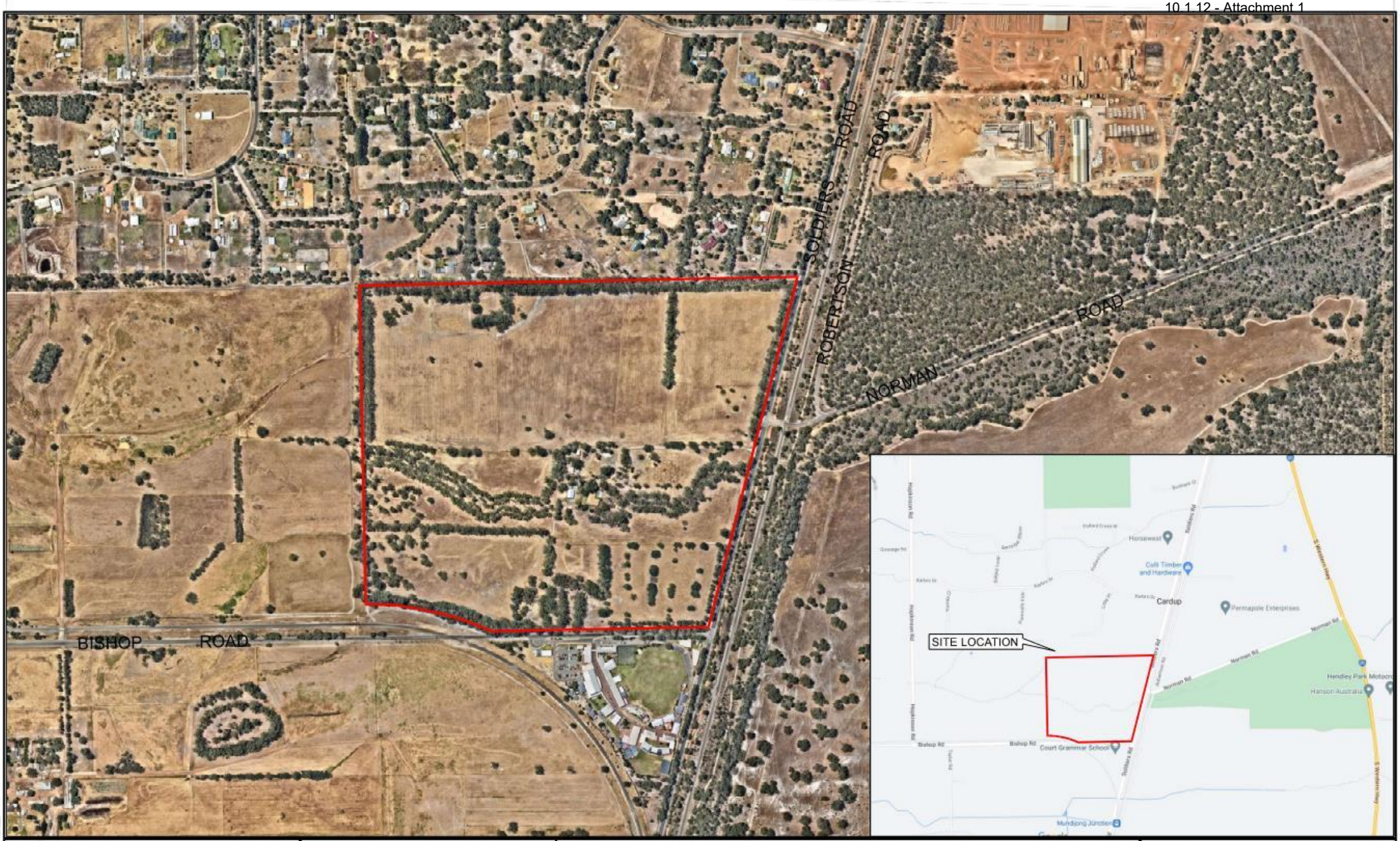

Location details:	Lot 30 (No. 496) Soldiers Road Cardup
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Accreditation number:	BPAD 23160
Accreditation expiry date:	31st January, 2023
Date aerial photo:	January 2022

FIGURE 2
SITE LOCATION PLAN

0 100 200 300m

SCALE 1:10 000 @ A4
DATE: FEBRUARY 2022

NORTH

LEGEND

SUBJECT LAND

Base mapping supplied by Nearmap & Google Maps

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Policy and Guidelines

1.1 Application of SPP 3.7

The *State Planning Policy No. 3.7: Planning in Bushfire Prone Areas (SPP 3.7)* provides the foundation for land use planning to address bushfire risk management in Western Australia. It is used to inform and guide decision makers, referral agencies and land owners/proponents to help achieve acceptable bushfire protection outcomes.

The policy contains objectives and policy measures as well as reference to the bushfire protection criteria as outlined in the Guidelines for Planning in Bushfire Prone Areas (WAPC 2021 V1.4; the Guidelines). The policy applies to this re-zoning proposal because the site is located in a designated bushfire prone area on the WA Map of Bushfire Prone Areas (Figure 3).

The following policy measures will need to comply with SPP 3.7:

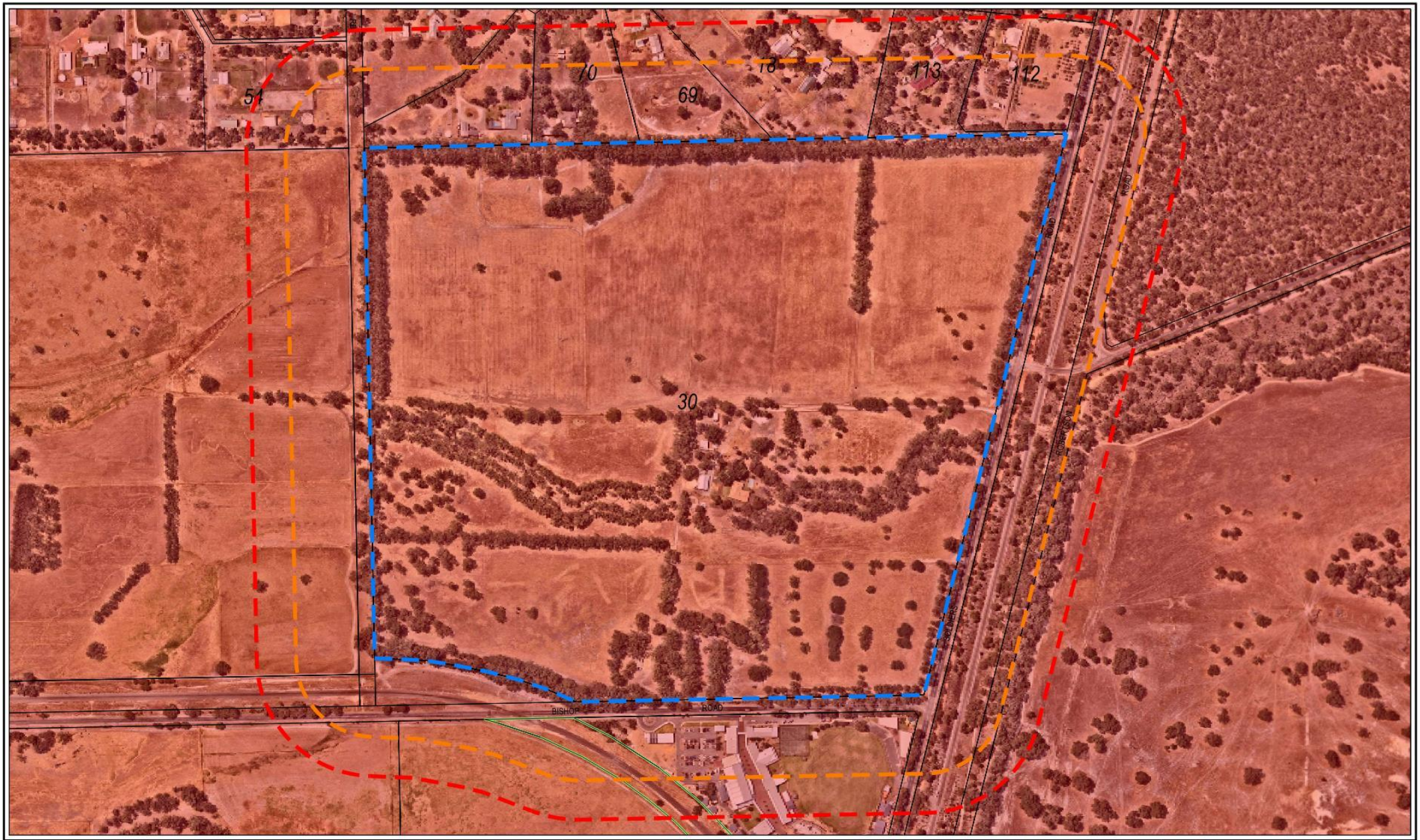
Table 1. Policy measures

Policy Measure 6.2	The re-zoning application is located within a designated bushfire prone area (Figure 3) and will have a Bushfire Hazard Level above low and a Bushfire Attack Level rating above BAL-LOW.
Policy Measure 6.3	Policy 6.3 applies meaning that any strategic planning proposal be accompanied by: - BHL assessment results - Identification of relevant issues; and - Demonstration of compliance with the guidelines
Policy Measure 6.9	When making decisions on strategic planning proposals, the advice of the State/relevant agencies/authorities responsible for biodiversity conservation management and environmental protection be sought if substantial clearing of locally significant native vegetation is proposed.

1.2 Guidelines for Planning in Bushfire Prone Areas V1.4 (2021)

The Department of Planning has released the *Guidelines for Planning in Bushfire Prone Areas V1.4 (2021).* The requirements of this document are accommodated within this BMP.

The *Guidelines for Planning in Bushfire Prone Areas V 1.4(2021)* is intended to inform and guide decision makers, referral authorities and proponents to achieve acceptable bushfire protection outcomes, including expectations at the different stages of planning.



Location details:	Lot 30 (No. 496) Soldiers Road Cardup
Assessment date:	February, 2022
Prepared by:	Bushfire Safety Consulting
Accreditation level:	Level 3 BPAD Practitioner
Accreditation number:	BPAD 23160
Accreditation expiry date:	31st January, 2023
Date aerial photo:	January 2022

FIGURE 3
BUSHFIRE PRONE AREAS

0 50 100 150 200m
SCALE 1:4500 @ A3
DATE: FEBRUARY 2022
NORTH

LEGEND:
- SUBJECT LAND
- ASSESSMENT AREA (150m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE
- ASSESSMENT AREA (100m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE
- BUSHFIRE PRONE AREAS

SOURCE OF PHOTOGRAPHY: NEARMAP

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2 ENVIRONMENTAL CONSIDERATIONS

2.1 Native Vegetation – modification and clearing

The site is primarily used for cattle grazing and the retained native vegetation has been highly modified. There is no native understorey vegetation, leaving strips of eucalypt trees around the boundary and in the drainage line with grass understorey only.

There are no environmental restrictions to limit the future planning process and the development of a Local Structure Plan which will assess issues in more details.

2.2 Revegetation/Landscape Plans

There are no landscape or revegetation plans for the site. These plans will be developed at the next stage in planning and bushfire implications will be thoroughly assessed.

3 BUSHFIRE ASSESSMENT RESULTS

Bushfires are common in the Shire of Serpentine Jarrahdale, local brigades respond to numerous bushfires throughout the district annually. Given the obvious bushfire threat in the area, this BMP plays a critical role in ensuring that the re-zoning of the land and the inherent possibility of an increase in usage and intensity appropriately mitigates the risk from bushfire in the appropriate planning stages.

3.1 Assessment Inputs

The methodology used to assess the site is outlined in the *Guidelines for Planning in Bushfire Prone Areas V1.4 (2021).* The concept plan for the site is very high level and will be confirmed at LSP stage. Because of the potential for the re-zoning of the site to introduce greater intensification of the land use for the site, a strategic level bushfire hazard assessment is required as is an assessment against the post development hazard rating based on the concept plan. A BAL Contour map is not provided because the concept plan is preliminary and lot and road layouts are not confirmed.

A detailed assessment and BAL implications will be assessed at LSP stage.

Assessing bushfire threat at the site-specific level accounts for the predominant class of vegetation on the site and surrounding area for a minimum of 150 metres, as shown in Figure 4.

3.1.1 Vegetation Classification

The site is largely cleared grazing land, mostly covered in pasture grasses. Eucalypt shelter belts and strips of vegetation occur around the perimeter of the site. A 40-50m wide strip of eucalypts bisect the site from east to west through the middle and eucalypts surround the farmhouse, sheds and outbuildings located in the centre of the site.

A small area of eucalypt vegetation occurs in the south-west corner of the site and on the southern boundary opposite the Serpentine-Jarrahdale Grammar School is to the south of the site. Small area of fuel managed vegetation occurs in the school grounds and surrounding dwellings north of the site. The pre-development vegetation has been mapped in Figure 4.

The post development vegetation plots are found in Figure 4A and demonstrate how internal vegetation would be reduced to accommodate a future residential development.

The vegetation plots on and surrounding the site and within 150 metres of the site boundary are found in Figure 4 with plot descriptions below.

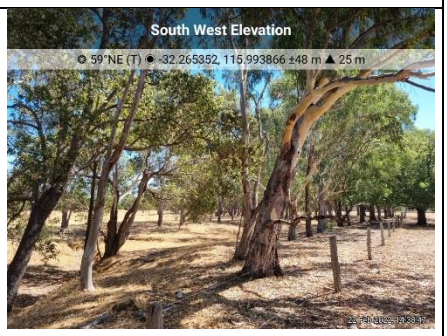
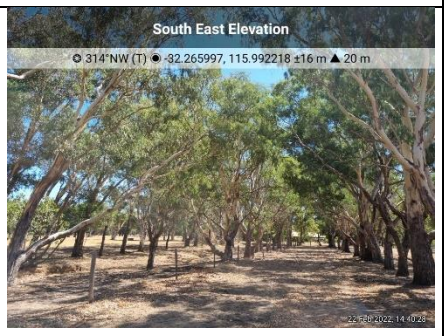
Photo ID: 1 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Two rows of eucalypt trees. Open forest to 15m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 2 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Mixed species to 15m high; 30 – 70% foliage cover, xanthorrhoea scrub and low shrubs on understorey.	
Photo ID: 3 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Open eucalypt forest with wandoo and other eucalypts to 16m high; 30 – 70% foliage cover, grass understorey and leaf litter.	
Photo ID: 4 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Open eucalypt forest to 15m high; 30 – 70% foliage cover, grass understorey and leaf litter.	

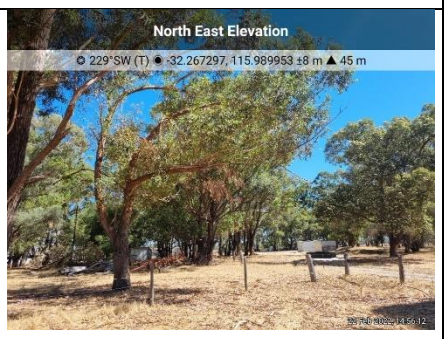
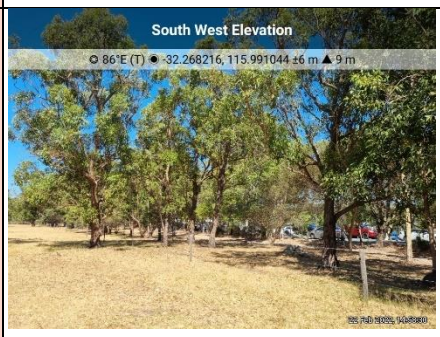
Photo ID: 5 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Marri eucalypts to 16m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 6 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Eucalypt forest to 17m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 7 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Mixed eucalypt forest to 18m high; 30 – 70% foliage cover, grass and leaf litter in the understorey.	
Photo ID: 8 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Eucalypt vegetation insde the site and in the road reserve to 15m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 9 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Two rows of eucalypt trees to 20m high; 30 – 70% foliage cover, grass, dead branches and heavy leaf litter and ribbon bark in the understorey.	

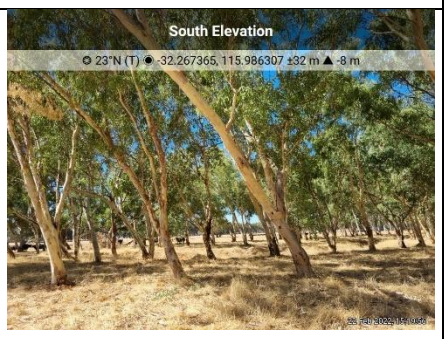
Photo ID: 10 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Open eucalypt forest to 140m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 11 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Eucalypt rows to 17m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 12 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Wandoo eucalypts forest to 14m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 13 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Mixed eucalypt trees to 16m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 14 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Eucalypt forest to 20m high; 30 – 70% foliage cover, grass understorey.	

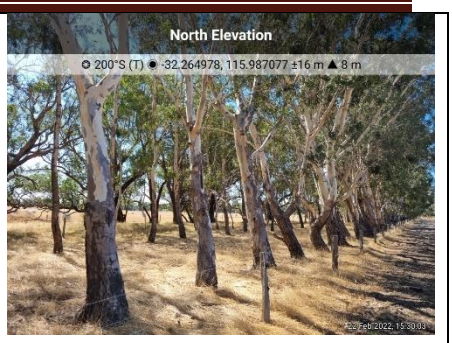
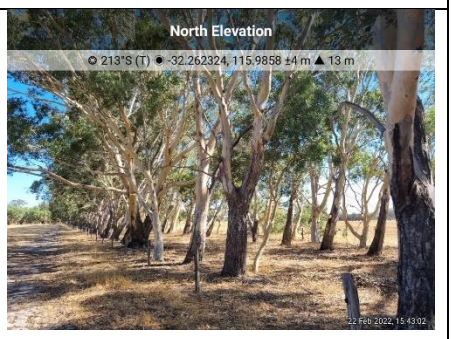
Photo ID: 15 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Rows of eucalypt trees to 20m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 16 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Open eucalypt forest and rows of trees to 18m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 17 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Open eucalypt forest and rows of trees to 18m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 18 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Open eucalypt forest and rows of trees to 18m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 19 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Open eucalypt forest and rows of trees to 18m high; 30 – 70% foliage cover, grass understorey.	

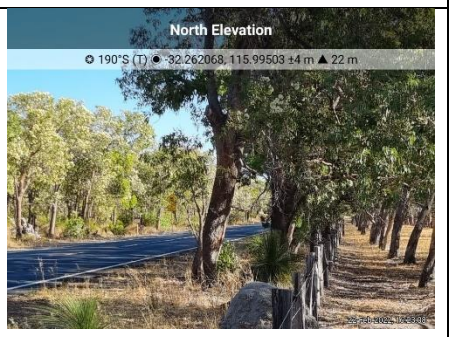
Photo ID: 20 **Plot Number:** 1 Class: A Forest **Description/justification of classification** Open eucalypt forest and rows of trees to 18m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 21 **Plot Number:** 1 Class: A Forest **Description/justification of classification** Open eucalypt forest and rows of trees to 18m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 22 **Plot Number:** 1 Class: A Forest **Description/justification of classification** Eucalypt trees inside the site and in the road reserve to 18m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 23 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Eucalypt trees inside the site and in the road reserve to 18m high; 30 – 70% foliage cover, grass understorey.	
Photo ID: 24 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Remnant vegetation including marri eucalypts to 20m high; 30 – 70% foliage cover, xanthorrhoea, low shrubs and grass understorey.	

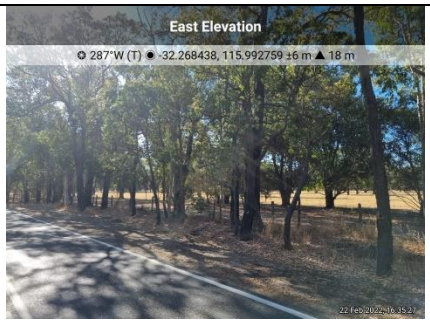
Photo ID: 25 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Remnant vegetation including marri eucalypts to 20m high; 30 – 70% foliage cover, xanthorrhoea, low shrubs and grass understorey..	
Photo ID: 26 **Plot Number:** 1 Class: A Forest **Description/justification of classification** Remnant vegetation including marri eucalypts to 20m high; 30 – 70% foliage cover, xanthorrhoea, low shrubs and grass understorey.	
Photo ID: 27 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Remnant vegetation including marri eucalypts to 20m high; 30 – 70% foliage cover, xanthorrhoea, low shrubs and grass understorey.	
Photo ID: 28 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Remnant vegetation including marri eucalypts to 20m high; 30 – 70% foliage cover, xanthorrhoea, low shrubs and grass understorey.	
Photo ID: 29 **Plot Number:** 1 **Vegetation classification or exclusion clause:** Class: A Forest **Description/justification of classification** Remnant vegetation including marri eucalypts to 20m high; 30 – 70% foliage cover, xanthorrhoea, low shrubs and grass understorey.	

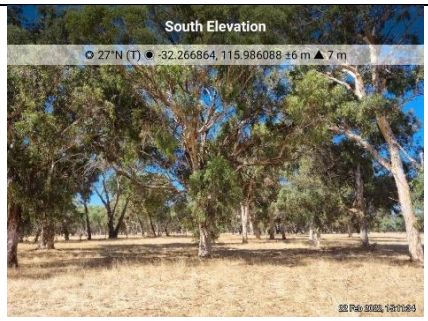
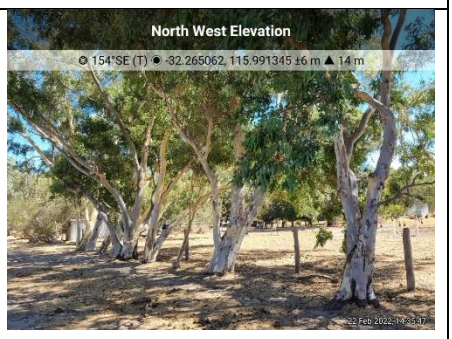
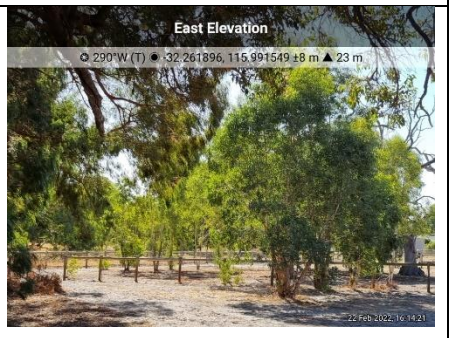
Photo ID: 30 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Eucalypt trees 14m high; 10 – 30% foliage cover. Grass understorey in paddocks.	
Photo ID: 31 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Eucalypt trees 14m high; 10 – 30% foliage cover. Grass understorey in paddocks.	
Photo ID: 32 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Row of eucalypt trees 14m high; 10 – 30% foliage cover. Grass understorey in paddocks.	
Photo ID: 33 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Eucalypt trees 14m high; 10 – 30% foliage cover. Grass understorey in paddocks.	
Photo ID: 34 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Mixed species including eucalypt and acacia trees 14m high; 10 – 30% foliage cover.	

Photo ID: 35 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Mixed species including eucalypt and acacia trees 14m high; 10 – 30% foliage cover.	
Photo ID: 36 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Eucalypt trees 10 - 30m high; 10 – 30% foliage cover. Grass understorey.	
Photo ID: 37 **Plot Number:** 2 **Vegetation classification or exclusion clause:** Class: B Woodland **Description/justification of classification** Remnant vegetation including marri eucalypts to 20m high; 10 – 30% foliage cover, some low shrubs and grass understorey.	
Photo ID: 38 **Plot Number:** 3 **Vegetation classification or exclusion clause:** Class: C Shrubland **Description/justification of classification** Mixed shrubs including xanthorrhoea <2m high; greater than 30% foliage cover.	
Photo ID: 39 **Plot Number:** 3 **Vegetation classification or exclusion clause:** Class C: Shrubland **Description/justification of classification** Mixed shrubs including xanthorrhoea <2m high; greater than 30% foliage cover.	

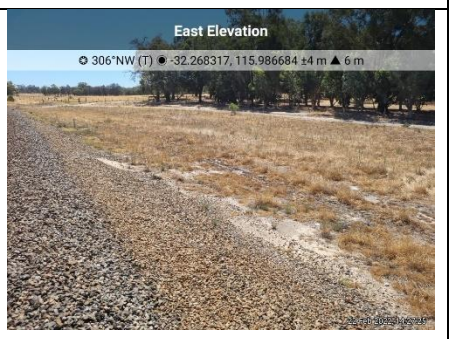
Photo ID: 40 **Plot Number:** 3 **Vegetation classification or exclusion clause:** Class C: Shrubland **Description/justification of classification** Mixed shrubs and grasses including xanthorrhoea <2m high; greater than 30% foliage cover.	
Photo ID: 41 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 42 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in railway reserve.	
Photo ID: 43 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock grazed by cattle.	
Photo ID: 44 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	

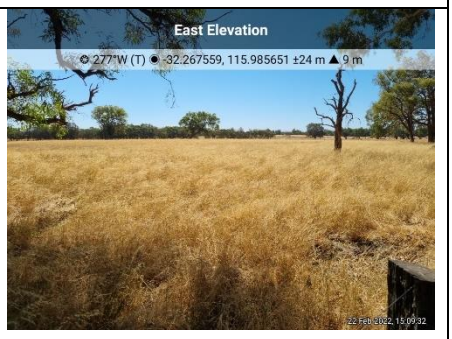
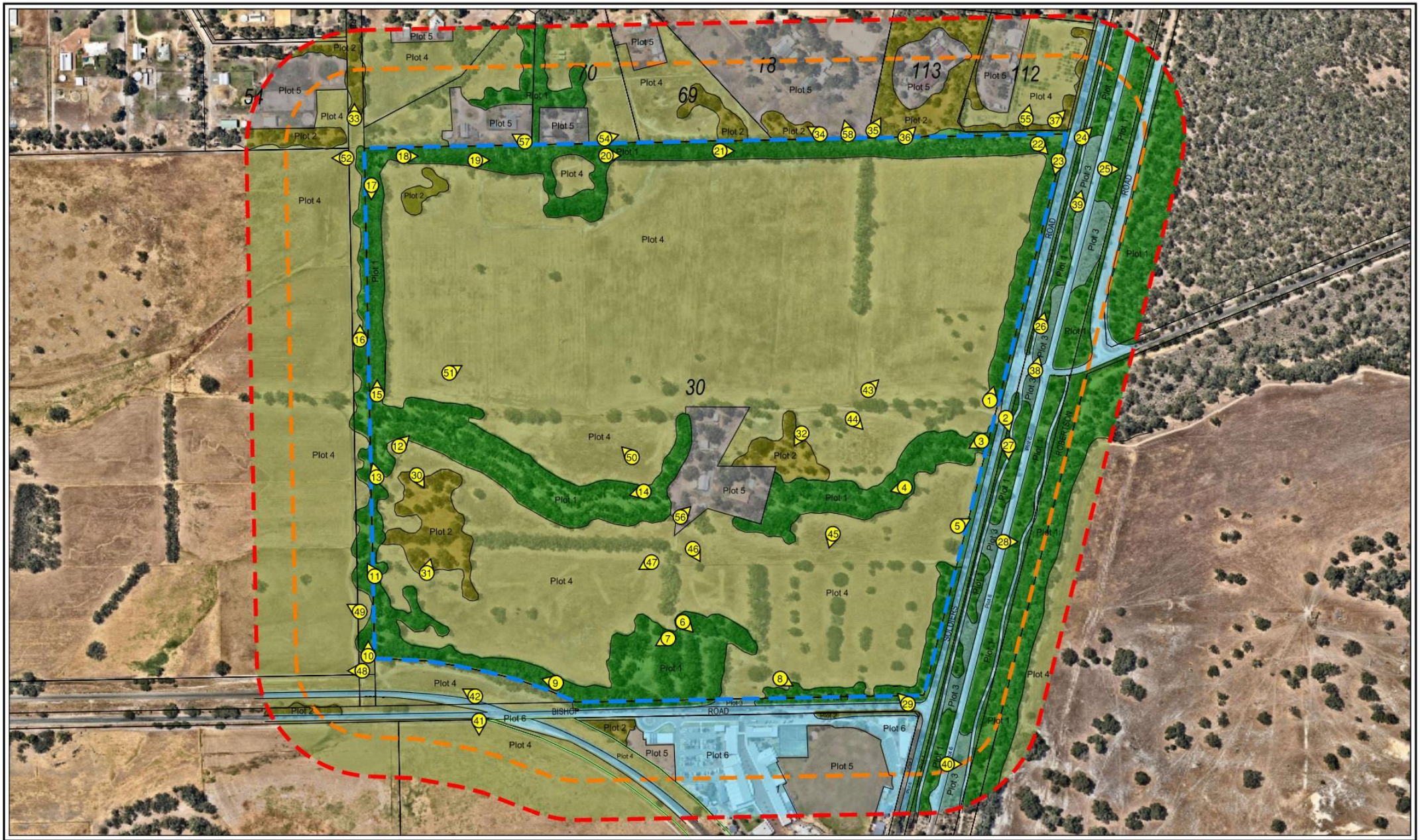
Photo ID: 45 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 46 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 47 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 48 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 49 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	

Photo ID: 50 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 51 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 52 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock, some hay cutting.	
Photo ID: 53 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	
Photo ID: 54 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock.	

Photo ID: 55 **Plot Number:** 4 **Vegetation classification or exclusion clause:** Class: G Grassland **Description/justification of classification** Grass fuels in rural paddock with olive plantation in background.	
Photo ID: 56 **Plot Number:** 5 **Vegetation classification or exclusion clause:** Exclusion Clause 2.2.3.2(f) **Description/justification of classification** Low threat vegetation; managed lawns and gardens. Irrigated mown lawn	
Photo ID: 57 **Plot Number:** 5 **Vegetation classification or exclusion clause:** Exclusion Clause 2.2.3.2(f) **Description/justification of classification** Low threat vegetation in the background; managed lawns and gardens. Irrigated mown lawn	
Photo ID: 58 **Plot Number:** 5 **Vegetation classification or exclusion clause:** Exclusion Clause 2.2.3.2(f) **Description/justification of classification** Low threat vegetation; low fuel horse paddocks.	

3.1.2 Effective Slope

The topography of the site is consistently a gentle downslope from the east corner to the western boundary. There is a fall of approximately 10 metres over the 800 metres length and average slope is less than 1 degree. It is flat or upslope to the north and west and directly south of the site.



Location details:	Lot 30 (No. 496) Soldiers Road Cardup
Assessment date:	February, 2022
Prepared by:	Bushfire Safety Consulting
Accreditation level:	Level 3 BPAD Practitioner
Accreditation number:	BPAD 23160
Accreditation expiry date:	31st January, 2023
Date aerial photo:	January 2022

FIGURE 4 - PRE DEVELOPMENT VEGETATION CLASSIFICATION MAP

0 50 100 150 200m

SCALE 1:4500 @ A3
DATE: FEBRUARY 2022

NORTH

LEGEND:

- SUBJECT LAND
- ASSESSMENT AREA (150m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE
- ASSESSMENT AREA (100m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE

- PLOT 1 - CLASS A FOREST
- PLOT 2 - CLASS B WOODLAND
- PLOT 3 - CLASS C SHRUBLAND
- PLOT 4 - CLASS G GRASSLAND
- PLOT 5 - EXCLUSION CLAUSE 2.2.3.2(f)
- PLOT 6 - EXCLUSION CLAUSE 2.2.3.2(e)

SOURCE OF PHOTOGRAPHY: NEARMAP

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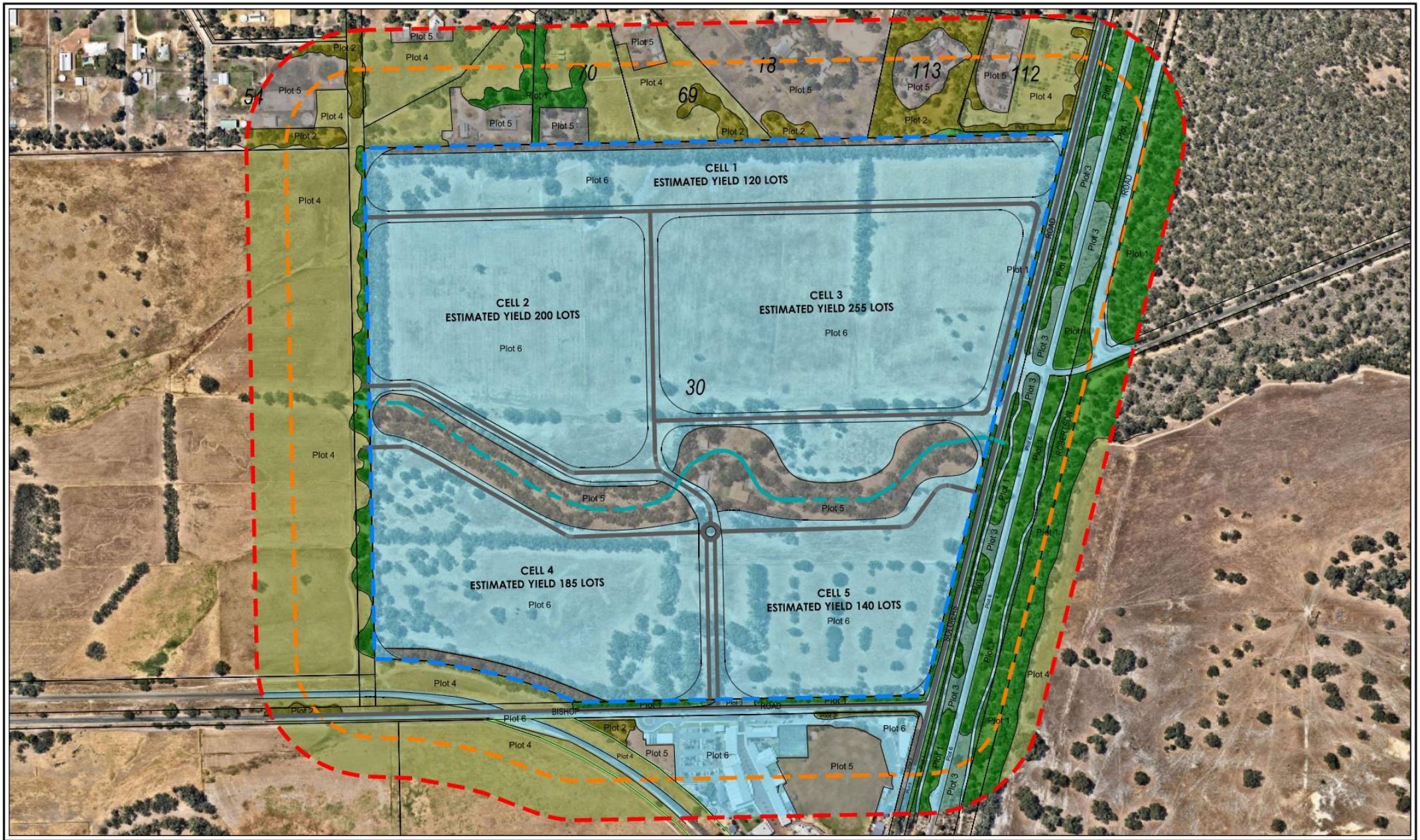

Location details:	Lot 30 (No. 496) Soldiers Road Cardup
Assessment date:	February, 2022
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Accreditation level:	Level 3 BPAD Practitioner
Accreditation number:	BPAD 23160
Accreditation expiry date:	31st January, 2023
Date aerial photo:	January 2022

FIGURE 4A - POST DEVELOPMENT VEGETATION CLASSIFICATION MAP

0 50 100 150 200m

SCALE 1:4500 @ A3
DATE: MARCH 2022

NORTH

LEGEND:

- SUBJECT LAND
- ASSESSMENT AREA (150m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE
- ASSESSMENT AREA (100m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE

- PLOT 1 - CLASS A FOREST
- PLOT 2 - CLASS B WOODLAND
- PLOT 3 - CLASS C SHRUBLAND
- PLOT 4 - CLASS G GRASSLAND
- PLOT 5 - EXCLUSION CLAUSE 2.2.3.2(f)
- PLOT 6 - EXCLUSION CLAUSE 2.2.3.2(e)

SOURCE OF PHOTOGRAPHY: NEARMAP

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3.2 Assessment Outputs

A pre-development BHL assessment was undertaken according to the *Guidelines for Planning in Bushfire Prone Areas V1.4 (2021)* and the results are found in Table 2 and Figure 5.

Table 2. Summary of vegetation type and effective slope

Vegetation Area/ Plot	Applied Vegetation Classification	Effective Slope under the Classified Vegetation (degrees)	Hazard Level
1	Class A Forest	Flat and Downslope 0-5 on western interface	Extreme
2	Class B Woodland	Flat / Upslope	Extreme
3	Class C Shrubland	Flat	Moderate
4	Class G Grassland	Flat and Downslope 0-5 on western interface	Moderate
5	Exclusion Clause 2.2.3.2 (f)	N/A	Low unless within 100m of extreme or moderate hazard
6	Exclusion Clause 2.2.3.2 (e)	N/A	Low unless within 100m of extreme or moderate hazard

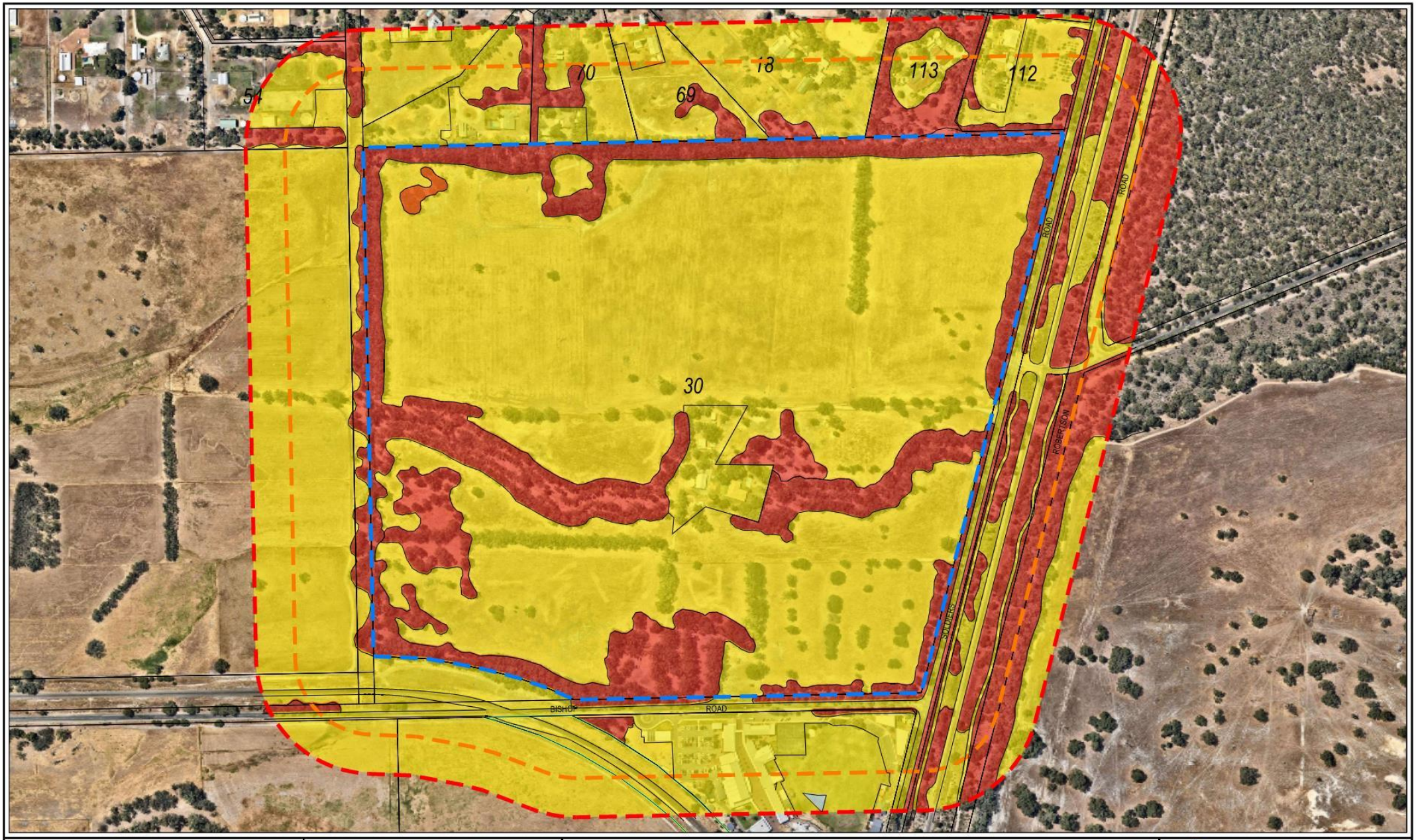
4 IDENTIFICATION OF BUSHFIRE HAZARD ISSUES

Grassland across much of the site creates a moderate bushfire hazard. An extreme hazard exists in the narrow shelterbelt vegetation on the perimeter of the site in the north, north-east, north-west and south-east, and part of the west and east side of the southern boundary. There is also extreme hazard in the strip of planted vegetation running east-west across the full length of the centre of the site and in an area intruding into the southern, centre of the site. Surrounding the site the vast majority of the hazard is moderate although woodland and forest in the east is an extreme hazard (Figure 5).

Extreme post-development bushfire hazard will continue to be present surrounding the site especially in the east, however large areas become low hard rating because the vegetation could be replaced with urban development and public roads.

The concept plan shows minimal detail and the threat of vegetation within the POS reserve will be assessed at LSP stage. The site has sufficient room to accommodate perimeter roads or landscaped parks to ensure compliance with SPP 3.7. Specific detail will be provided at LSP stage and the final design will ensure BAL ratings on interface lots will achieve BAL-29 or lower.

Existing public roads (Soldiers and Bishop) provide east/west and north /south access and connector options to the proposed development. A reticulated water supply will service the entire site. A summary of the issues is outlined in the Spatial Representation of Bushfire Management Issues (Post Development BHL Assessment) in Figure 6.



Location details:	Lot 30 (No. 496) Soldiers Road Cardup
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Accreditation level:	Level 3 BPAD Practitioner
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Date aerial photo:	January 2022

FIGURE 5 - PRE DEVELOPMENT BUSHFIRE HAZARD LEVEL RATINGS

0 50 100 150 200m

SCALE 1:4500 @ A3
DATE: MARCH 2022

NORTH

LEGEND:

- SUBJECT LAND
- ASSESSMENT AREA (150m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE
- ASSESSMENT AREA (100m) FROM THE EXTERNAL BOUNDARY OF THE SUBJECT SITE
- EXTREME
- MODERATE
- LOW

SOURCE OF PHOTOGRAPHY: NEARMAP

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5 ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA

A concept plan for the development of the site following re-zoning is illustrated in Figure 1 which provides only high level details as to the intensity of any future proposed land use. This report therefore outlines strategies and commitments on how compliance with the bushfire protection criteria can be achieved at the next stage of planning. When a structure plan application is progressed. A BMP specific to the detailed proposal will then be developed.

Acceptable solutions are achievable at the site, but performance solutions could also be proposed at LSP and subdivision application stages depending on the final proposal and circumstances.

5.1 Element 1: Location

Intent

To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.

Acceptable Solution – A1.1 Development Location

The performance principle can be achieved. The acceptable solution is achievable because the strategic planning proposal is located within an area that will on completion, be subject to either a moderate or low bushfire hazard level rating (Figure 6) and dwellings can achieve BAL-29 and lower.

5.2 Element 2: Siting and Design of Development

Intent

To achieve compliance with this Element the following acceptable solution must be met.

Acceptable Solution – A2.1 Asset Protection Zone (APZ)

The performance principle can be achieved because there is sufficient space for every habitable building to be surrounded by an APZ of sufficient dimensions to ensure the potential radiant heat flux impacts on dwellings does not exceed BAL-29 in all circumstances. APZ standards are outlined in Appendix 1.

The acceptable solution is achievable because the strategic planning proposal is located within an area that will on completion, be subject to either a moderate or low bushfire hazard level rating (Figure 6) and dwellings can achieve BAL-29 and lower.

While development within the site will be undertaken within 150 m of areas of moderate or extreme bushfire hazards (**Figures 5 & 6**) it can be sited and designed to manage or mitigate the associated bushfire risk by locating residential lots in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL–29 or below.

AS 3959:2018 Construction of buildings in bushfire prone areas has six categories of Bushfire

Attack Level, namely BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ based on heat flux exposure thresholds. The BAL rating for a site requires a specific assessment of vegetation and of topographic slopes. Each BAL rating is associated with appropriate construction standards that apply as a minimum for buildings in bushfire-prone areas (as per AS 3959). The categories of BALs have been summarized in Table 3 below.

Attack Level (BAL)	**Classified vegetation within 100 m of the subject building and heat flux exposure thresholds**	**Description of the predicted bushfire attack and levels of exposure**	**Construction section (within AS 3959)**
BAL-LOW	See Section 2.2.3.2 of AS 3959	There is insufficient risk to warrant specific construction requirements	4
BAL-12.5	≤ 12.5 kW/m2	Ember attack	3 & 5
BAL-19	> 12.5 kW/m$_2$ to ≤ 19 kW/m$_2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 6
BAL-29	> 19 kW/m$_2$ to ≤ 29 kW/m$_2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 7
BAL-40	> 29 kW/m$_2$ to ≤ 40 kW/m$_2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with the increased likelihood of exposure to flame	3 & 8
BAL-FZ	≤ 40 kW/m2	Direct exposure to flames from fire front in addition to heat flux and ember attack	3 & 9

Table 3: AS 3959. BAL ratings, heat flux thresholds and associated construction standard

The current Concept Plan (**Figure 1**) demonstrates one development scenario. Further refinement of this plan will take place as part of structure planning and subdivision. These stages of planning represent the appropriate time for the preparation of BAL contour plan consistent with SPP 3.7.

The site is assessed in the post development bushfire hazard level rating (**Figure 6)** to demonstrate that future development can be accommodated on the site consistent with the broad proposed land uses.

A detailed BAL assessment/s will be undertaken at the LSP stage and for each subdivision stage to respond to the bushfire risk posed at the time of development. This will ensure the provision of appropriate mitigation measures such as APZs to ensure future dwellings are not exposed to a BAL rating greater than BAL-29, in accordance with SPP 3.7 and the Guidelines (WAPC 2021).

Planning around retained areas of vegetation such as within internal POS areas will be confirmed at LSP stage. Any increase of fuel loads associated with future revegetation works will be responded to by increases in perimeter roads and perimeter APZ design.

These design features, including compliance with AS 3959 where appropriate, will minimize the bushfire risk to people, property and infrastructure.

5.3 Element 3: Vehicular Access

Intent

To ensure that the vehicle access serving a subdivision is available and safe during a bushfire event.

Acceptable Solution A3.1 – Public Roads

Existing surrounding roads comply with the standards in Appendix 2. Future roads will comply with the same minimum standards.

Acceptable Solution A3.2a – Multiple Access Routes

The site is bordered to the south and east by major public roads (Bishop and Soldiers Roads respectively). The development concept plan demonstrates connector roads and access options to these public roads that provides two access ways to two different destinations.

The design of the internal road network will be determined as part of the LSP stage and will meet the applicable requirements of the Guidelines including public roads to a trafficable standard to allow safe egress and ensuring at least two forms of access in the event of a bushfire. The site will have multiple public road access routes consistent with traffic volume and the urban landscape that will be created which direct traffic to multiple destinations. All public roads in the vicinity of the site comply with minimum standards for public roads outlined in Appendix 2.

Where staged implementation of development occurs prior to construction of all proposed public roads, temporary secondary access will be provided to ensure two external access options are available.

Acceptable Solution A3.2b – Emergency Access Ways

If required, Emergency Access Ways will comply with minimum standards.

Acceptable Solution A3.3 – Through Roads

All public roads should be though roads. If necessary they can be considered as an acceptable solution and further details will be provided at LSP stage.

Acceptable Solution A3.4a – Perimeter Roads

A perimeter road is a public road and should be provided for greenfield sites where 10 or more lots are proposed. This detail will be confirmed at LSP stage. They may not be required where lots do not require additional separation between classified vegetation and the individual lot or the adjoining classified vegetation is Class G Grassland.

Acceptable Solution A3.4b – Fire Service Access Route

A Fire Service Access Route can be sited where a perimeter road is not required and can be considered as an acceptable solution to provide fire fighter access where access is not provided to classified vegetation.

5.4 Element 4: Water

Acceptable Solution A4.1 – Identification of future water supply

The site will have a reticulated water supply together with fire hydrants that will meet the specifications of Water Corporation Design Standard DS 63 and meet DFES requirements. Fire hydrants on land zoned as residential are required to be sited at or within 200 m of residential dwellings (Class 1a).

6 CONCLUSIONS

This plan provides an assessment of the sites existing and post development Bushfire Hazard Level (BHL) ratings and is consistent with the objectives and policy measures of SPP3.7 and the Guidelines for Planning in Bushfire Prone Areas V1.4. The Bushfire Hazard Level provides a measure of the likely intensity of a bushfire on the site.

The site currently has areas of grassland, woodland and low open forest. These areas in and around the site are rated as extreme. Post development changes large area of extreme hazard to moderate and low hazard (**Figure 6**). Grassland areas are rated as moderate hazard as are all areas within 100 metres of extreme and moderate hazard.

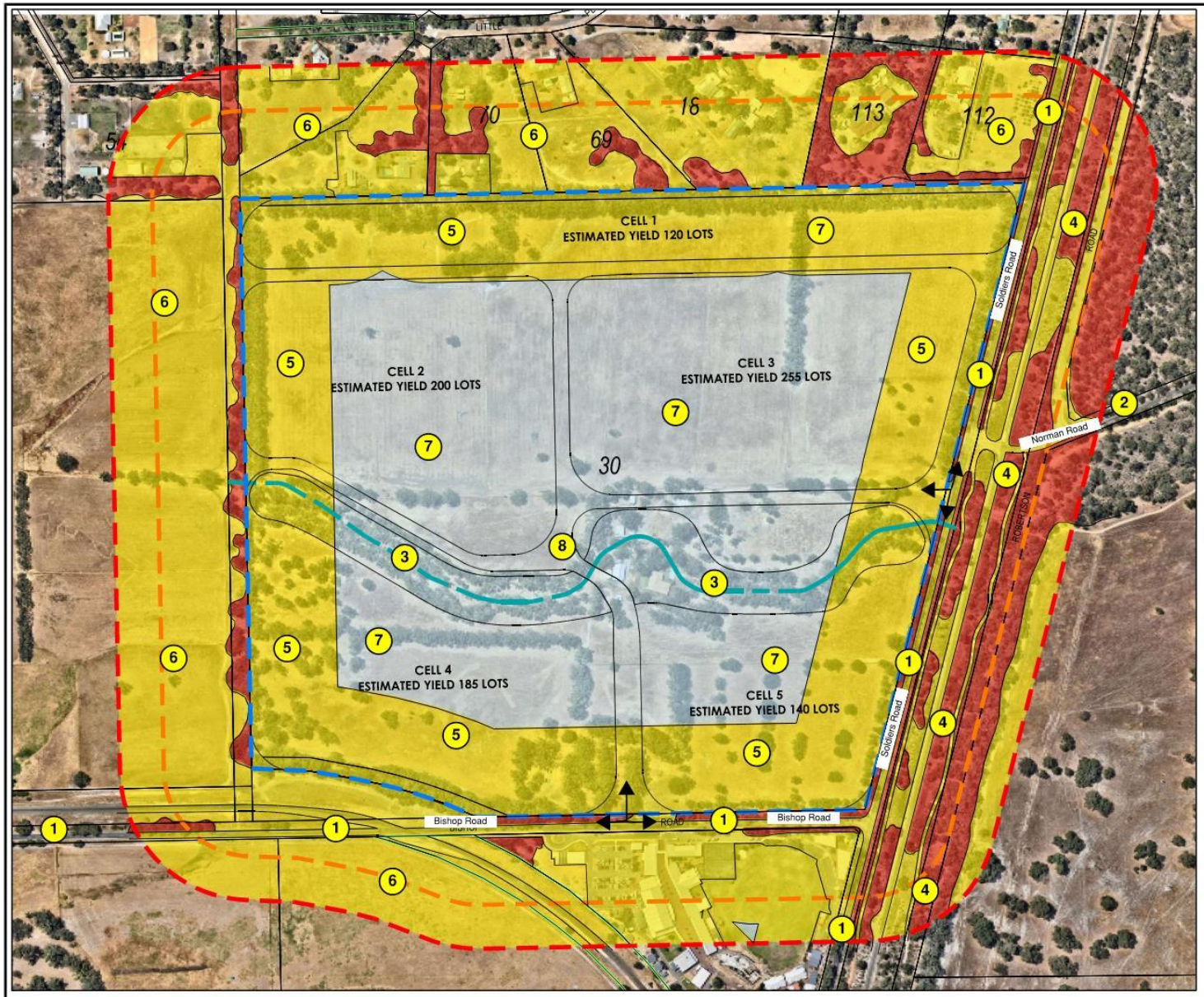
Bushfire threat from surrounding areas with classified vegetation will be addressed through the establishment of APZs based on perimeter roads, or appropriate landscaped and managed areas. At LSP stage, internal APZs will be considered to ensure compliant separation occurs at each level of planning. Future external and internal APZs will be identified in detail at LSP stage to separate areas of external and internal hazard from buildings and site occupants. BAL-29 will not be exceeded at the site. Compliance is achieved with policy clauses 6.2 and 6.3.

It is expected that this Bushfire Management Plan will be updated at LSP stage and will examine in greater detail the four bushfire protection elements outlined in the Guidelines for Planning in Bushfire Prone Areas. The BMP complies with Policy measure 6.2 and 6.3 of SPP 3.7 because it demonstrates that compliance with the bushfire protection criteria in the Guidelines for Planning in Bushfire Prone areas can be complied with at subsequent planning stages.

The compliance table (**Table 4**) outlines strategies and commitments to achieve compliance with the bushfire protection criteria at a future LSP Stage, reflecting the concept plan provided at this stage and as required under policy measure 6.3 of SPP 3.7.

Table 4: Compliance Table

Bushfire Protection Criteria	Method of compliance Acceptable Solutions	Proposed bushfire management strategies
Element 1: Location	A1.1 Development Location	The development is located in an area that will on completion be subject to a bushfire hazard rating level of moderate or lower (Figure 6). A BAL rating of BAL-29 or lower for future dwellings can be achieved.
Element 2: siting and Design	A2.1 Asset Protection Zone (APZ)	An APZ can be accommodated where required to separate permanent areas of classified vegetation and residential lots. The siting and the dimensions of a future APZ will be determined at LSP stage when there is clarity on the areas of retained vegetation and vegetation clearing and any landscaping. The future APZ will be managed in accordance with the requirements of the standards in Appendix 1.
Element 3: Vehicular Access	A3.1 Public roads	Bishop Road and Soldiers Road comply with minimum public road standards (Appendix 2) as will all proposed roads.
	A3.2a Multiple access routes	The site is bounded by Soldiers Road and Bishop Road. This provides a minimum two access and egress route options to and from the site. Existing and new public roads will also connect to provide multiple routes.
	A3.2b Emergency access way	If required, standards are outlined in Appendix 2.
	A3.3 Through roads	All public roads should be though roads. If necessary they can be considered as an acceptable solution and further details will be provided at LSP stage.
	A3.4a Perimeter roads	A perimeter road can be accommodated are around the whole site. They may not be required where lots do not require additional separation between classified vegetation and the individual lot or the adjoining classified vegetation is Class G Grassland.
	A3.4b Fire service access route	A Fire service access route may be sited and considered an acceptable solution to provide fire fighter access to classified vegetation.
Element 4: Water	A4.1 Identification of future water supply	The site will have a reticulated water supply together with fire hydrants that will meet the specifications of Water Corporation Design Standard DS 63 and meet DFES requirements.



LEGEND:

- SUBJECT LAND
- EXTREME
- MODERATE
- LOW

TWO ACCESS ROUTES TO TWO DIFFERENT DESTINATIONS ARE REQUIRED AT ALL TIMES

FIGURE 6 - SPATIAL REPRESENTATION OF BUSHFIRE MANAGEMENT STRATEGIES (POST DEVELOPMENT BHL ASSESSMENT)

CONSIDERATIONS

1. Soldiers Road and Bishop Road border two sides of the site, they are both sealed public roads that provide access to the north, south and west.

2. Norman Road leads from the site to the east.

3. All internal areas of Public Open Space areas will need to be landscaped as low fuel condition and maintained in low fuel standards or it will be classified as a vegetation class and will be assessed as requiring BAL Contours and Asset Protection Zones to ensure future development is setback in areas exposed to BAL-29 or less. If the Public Open Space areas are to be established and maintained as 'Low Threat Vegetation' as per Exclusion Clause 2.2.3.2 (f) in Australian Standards AS3959:2018. Ongoing management of vegetation in the POS will include - mowing of turf to maintain height of 50mm or less, removal of all accumulated fine fuels (leaf litter, twigs, dead branches etc), removal of weeds, pruning including removal of lower branches to 2 metres from ground or shrub height level, removal of dead and diseased plants, or parts of plants, pruning of shrubs to maintain separation between clumps of shrubs.

4. Long term permanent extreme bushfire hazard occurs east of the site in the road and railway reserve from areas of permanent classified vegetation including woodland and forest.

5. Urban Lots will remove much of the internal bushfire hazard which will result in moderate hazard within 100 metres of perimeter vegetation outside of the site.

6. The dominant vegetation around the site is grassland that reflects the rural land-use and farming community.

7. The area will be provided with a reticulated water supply and future development of the lots can comply with required water supply standards.

8. Internal roads must provide all residents two access ways to two different destinations at all times.

bushfire CONSULTING
Science. Culture. Solutions.
PO BOX 84 STONEVILLE WA 6081
Mbl: 0429 949 262
www.bushfiresafety.net

0 50 100 150 200m

SCALE 1:5000 @ A3
DATE: MARCH 2022

NORTH

Location details:	Lot 30 (No. 496) Soldiers Road Cardup
Assessment date:	February, 2022
Prepared by:	Bushfire Safety Consulting
Accreditation level:	Level 3 BPAD Practitioner
Accreditation number:	BPAD 23160
Accreditation expiry date:	31st January, 2023
Date aerial photo:	January 2022

7 RESPONSIBILITIES FOR IMPLEMENTATION AND MANAGEMENT OF THE BUSHFIRE MEASURES

Table 5 outlines the broad ongoing responsibilities, actions and associated works that need to be undertaken by the future Developer / Proponent or Land Owner and the Shire of Serpentine Jarrahdale. An accredited Bushfire Planning Practitioner will need to be engaged at LSP and Subdivision Application stages to update the BMP and assess the development against all of the bushfire protection criteria and SPP 3.7.

Table 5. Responsibility for bushfire measures

DEVELOPER / PROPONENT / LANDOWNER **LOCAL STRUCTURE PLAN STAGE AND ONGOING MANAGEMENT**	
1	**Update the Bushfire Management Plan to demonstrate full compliance with relevant sections of SPP 3.7 and the Guidelines for Planning in Bushfire Prone Areas.**
2	**Ensure the site complies with the Shire of Serpentine Jarrahdale's Firebreak and Fuel Load Notice as published.**
3	**Ensure any future construction of buildings comply with AS 3959:2018 as and when required.**
4	**Update the Bushfire Management Plan if requested by the Shire of Serpentine Jarrahdale if it has reason to believe site conditions have substantially changed, or new methodologies or practice are adopted as identified in future revisions of the "Guidelines".**
SHIRE OF SERPENTINE JARRAHDALE – ONGOING MANAGEMENT	
5	**Maintain public roads to appropriate standards and ensure compliance with the Shire of Serpentine Jarrahdale's Fire Control and Fuel Load Notice.**
6	**Provide fire prevention and preparedness advice to landowners upon request, including the *Homeowners Bush Fire Survival Manual, Prepare, Act, Survive* (or similar suitable documentation) and the Shire of Serpentine Jarrahdale's Fire Control and Fuel Load Notice.**

REFERENCES

DFES. (2017). *PREPARE. ACT. SURVIVE.*

http://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/BushfireManualsandGuides/DES_Bushfire-Prepare_Act_Survive_Booklet.pdf

Standards Australia. 2009. Construction of buildings in bushfire-prone areas (Amendments 1-3), AS 3959-2009, Standards Australia International Ltd, Sydney

Western Australian Planning Commission (WAPC). 2021. Guidelines for Planning in Bushfire Prone Areas. December 2021 V1.4. Western Australian Planning Commission and Department of Planning WA, Government of Western Australia.

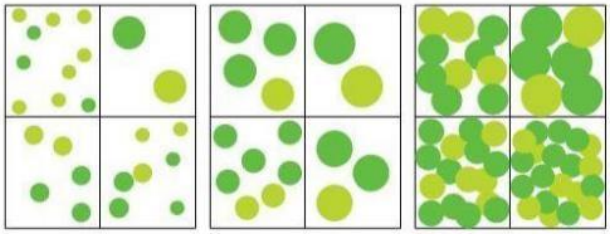
Western Australian Planning Commission (WAPC). 2015b. State Planning Policy No. 3.7: Planning in Bushfire Prone Areas (SPP3.7). December 2015. Western Australian Planning Commission and Department of Planning WA, Government of Western Australia.

APPENDICES

Appendix 1: Asset Protection Zone Standards
Appendix 2: Vehicular Access Technical Requirements
Appendix 3: Shire of Serpentine Jarrahdale Firebreak Notice 2021/2022

Appendix 1: Asset Protection Zone Standards

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

OBJECT	REQUIREMENT
Fences within the APZ	• Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness)	• Should be managed and removed on a regular basis to maintain a low threat state. • Should be maintained at <2 tonnes per hectare (on average). • Mulches should be non-combustible such as stone, gravel or crushed mineral earth or wood mulch >6 millimetres in thickness.
Trees* (>6 metres in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building. • Branches at maturity should not touch or overhang a building or powerline. • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be <15 per cent of the total APZ area. • Tree canopies at maturity should be at least five metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ. **Figure 19:** Tree canopy cover – ranging from 15 to 70 per cent at maturity  15% 30% 70%
Shrub* and scrub* (0.5 metres to six metres in height). Shrub and scrub >6 metres in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings. • Should not be planted in clumps >5 square metres in area. • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground covers* (<0.5 metres in height. Ground covers >0.5 metres in height are to be treated as shrubs)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above. • Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.
Grass	• Grass should be maintained at a height of 100 millimetres or less, at all times. • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	• Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
LP Gas Cylinders	• Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. • The pressure relief valve should point away from the house. • No flammable material within six metres from the front of the valve. • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

APPENDIX 2: Vehicle Access Technical Requirements

Table 6: Vehicular access technical requirements

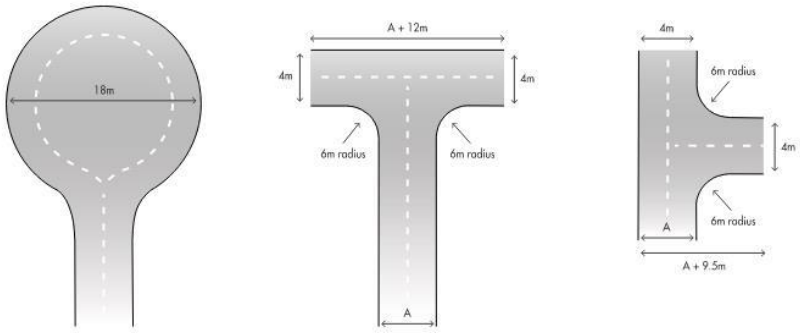
TECHNICAL REQUIREMENTS	1 Public roads	2 Emergency access way[1]	3 Fire service access route[1]	4 Battle-axe and private driveways[2]
Minimum trafficable surface (metres)	In accordance with A3.1	6	6	4
Minimum horizontal clearance (metres)	N/A	6	6	6
Minimum vertical clearance (metres)	4.5			
Minimum weight capacity (tonnes)	15			
Maximum grade unsealed road[3]	As outlined in the IPWEA Subdivision Guidelines	1:10 (10%)		
Maximum grade sealed road[3]		1:7 (14.3%)		
Maximum average grade sealed road		1:10 (10%)		
Minimum inner radius of road curves (metres)		8.5		

Notes:

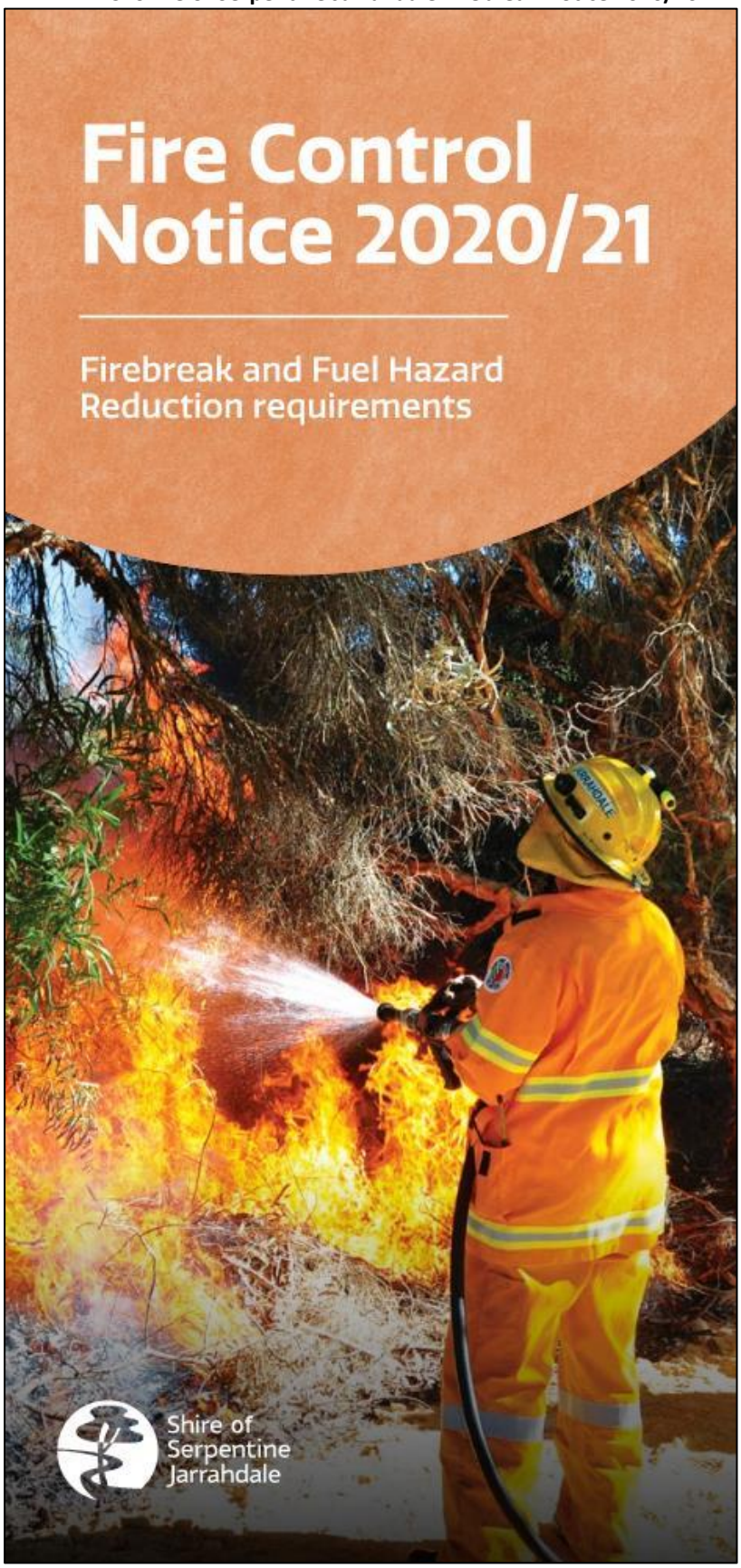
[1] To have crossfalls between 3 and 6%.

[2] Where driveways and battle-axe legs are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

[3] Dips must have no more than a 1 in 8 (12.5% -7.1 degree) entry and exit angle.



APPENDIX 3: Shire of Serpentine Jarrahdale Firebreak Notice 2020/2021



Firebreak Notice

Please read carefully as these are your legal requirements.

This notice applies to all owners and/or occupiers of land within the Shire of Serpentine Jarrahdale.

Pursuant to Section 33 of the *Bush Fires Act 1954* you are required to take action in accordance with this notice for the duration indicated in your category.

The following categories detail what you must do to comply, with no exemptions. Failure to comply may result in you being fined and/or Council entering your land to complete works at the owners expense.

This notice and information has effect **1 October 2020**. All previous Firebreak Notices are hereby cancelled.

By order of the Chief Executive Officer.

Definitions

Acre – 4047m² area of land.

Agricultural buildings – Any sheds or groups of buildings on agricultural zoned land.

Asset Protection Zone (APZ) – An area required to achieve a BAL-29 or less, measured from the outer edge of the building or as stated in your approved BAL assessment (within the boundaries of your land). Fuel loads in this zone may not exceed 2 tonnes per hectare.

Bushfire Attack Level (BAL) Assessment – A measurement of the buildings potential exposure to a bushfire, in accordance with Australian Standard 3959 – Construction of buildings in bushfire prone areas.

Firebreak – A strip of land that has been cleared of all flammable material, leaving bare mineral earth. This includes the trimming back of anything overhanging the fire break area. Mowed firebreaks are not acceptable.

Flammable material – Any vegetation (bushes, grasses, trees, mulch and green waste), object or material that is likely to catch fire.

Fire Management Plan (FMP) – A document forming part of a building, development or subdivision approval that sets out short, medium and long-term bushfire risk management strategies for the life of the development.

Fuel and vegetation storage – Storage of hydrocarbons and/or fuel dumps (containing fuel or not) including drums, piles or stacks and any other flammable material.

Trafficable – The ability for 4x4 vehicles to access your land on a firm surface without obstruction. No firebreak is to terminate without provision for departure to a safe place or a cleared turnaround area of not less than a 21m radius (prior written approval from the Shire is required).

You – Owner or occupier of any land within the Shire.

Vertical axis – An uninterrupted vertical line at a right angle to the horizontal line of the firebreak.

Your legal requirements

If you live on 1 acre or less

On your land:

- Cut all grass to less than 25mm in height and maintain until 31 May, 2021
- 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.
- Trim all trees and bushes that overhang driveways, access ways and firebreaks to leave a 4 metre wide clearance and a clear vertical axis

For your dwellings

- Maintain 20 metre asset protection zones or as per your approved BAL/FMP assessment.
- Trim back all trees overhanging buildings.

Compliance is required by 30 November and must be maintained until 31 May each and every year.

Fire Control Notice 2020/21 3

If you live on more than 1 acre

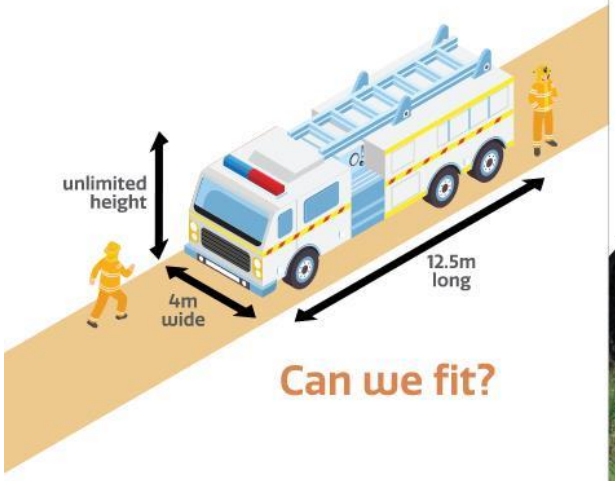
On your land:

- 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.
- For your dwellings
- Maintain 20 metre asset protection zones or as per your approved BAL/FMP assessment.
- Trim back all trees overhanging buildings

Compliance is required by 30 November and must be maintained until 31 May each and every year.



To vary your firebreak

Apply in writing to the Shire from 1 June to 31 October requesting your variation and the reasons for your application. If approved all firebreak conditions will be as per your variation with a new notice being issued for your property..

If your variation is not approved or your previous variation is cancelled, you must comply with the Firebreak Notice requirements for your land.

You don't need to apply for a variation every year. Remember, variations are provided to the property owner, not the land.

To apply for a variation call **9526 1111** and request a Firebreak Variation Application Form. Further information, including key dates, is available at **www.sjshire.wa.gov.au/firebreaks**

Compliance is required by 15 November and must be maintained until 31 May each and every year.

For further information on firebreaks, including properties with plantations, storing fuel and haystacks and other flammable materials, hazard reduction, as wells as FAQs, visit the Shire's website at www.sjshire.wa.gov.au/firebreaks

Bushfire prone areas

The Fire and Emergency Services Commissioner has identified Bushfire Prone Areas as being subject, or likely to be subject, to bushfire attack.

Around **97% of our Shire is declared bushfire prone.** This means that additional planning and building requirements may apply to developments on your land. A Bushfire Attack Level (BAL) assessment and/or a Bushfire Management Plan may be required.

You can check if your land is bushfire prone on the Map of Bush Fire Prone Areas website **maps.slip.wa.gov.au/landgate/bushfireprone**

Contractors who can help

The Shire maintains a list of contractors that can assist you with:

- Firebreak works.
- Fuel hazard reduction works.

Visit **www.sjshire.wa.gov.au/firebreaks**

For assistance with:

- Bushfire Attack Level Assessments
- Fire management planning.

Visit **www.fpaa.com.au/bpad**

Before you burn

Before you commence the burn, you need to notify the Department of Fire and Emergency Services Communications Centre on **9395 9209** and the Shire on **9526 1111**.

Go to **www.sjshire.wa.gov.au/burning** to find out what you need to do while burning or if you're being paid to burn.

Burning

Fire Danger Rating (FDR)

The FDR tells us what the level of bushfire threat could be on any given day. The FDR is supplied daily by the Bureau of Meteorology.

You can find it at **www.bom.wa.gov.au** or **www.emergency.wa.gov.au** or by calling the Perth Weather Service on **9263 2222.**

When the fire rating is Very High, Severe, Extreme or Catastrophic:

- Campfires aren't allowed.
- Permits are automatically cancelled.
- No burning (including garden refuse) is allowed.
- You can't use any BBQ or cooker in the open air that requires solid fuel (wood or charcoal). This includes wood-fired ovens or stoves.

Burning periods

We have burning periods because risks vary depending on the time of the year. Burning periods define what is allowed during these periods of risk.

We may vary burning periods depending on weather and other conditions, so it is essential that you stay up to date.

You can find the latest on burning periods on our website **www.sjshire.wa.gov.au/burning** and Facebook page @shireofsj.

JAN	FEB	MAR	APR
MAY	JUN	JUL	AUG
SEP	OCT	NOV	DEC

Prohibited burning period
All burning and fires are prohibited during this time.

Restricted burning period
No burning on Sundays and Public Holidays.
You can burn one 1m x 1m pile of garden waste without a permit under the conditions on the website.
You need a permit to burn grass, paddocks and bush.

Unrestricted burning period
Burning is allowed on any day.

Total Fire Ban (TFB)

TFBs are declared by the Department of Fire and Emergency Services on days of extreme weather or when widespread fires are seriously stretching firefighting resources. TFBs are generally declared the evening before they take effect. To find out if a TFB has been declared visit **www.emergency.wa.gov.au** or tune in to 720AM on your radio.

When a TFB is declared it prohibits the lighting of any fires in the open air and any other activities that may start a fire.

The ban includes all open air fires for cooking or camping. It also includes incinerators, welding, grinding, soldering or gas cutting. For more information including exemptions visit **www.dfes.wa.gov.au/totalfirebans.**

Harvest and Vehicle Movement Bans (HVMB)

A HVMB, once declared by the Shire, prohibits all harvesting operations and all vehicle movements on a property (except for the essential watering of stock using a diesel powered vehicle).

HVMBs remain in place until midnight on the day called or until lifted (revoked) by the Shire.

A ban may be called on the basis of:

- Unfavourable fire weather conditions.
- Lack of firefighting resources due to existing commitments.
- Public holidays.

You can find out if a HVMB has been declared on the Shire's website **www.sjshire.wa.gov.au** and Facebook page or by tuning into 720AM on your radio.

Burning permits

If you want to burn grass, paddocks and bush during the Restricted Burning Period, you will need a burning permit. To apply for a permit call your local Fire Control Officer **at least 1 week before your burn**. They will assess your burn and issue a written permit (if approved).

Burning permits are only valid for the day or days written on the permit. If you have been refused a permit, you can't reapply for the same burn. Appeals to a refusal can only be lodged to the Chief Bush Fire Control Officer by emailing **info@sjshire.wa.gov.au.**

If you want to burn a Council road reserve or verge you need written approval from the Shire, as well as an approved permit from a Fire Control Officer. Contact us on **9526 1111** for more information.

Who to call for a permit

Name	Contact
Byford, Darling Downs, Karrakup and Cardup (East of Hopkinson Rd)	
Frank Rankin	9525 1146
David Gibson	0425 250 100
Oakford, Oldbury (North of the rail line) and Cardup (West of Hopkinson Rd)	
Paul Williamson	0439 994 803
Mundijong, Whitby, Mardella (North of Lowlands Rd and Oldbury, South of the rail line)	
Steve Chadwick	0419 983 838
Jarrahdale	
Belinda Briscoe	0427 474 809
Serpentine (West of the rail line), Hopeland (North or Utley Rd, Punrak Rd and Wigg Rd)	
Ray Elliott	0409 106 610
Serpentine (East of the rail line)	
Don Downey	0400 252 352
Keysbrook (East of Westcott Rd)	
Scott Hambley	0417 173 410
Keysbrook and Hopeland (West of Westcott Rd and South of Utley Rd)	
Ken Elliott	0419 860 010

Please only contact Fire Control Officers between the hours of 9am - 5pm Monday to Friday.

Remember you can only call the Fire Control Officer appointed to your area or call us on **9526 1111**.

For further information on burning permits, including tips, fines and penalties, visit the Shire's website at www.sjshire.wa.gov.au/permits

Be Bushfire Ready

Bushfire and Emergency Management Plans Assessments

Some properties need to comply with approved:

- Bushfire Management Plans.
- Emergency Management Plans.

These requirements are in addition to the requirements of this Notice.

Compliance is required throughout the whole year. Find out more on our website.

Be prepared

Bushfires are unpredictable and happen every year with the single biggest killer being indecision.

To survive a bushfire you must be prepared to make your own decision, every minute counts.

When will you know to leave?

Where will you go?

Which way will you go?

More information on being prepared can be found at **www.emergency.wa.gov.au** and **www.redcross.org.au/prepare**

Alerts and warnings

During emergencies, alerts and warnings may be issued by the Department of Fire and Emergency Services. You can get these warnings by visiting **www.emergency.wa.gov.au** or calling **13 DFES (13 33 37).**

Bushfire Emergency Warning
Authorities have confirmed that you are in danger and need to take immediate action to protect yourself and your family. Leave now if the way is clear, or prepare to actively defend your home.

Bushfire Watch and Act
Authorities have confirmed that there is a threat or possible threat to life and/or property. Take action now to stay safe.

Bushfire Advice/Other Fires
An incident has been reported near this location. You need to be aware and keep up to date – act for your safety. Get prepared.

Prescribed Burn/Bushfire All Clear
An incident has been reported near this location. You need to be aware and keep up to date – act for your safety. Get prepared.

Do not wait to take action. If you see fire activity or smoke put your plan in place straight away.

Alerts, warnings, and fire ban information is broadcast on ABC radio (720 AM).

Prescribed burns

The Parks and Wildlife Service at the Department of Biodiversity, Conservation and Attractions conduct prescribed burns throughout the year. Find out where these are occurring at **www.dpaw.wa.gov.au/management/fire/prescribed-burning/burns** or by calling **9219 8000.**

Important contacts

In emergencies call 000

Other important numbers

State Emergency Service	132 500
DFES Public Information	13 33 37
Main Roads WA	138 138
Western Power	13 13 51
ATCO Gas	13 13 52
Water Corporation	13 13 75
Telstra	13 22 03
RSPCA WA	9209 9300
Wildcare Helpline	9474 9055
DBCA Perth Hills District	9290 6100

Shire of Serpentine Jarrahdale

6 Paterson Street
Mundijong WA 6123
9526 1111
9525 5441
info@sjshire.wa.gov.au
www.sjshire.wa.gov.au
facebook.com/shireofsj
instagram.com/shireofsj

Disclaimer: Shire of Serpentine Jarrahdale does not accept any liability for loss, damages, or inconvenience caused due to any errors in the information provided.

This program is available in an alternative format on request by phoning 9526 1111.