4. Potential Impacts, Mitigation, Management and Recommendations

The proposed structure plan identifies the following land uses:

- Residential (R20).
- POS.
- Conservation Category Wetland (CCW).
- CCW Buffer (50 m).
- Road Reserve.
- Urban Deferred Zone Boundary and Area.

Based on an assessment of the proposed structure plan against known and likely environmental values described within the Site, the following environmental factors are considered to be relevant:

- Flora and Vegetation.
- Terrestrial Environmental Quality.
- Inland Waters.
- Terrestrial Fauna.

The primary method of avoiding environmental impacts through the structure plan, is through the designation of a 2.51 ha area comprising of POS1, CCW and CCW buffer (as identified in the concept plan, Figure 3). This area includes the following values:

- 2.11 ha of native vegetation, including 1.85 ha of potential black cockatoo foraging habitat.
- Seven potential nesting trees (*Eucalyptus wandoo* [no hollows observed]).

The foreshore reserve mapped by PGV (2023), now referred to as POS1, CCW and CCW buffer under the Structure Plan, has been reduced by approximately 0.021 ha along the middle and east of the Site, for a road reserve. However, an additional 0.16 ha has been included within POS1, to both provide for additional retention of vegetation and space for bioretention basins. This refined area has resulted in an increase area of retention along Kadina Brook, and also allows for sufficient lot yield to make development of the Site viable. Bioretention areas will be sited within cleared areas only, to limit any further clearing of native vegetation.

As a result of the updated extent of the POS1 area, a total of 0.12 ha of native vegetation (as mapped by Gambara [2025]) will be impacted along the POS1 interface. However a total of 2.11 ha of native vegetation will be retained within the POS1 area, with revegetation proposed across the entire 2.51 ha area.

As part of the concept plan, further refinement of the design has been undertaken, with reference to previous and existing surveys and agency comments. As a result, hard-edge interface to the POS1 area has been implemented through road reserve siting. It is anticipated that a Wetland/Foreshore Management Plan will be required as a condition of subdivision. As such, Gambara (2025) have provided a range of recommendations, including a weed control program and revegetation management zones, to improve and maintain the quality of the POS1 area. These are summarised in the following section.

Potential environmental impacts associated with the structure plan, and the proposed management measures, are summarised in Table 4-1.

4.1 Vegetation Management and Rehabilitation

As part of their site assessment, Gambara (2025) identified six indicative revegetation zones within the Site, which will be implemented within the POS1, CCW and CCW buffer area. These are described in further detail below, and shown in Figure 14.

4.1.1 Eucalyptus rudis Full Revegetation

Mapped where the native vegetation includes *Eucalyptus rudis* open woodland, but lacks understorey species and contains sparse overstorey. These areas typically had high weed load. The following revegetation measures were recommended:

- Installation of *Eucalyptus rudis* open woodland species at a rate of four per m^2 for understorey and ground cover species, and two per m^2 for overstorey species.
- Weed control as recommended within Appendix D. Ensure zone has low weed load prior to planting.

4.1.2 Eucalyptus rudis Understorey Revegetation

Mapped where the vegetation type is *Eucalyptus rudis* open woodland, but lacks understorey species. These areas typically had high weed load. The following revegetation measures were recommended:

- Installation of *Eucalyptus rudis* open woodland species at a rate of four per m^2 for understorey and ground cover species.
- Weed control as recommended within Appendix D. Ensure zone has low weed load prior to planting.

4.1.3 Eucalyptus wandoo Full Revegetation

Mapped where the vegetation type is *Eucalyptus wandoo* open woodland, but lacks understorey and contains sparse to no understorey. These areas typically had high weed load. The following revegetation measures were recommended:

- Weed control as per Appendix D. Ensure zone has low weed load prior to planting.
- As the area is large and bare of native vegetation, rip and furrowing the ground with a tractor is an option to ensure better penetration of tube stock. For rip and furrow works, utilise the following specifications:
    - Internal furrow width measures 700 to 1300 mm, with a target width of 1000 mm.
    - Furrow measures 100 to 200 mm deep from ground level.
    - Rip measures 300 to 500 mm deep from ground level, with a target depth of 450 mm.
    - No gaps between furrows should occur, except for the soil making up the top of the furrows.
    - Furrows to run perpendicular to the gradient as to minimise erosion.
- If rip and furrowing does occur:
    - Install seedlings into furrows as to accommodate an install rate of four stems per m^2 for understorey and two stems per m^2 for overstorey.
    - Spread a 50:50 native seed to clean mix material at 1.3 kg per hectare across the rip and furrowed area.
- If rip and furrow activities are not undertaken, install seedlings across zone at a rate of four stems per m^2 for understorey and groundcover species and two stems per m^2 for overstorey species.

4.1.4 Eucalyptus wandoo Understorey Revegetation

Mapped where the vegetation type is *Eucalyptus wandoo* open woodland, but lacks understorey. These areas typically had high weed load. The following revegetation measures were recommended:

- Installation of *Eucalyptus wandoo* open woodland species at a rate of four per m^2 for understorey and ground covers species.
- Weed control as per Appendix D. Ensure zone has low weed load prior to planting.

4.1.5 Melaleuca Woodland Understorey Revegetation

Mapped where the vegetation type is *Melaleuca raphiophylla* dominated and can be described as low open forest lacking understorey. These areas typically had high weed load. The following revegetation measures were recommended:

- Installation of *Melaleuca raphiophylla* low open forest species at a rate of four per m2 for understorey and ground covers species.
- Weed control as per Appendix D. Ensure zone has low weed load prior to planting.

4.1.6 Wetland/Riverbank Revegetation

Mapped where a wetland area was identified, including a dry and water filled stream. The south-east wetland/riverbank likely remains wet all year round, and the north and north/west wetland/riverbank areas were either dry, damp or wet and likely seasonally inundated during winter months. The following revegetation measures were recommended:

- Installation of sedges, rushes and other native wetland species that are found within melaleuca woodlands. Install on banks of permanently wet areas and throughout damp areas at a rate of six stems per m^2.
- Treat any weed load with a Roundup Biactive or similar aquatic-friendly herbicide, as per schedule outlined in Appendix D.
- Install native species able to survive seasonal inundation on dry river beds, such as *Melaleuca viminea* and *Lepidosperma longitudinale*, at a rate of six stems per m^2.

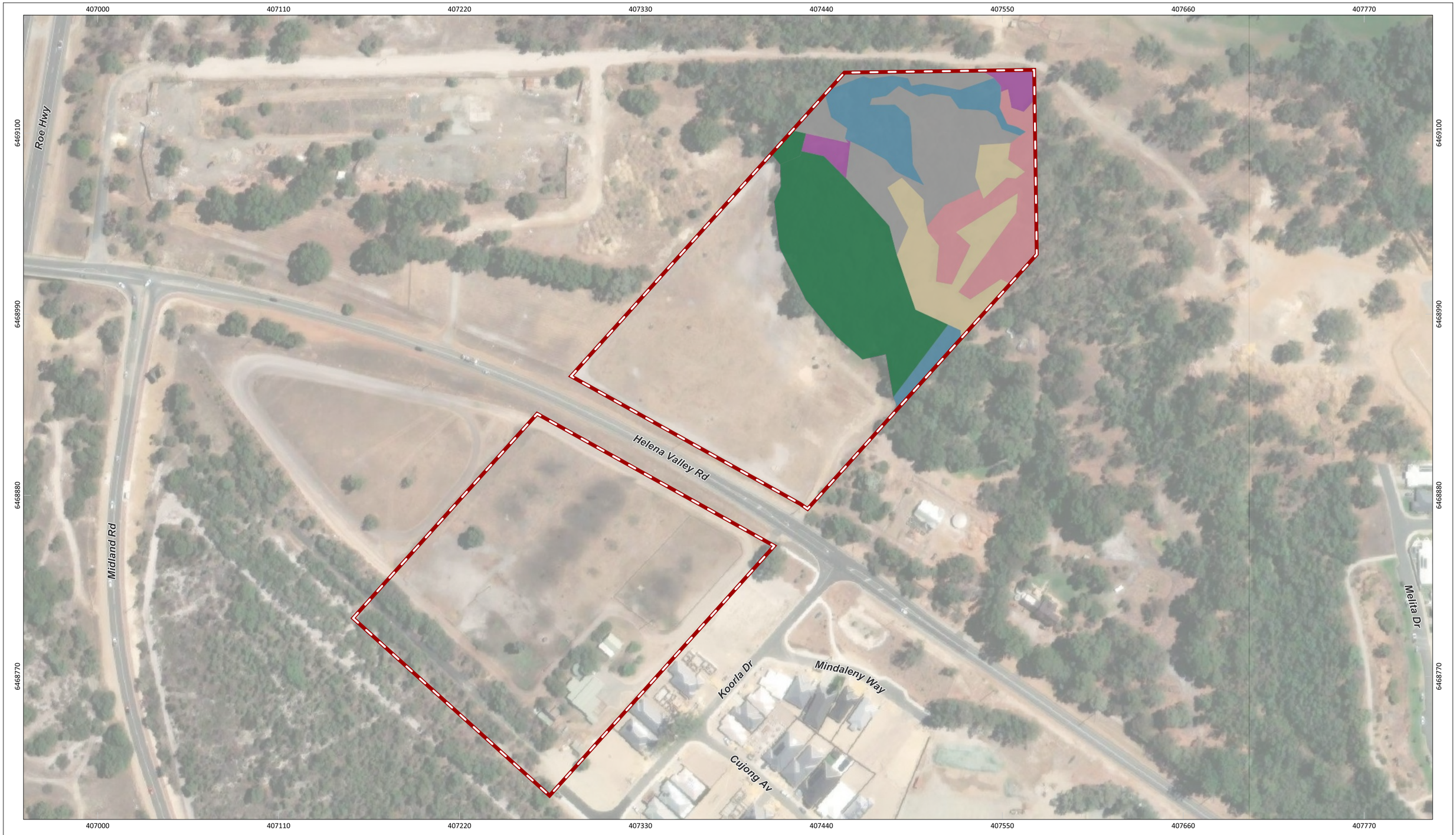

Figure 22: Revegetation Areas

N

0 25 50 75 100 125 m

SCALE: 1:2,200	SHEET SIZE: A3 COLOUR
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA Zone 50	
DATA SOURCE:	

PROJECT/REPORT NAME: Environmental Due Diligence Helena Valley Road Subdivision	
CLIENT: Ingwe Helena Valley Pty Ltd	
PROJECT NUMBER: A25.232	VERSION: 1
DRAWN BY / REVIEWED BY: West GIS / Stephen Moore	DATE: 10/12/2025

Legend

- Site Boundary

Revegetation Areas

- *Eucalyptus rudis* - Full Revegetation
- *Eucalyptus rudis* - Understorey Revegetation
- *Eucalyptus wandoo* - Full Revegetation
- *Eucalyptus wandoo* - Understorey Revegetation
- Melaleuca Woodland - Understorey Revegetation
- Wetland/Riverbank - Revegetation

No	Description	Drawn	Approved	Date
A	Original issue	WG	SM	10/12/2025

NOTES:

Base map ESRI Imagery.

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Table 4-1: Potential Impacts, Mitigation and Management Considerations

Environmental Aspect	Ecological Values and Potential Impacts	Mitigation and Management Considerations
Acid Sulfate Soils	The majority of Lot 253 is mapped as having a 'moderate to low risk' of ASS within 3 m of the natural ground surface, and high risk beyond 3m. The balance of the Site is not identified to have a risk of ASS occurrence.	The potential presence of ASS is not a constraint to development, however may require further investigation and potential management during development and earthwork phases for subdivision, in accordance with the National Acid Sulfate Soils Guidance (Water Quality Australia, 2018).
Groundwater / Surface Water	Groundwater mapping indicates the depth to ground water is between 1-3m across the majority of the Site.	A groundwater and dewatering management plan should be prepared if groundwater is expected to be encountered during construction. This is not considered a constraint, however, and can be managed during construction. Surface water management will need to be considered, regarding changes to topography that may alter runoff and drainage within the Site, particularly to Kadina Brook. This can be managed through a Construction Environmental Management (CEMP) to reduce the risk of sedimentation, and a Wetland and Foreshore Management Plan, which can both be prepared as a condition of subdivision.
Wetlands	There are no geomorphic wetlands mapped within the Site, however the retained native vegetation is associated with Kadina Brook and links to a CCW (UFI: 15,440), Helena River.	All vegetation associated with the CCW and within the 50 m buffer to the wetland, is to be retained within POS 1. Management should include the measures also described for Acid Sulfate Soils and Groundwater/Surface water, including further soil investigations and water management plans. A Mosquito Management Plan is likely to be required as a condition of subdivision. Management of retained wetland and vegetation can be managed through a Wetland and Foreshore Management Plan, which is likely to be required as a condition of subdivision. Revegetation will be implemented within the POS1, CCW and CCW buffer area, to improve vegetation and habitat quality (as discussed in Section 4.1). This can be managed through a revegetation plan incorporated into the Wetland and Foreshore Management Plan, to be developed in accordance with the revegetation areas summarised in Section 4.1 and utilising the weed treatment program described in Appendix D.

Environmental Aspect	Ecological Values and Potential Impacts	Mitigation and Management Considerations
Flora and Vegetation	Vegetation within the Site was assessed to be in predominantly Degraded or Completely Degraded. Vegetation in better condition is limited to 0.05 ha and will be retained within POS 1. To facilitate development of the Site, approximately 0.618 ha of Degraded, or worse, vegetation will be removed. Approximately 0.02 ha of the wetland vegetation is mapped within POS1 (Figure 12) and anticipated to be removed. This vegetation is in Degraded condition. No clearing of TECs/PECSs or flora listed under the EPBC Act, BC Act, or as a Priority by DBCA is proposed	A total of 0.37 ha of native vegetation will be cleared to facilitate future development in accordance with the LSP. Clearing is expected to be effectively managed through future subdivision approval process and associated conditions. This may include a Flora, Vegetation and Management Plan (or similar). 2.1 ha of vegetation will be retained along the Kadina Brook interface, within the CCW, CCW buffer and POS1. This vegetation can be managed through a Wetland and Foreshore Management Plan. Revegetation will be implemented within the POS1, CCW and CCW buffer area, to improve vegetation and habitat quality. This can be managed through a revegetation plan incorporated into the Wetland and Foreshore Management Plan. Any potential indirect impacts to adjacent vegetation and conservation areas can be managed through appropriate management plans. Roads have been sited to provide hard edge interfaces to adjacent vegetation, as recommended by agencies.
Fauna	The Degraded condition of native vegetation and lack of native understorey within the Site presents limited fauna habitat values for most species. However, all three black cockatoo species may potentially utilise the canopies of remnant trees, and Quendas may use the low shrub. The proposed development will include the removal of 0.139 ha of Degraded vegetation which is not considered suitable habitat for any conservation significant fauna.	The Site provides limited fauna habitat values, and includes impacts to 0.12 ha of foraging habitat for three black cockatoo species. As this impact does not meet the minimum criteria of 1 ha of foraging habitat within the Referral guideline for 3 WA threatened black cockatoo species (DAWE, 2022),, no further approvals are anticipated, nor is an EPBC referral expected to be required. However, a Flora, Vegetation and Fauna Management Plan may be required as a condition of subdivision. If required, this plan should include standard pre-clearance measures for quenda trapping and fauna trapping To prevent potential injury to fauna, vegetation clearing of both lots should begin at Helena Valley Road and work away, towards the surrounding vegetation. Clearing should be undertaken outside of the breeding period for black cockatoos.
Contamination	According to the DWER Contaminated Sites Database there are no contaminated sites intersecting with the Site. However several registered sites are located adjacent to, and in close proximity to the Site.	A Pre-Construction Preliminary Site Investigation is recommended to be undertaken prior to subdivision, to confirm if any contamination is present within the Site, and identify any remediation that may be

Environmental Aspect	Ecological Values and Potential Impacts	Mitigation and Management Considerations
		required. However this can be managed through the subdivision process, and is not considered a constraint to development.
Heritage	Two registered Aboriginal heritage places are mapped as intersecting the Site: • Holding paddock 1-4 (ID 3966). • Helena River (ID 3758).	An Aboriginal Cultural Heritage Assessment has been commissioned to investigate the condition and presence of the two registered Aboriginal Cultural Heritage Places, and to determine the potential direct or indirect impacts. At the time of writing this EAR, the results of this assessment are not yet available. Any potential impacts to Aboriginal cultural heritage values, including lodged or registered sites, should not be undertaken until all obligations and approvals required under the AH Act have been met. A chance finds protocol should be incorporated into the CEMP, including a stop-works procedure if any potential heritage values are identified during construction.
Bushfire	A majority of the area is mapped as a Bushfire Prone Area.	Development should be implemented in accordance with the BMP. Roads have been sited to provide hard edge interfaces to adjacent vegetation, as recommended by agencies.

Figure 23: Retained and Impacted Values within the Site

N

0 25 50 75 100 125 m

PROJECT/REPORT NAME	Environmental Due Diligence Helena Valley Road Subdivision
SCALE	1:2,200
SHEET SIZE	A3 COLOUR
CLIENT	Ingwe Helena Valley Pty Ltd
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA Zone 50
PROJECT NUMBER	A25.232
VERSION	1
DATA SOURCE	
DRAWN BY / REVIEWED BY	West GIS / Stephen Moore
DATE	10/12/2025

Legend

- Site Boundary
- Initial PGV Foreshore Boundary

Black Cockatoo Nesting Trees

- Marri (*Corymbia calophylla*)
- Wandoo (*Eucalyptus wandoo*)
- Potential Black Cockatoo Foraging Habitat
- Conservation Conserved Wetland Buffer
- Conservation Conserved Wetland
- Public Open Spaces
- Residential R20
- Road Reserves
- Urban Deferred Zone

Mapped Vegetation Extent

- To Be Retained
- To Be Cleared

No	Description	Drawn	Approved	Date
A	Original issue	WG	SM	10/12/2025

NOTES:

Base map ESRI Imagery.

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Appendix A
MRS Amendment - Addendum

Our Ref: 451

29 June 2023

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

Attn: Brett Pye – Senior Planner, Schemes & Strategies

Dear Sir / Madam,

PROPOSED METROPOLITAN REGION SCHEME AMENDMENT – ADDENDUM
HELENA VALLEY URBAN PRECINCT (HVUP)

On behalf of Dodd & Dodd Pty Ltd and Noble Hodge Pty Ltd, Dynamic Planning and Developments has prepared this supplementary addendum to our proposed Metropolitan Region Scheme (MRS) amendment. The intent of this addendum is to provide our responses to the referral comments received from the various government authorities as part of the referral process undertaken by the WAPC and to provide an indicative vision for the future development of the HVUP area.

In review of the preliminary comments received on the proposed amendment the key matters which require further investigation/discussion are:

- The proposed design for the Bushmead Road/Helena Valley Road overpass bridge;
- Whether part of the foreshore reserve area for Kadina Brook needs to be reserved Parks and Recreation under the MRS;
- There being a need to provide appropriate separation distances between any future sensitive land uses (i.e. residential) with the amendment area and industrial activities in the Hazelmere industrial area to the west which may have off-site impacts.
- The finalisation and endorsement of the DWMS for the site.

The below table provides a detailed summary of the referral comments received and our respective comments in response to those comments focusing on the key issues identified above. It is requested that these responses be considered as part of the assessment of the proposed MRS amendment.

Additionally, contained within **Attachment 1** are the preliminary concepts to demonstrate the potential development outcomes and to assist the WAPC in their assessment of the proposed amendment. It is noted that these concepts are purely indicative only and not intended for development until further planning has progressed.

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Referral Comments	Response
Department of Biodiversity, Conservation and Attractions **Kadina Brook, Helena River and Swan and Canning River System** The DBCA has responsibilities under the Swan Canning Rivers Management (SCRM) Act which seeks to protect the ecological and community benefits and amenity of the Swan Canning Development Control Area and promote and facilitate the good management of the catchment area to meet this objective.	
SPP 2.10: Swan-Canning River System states that "land use changes should not result in further water quality degradation but should, if possible, improve the situation." The development of the 'Helena Valley Urban Precinct' should therefore be undertaken in accordance with best management practice to ensure that water quality from future development will be appropriate prior to entering Kadina Brook, the Helena River and ultimately the Swan River.	Removal of current industrial activities and fertiliser use/high stock numbers will reduce contaminant inputs. WSUD designs will assist with removing contaminants in post development land use. Text can be added to the DWMS to highlight this.
Kadina Brook and its associated vegetated riparian zone and floodplain is the main feature within the subject site. The Environmental Assessment Report notes that Kadina Brook is a waterway rather than a basin type of wetland and, as such, management of the waterway is administered by DWER rather than DBCA. However, it is noted that DBCA has a role to play regarding planning adjacent to the Swan Canning Development Control Area.	Noted.
A biophysical assessment was undertaken to determine an appropriate foreshore reserve on the southern side of Kadina Brook in the Amendment Area. Based on the assessment, the Environmental Assessment Report recommended that an appropriate foreshore reserve was the outer extent of the native vegetation to the south of Kadina Brook. The proposed foreshore reserve is consistent with the Shire of Mundaring Foreshore Plan in the Foothills Growth Strategy. It is recommended that DWER assesses the suitability of the proposed foreshore reserve.	The 10m revegetation zone is deemed suitable to improve the ecological functioning of the wetland/waterway system. Updated layout reflects this. DWMS to be updated accordingly.
The Environmental Assessment Report also suggested that the foreshore reserve could contain some public amenity on the drier parts of the foreshore reserve. The Environmental Assessment Report also recommended that the stormwater and groundwater management/treatment systems should be located outside of the foreshore reserve, or the foreshore reserve should be widened to accommodate a drainage basin.	The updated layout allows for revegetation of the foreshore plus more active uses and stormwater treatment, due to an increase in the POS/foreshore reserve area.
It is unclear if the foreshore reserve that was recommended in the Environmental Assessment Report has been identified in the proposed lot, road and reserve layout shown in the District Water Management Strategy (DWMS). The DWMS shows a 50m buffer to the CCW and a 30m buffer to the REW. However, it is recommended that the DWMS should be amended to show	DWMS will be updated with the revised layout that includes further revegetation and a widening of the foreshore area to accommodate suitable wetland/waterway buffers. A figure showing the comparison can be provided.

the foreshore reserve recommended in the Environmental Assessment Report, as well as showing the formerly proposed wetland buffers, for comparison.	
Further, it is recommended that a foreshore reserve is applied to Kadina Brook and the associated vegetated floodplain and that this area is set aside under the MRS as Parks and Recreation Reserve. It may be appropriate to offset this provision of Parks and Recreation against the 10% public open space provision.	Noted.
Urban Water Management	
Stormwater management over the subject site shall address *Corporate Policy Statement 49: Planning for Stormwater Management Affecting the Swan Canning Development Control Area*, the Department of Water and Environmental Regulation's *Stormwater Management Manual for* Western Australia (2004-2007) and Decision Process for Stormwater Management in Western Australia (2017) and water sensitive urban design principles.	The DWMS provides Best Management Practices suited to the location and receiving riparian systems. Further information can be added to state how by doing this it also addresses these policies.
The District Water Management Strategy (DWMS) prepared by Oversby Consulting (2023) has been reviewed alongside the results from Galt Geotechnics field investigations that show the groundwater level (GWL) in Lot 250 is approximately 2.45m below the natural surface and the GWL in Lot 5 varies from 2.35m to more than 3.0m below the natural surface. The depth to GWL should be investigated further to inform the design of the stormwater management systems during subsequent planning phases.	The DWMS outlines in Section 9.4 and 12.1 outline the need for ground water monitoring to be undertaken to support the LWMS. The DWMS text will be updated to make this clearer and state that this Groundwater information is to be used to inform the stormwater management for the site. As groundwater levels are generally deep, there is likely to be little impact on the current design on the on-site infiltration systems.
The District Water Management Strategy (DWMS) states that groundwater discharged from subsoils (if subsoils are required) will be treated prior to entering downstream sensitive environments. This is strongly supported because the groundwater monitoring for the site has shown elevated nutrient levels. Therefore, the discharged groundwater must be treated in a water quality treatment system, such as a biofilter.	Text can be added stating that subsoil networks are to free drain to treatment systems prior to any discharge. The depth to groundwater means that there is unlikely to be high volumes of groundwater entering any subsoil networks.
The DWMS modelled pre- and post-development stormwater flows. This modelling showed that post-development flows to Kadina Brook for 20% AEP, 10% AEP and 1% AEP were approximately half the pre-development flow volumes. This significant reduction in surface water flows to Kadina Brook is not supported. It is strongly recommended that the stormwater flow modelling is recalculated to match the pre-development flows. This would also result in reduced sizing of the proposed 'bioretention basins'. Additionally, the pre- and post-development flow modelling should also include the 1EY rainfall event. This is because the 1EY event is very important for maintaining the ecology of Kadina Brook and Helena River because the 1EY event maintains the stability and form of waterway channels.	The larger storage systems were used to make sure that the system was conservative in relation to enough land being available for detention and treatment. This will be refined as part of detailed modelling to match in with the refined layout and can be presented in the updated DWMS.

The discussion in the DWMS about '1EY Management' should be changed to 'Small Rainfall Event Management' and the 15mm criterion from the Decision Process for Stormwater Management in Western Australia (DWER, 2017) should be the criterion that determines stormwater quality management. The proposed infiltration of stormwater on lots throughout the development in soakwells is supported. However, the proposal to pipe all road runoff to 'bioretention basins' located within POS is not supported. The runoff generated by the first 15mm of rainfall from roads and carparks should be managed at-source within road reserves and carparks via pervious paving, soakwells, vegetated swales, tree pits and raingardens, wherever possible. This would reduce the size of bioretention systems that would be required in Public Open Space (POS). This would improve the amenity of the POS and would more closely replicate the pre-development hydrology throughout the catchment.	DWMS can be updated to this alternative terminology. In relation to the use of bioretention basins in the POS rather than the road reserves the following should be noted: • The majority of the streets only drain past 4-5 houses before getting to an area of POS. • This is considered a suitable distance to be at source. • It is significantly easier to maintain bioretention systems within POS areas, so unless the Shire wants them in the street, the POS are deemed suitable for the residential areas. • For the commercial areas, there are green areas throughout, which can be utilised for bioretention systems. The exact locations are to be determined as part of the LWMS and UWMP, with the DWMS highlighting the principles as well as noting that the site is suitable for rezoning.
It is recommended that the DWMS documentation is amended to show the recommended foreshore reserve, the indicative POS area near Kadina Brook and the extent of the originally proposed wetland buffers. The foreshore reserve should be revegetated. As noted in the DWMS, this would "enhance the current ecosystem values, including its use as a fauna corridor". Revegetating the foreshore reserve, particularly the understorey, will also improve the water quality in the stormwater runoff and surface water flows entering Kadina Brook, which discharges into Helena River.	The revised layout accommodated the foreshore area with revegetation. The DWMS will be updated based on this layout.
It is also recommended that the proposed stormwater and groundwater management systems (e.g. 'bioretention basins') are located outside of the foreshore reserve. DBCA also recommends that weed control be undertaken in a staged approach to avoid an influx of nutrients into Kadina Brook from the large amount of decomposing vegetative matter, and that chemical control be undertaken with a herbicide suitable for wetland areas. It is requested that a list of species proposed for revegetation, methodology and densities of planting be provided.	Most of the stormwater and groundwater treatments will be outside of the foreshore reserve. Any systems that need to be on the northern boundary will be set back appropriate distance from the sensitive ecosystems, with the foreshore area having been expanded in the revised layout. The DWMS will be updated with this change. The species should be provided as part of future detailed design. The DWMS is to prove that the land is appropriate for rezoning. The planting will utilise locally endemic species, with the DWMS to note this.
A foreshore management plan should be prepared as part of future detailed design, including addressing the interface with the proposed commercial area. The location of POS and the proposed landscaping and integration of stormwater/groundwater management areas within POS is to be refined within the LWMS as part of future development design.	Text can be added to the DWMS that foreshore plan is to be undertaken at detailed design as well as POS refinement as part of the LWMS process.
Bushfire Planning *State Planning Policy 3.7 – Planning for Bushfire Prone Areas* (SPP 3.7) recognises the need to consider bushfire risk management measures alongside environmental, biodiversity, and conservation values. The associated *Guidelines for Planning in Bushfire Prone Areas* (Western Australian Planning Commission, 2017) states that planning proposals should satisfy bushfire	

protection requirements within the boundaries of the land being developed so as not to impact on the bushfire and environmental management of neighbouring foreshore reserves. Reserves within the Swan Canning river system are expected to be revegetated to a vegetation classification consistent with the ecological vegetation classification naturally occurring within the location. The Bushfire Management Plan submitted with the MRS Amendment includes detail on some retention and revegetation within the subject site, which is accounted for in the post development vegetation class and BHL assessments these are namely: • clearing of the minor areas of vegetation which are not associated with the wetland/waterway. These are Plot Numbers 6, 7, 8 and 9 noting that Plots 7 and 8 are grassland. • The bushfire hazard level assessment for the proposed development area, excluding the wetland, is classified as moderate or low bushfire hazard rating. • The primary management issue is the provision of a suitable setback from the hazard vegetation to ensure a maximum BAL-29 rating for any development area, noting the interface with this vegetation is to be 'hard edge' and should be a perimeter road. However, the DWMS states: "These buffers are to be revegetated, while taking into account the necessary bushfire requirements." As per SPP 3.7, bushfire protection requirements are to be incorporated within the land being developed, not within the foreshore reserve. It is generally expected that foreshore reserves of this type of site should be vegetated to Class A – Forest. It is noted that the proposed lot layouts do not propose a road between proposed Lot 67 and the area most likely proposed to be designated as a foreshore reserve. It is strongly recommended that a road is located between the proposed Lot 67 and the foreshore reserve to protect the foreshore reserve from threats such as weeds and rubbish and to reduce the bushfire risk to the adjoining residential lots. It is further noted that a Crown reserve (R27688), vested with the City of Swan for the purpose of 'Recreation and Fauna', provides a vegetated buffer between Bush Forever site 213 and the proposed development. No clearing to facilitate the residential development, including for the provision of adequate fire setbacks, should occur in any existing or future Crown reserves. As the MRS amendment is only supported by a bushfire hazard level (BHL) and not a bushfire attack level (BAL) of assessment, required setbacks and asset protection zones are not identified. The adequacy of the road width along the bushland and foreshore interfaces, as shown in the concept plan, in providing an adequate setback to the development, can therefore not be confirmed. **Bush Forever Site 213**	DWMS will reference the 10m revegetation strip (to A class forest) along the edge of the wetland/river system, with the buffer areas of the foreshore. The BMP has a 10m foreshore reserve based on the environmental advice. This was shown as revegetated land in Version B of the BMP but was removed as instructed by the project manager. The Environmental Assessment Report indicates that the boundary of the wetland foreshore is the extent of the existing vegetation and no additional area is required. The BMP will reflect the final approval of the wetland foreshore definition.

DBCA advises there are known occurrences of the threatened ecological community '*Banksia attenuata* woodland over species rich dense shrublands' (SCP 20a) which occur in the adjacent Bush Forever Site 213 (Bushmead Bushland, Swan) to the south-west of the amendment area. This Bush Forever site will be managed by DBCA in the future for the purpose of conservation. While it is recognised that the vegetation within the subject site is disturbed and may no longer contain sufficient remnant native flora species to align it with a specific floristic community type, the future development should ensure that during and post construction there are no direct or indirect impacts to the adjacent vegetation. Appropriate interface treatments should be implemented on the boundaries of the development area to control access both into the City of Swan's reserve, the foreshore area and the Bushmead bushland. This includes the provision of vegetated buffers, hard road edges along interfaces, adequate access control and bushfire asset protection zones. **Matters of National Environmental Significance** Due to the identification areas of vegetation on site which provides potential foraging and roosting habitat for threatened species such as Carnaby's Black Cockatoo (*Zanda latirostris*), Forest Redtailed Black Cockatoo (*Calyptorhynchus banksii naso*) and Baudin's cockatoo (*Zanda baudinii*) there may be an impact to threatened species listed under State and Federal legislation. Consideration should therefore be given to the obligations for assessment of the proposal in accordance with the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*. The proponent should contact the Commonwealth Department of Climate Change, Energy, the Environment and Water for further information on these responsibilities, prior to development.	
<u>Department of Fire and Emergency Services</u> It is noted the BMP has been prepared in accordance with v1.3 of the Guidelines, which has now been rescinded. DFES have assessed the BMP against version 1.4 of the Guidelines and advise that the BMP should be updated.	The DFES comments have been addressed within **Attachment 2** that contains additional justification and Figures.

1. **Policy Measure 6.3 a) (i) Results of a Bushfire Hazard Level (BHL) Assessment**

Issue	Assessment	Action
Vegetation Exclusion	**Plot 11 – not demonstrated** Areas in Plot 11 have been excluded from classification with justification that a residential subdivision is taking place in the adjoining lot, however the aerial imagery submitted does not align with the proposed classification. A single photo (Photo ID 20) is provided however it is unclear if this is located accurately and does not clearly detail the extent of the subdivision works taking place. Further evidence is required to validate the exclusion of the overall area, or alternatively, modifications are required the Vegetation Classification Map and BHL map to show the worst-case scenario.	Decision Maker to be satisfied with proposed vegetation classification.
Vegetation classification	A Vegetation Classification Map in accordance with appendix Two of the Guidelines (pages 59 and 60) is required to validate the vegetation classification proposed.	Modification to the BMP is required.
	This should be provided in the form of a single figure detailing the proposed vegetation plots, contours, Photo IDs and aerial imagery. The submitted BMP does not provide the above information in one diagram to allow for validation. Further, the slope of each plot should be included in both the above diagram, and the vegetation outputs table. The submitted BMP details one slope only and does not provide each plot's slope in table 3.	
Vegetation Classification	There is no post development vegetation assessment to detail the changes required to achieve the BHL outputs provided in Figure 8. It is unclear which areas are required to be modified to achieve this outcome. DFES is unable to validate the post development BHL based on the information submitted.	Modification to the BMP is required.
Administrative errors	In the Photo ID table, photos 6-9 are classified as 'Excluded', however the description and images are consistent with Class A Forest. This is presumed to be a typographic error but should be updated.	Modification to the BMP is required.

Department of Primary Industries and Regional Development

Thank you for inviting the Department of Primary Industries and Regional Development (DPIRD) to provide preliminary comment on the proposal to rezone Rural-Residential land on four lots to Urban zone. DPIRD objects to the proposed amendment for the following reasons:

- The amendment report does not adequately address the Western Australian Planning Commission (WAPC) *State Planning Policy 2.5 Rural Planning* (SPP2.5) or *State Planning Policy 4.1 Industrial Interface* (SPP4.1).
- While the amendment report refers to these state planning policies, it fails to acknowledge or consider the interface between the proposed urban zone and Western Australia's main rendering facility, Talloman, located at Lot 115 Lakes Road in the Hazelmere Industrial Area.
- The Talloman rendering facility is of State significance for WA's animal industries as it processes about 90% of Western Australia's animal waste.
- Rendering animal waste means that 180,000 tonnes per year of raw material is processed and does not end up in landfill.
- DPIRD understands that the Craig Moston Group is expanding and investing as the Talloman site and is committed to remaining at this location.
- Rendering works are listed in the table in Appendix 1 of the Environment Protection Authority Guidance No 3: *Separation Distances between Industrial and Sensitive Land Uses (June 2005) and described as facilities where 'animal matter is processed or extracted for use as fertilizer, stock food or other uses.' The table recommends a separation distance range of 1000-1500 metres, depending on wastewater treatment/disposal system, location and size of the facility.*
- *The boundary of Lot 250 Helena Valley Road is 878 metres from the boundary of Talloman rendering facility.*
- *The EPA Guidance specifically addresses generic separation distances between industrial and sensitive land uses to avoid conflicts between these land uses. It states that: Proponents and responsible authorities are encouraged to consider their proposals and schemes in the light of the guidance given. A proponent or responsible authority wishing to deviate from the advice in this Guidance Statement would be expected to put a well-researched, robust and clear justification arguing the need for that deviation.*
- *The proponent can access information about the Talloman Rendering Facility that is available in the public domain from the Department of Water and Environmental Regulation's website about its recently renewed licence (L4297/1983/17) and 2022 works approval (W6490/2021/1).*

Significance of land proposed for rezoning:

While it is noted that the subject site is within 1000m of the Talloman Rendering facility. The majority of the land affected being lot 250 and Lot 5 is unable, due to the ANEF contours, to support residential development and is only suitable for commercial which is not classified as a sensitive land use. Further the expansion of the existing facility is away from the subject site.

A small portion of lot 253 is impacted and is 932m from the rendering facility when taking the buffer from the closet point of the facility. Please see image below.

Contained within the EPA Guidance document it is mentioned that these buffer distances are capable of being reduced subject to a sound site specific technical analysis to guide the separation distance.

"Where the separation distance is less than the generic distance, a scientific study based on site- and industry-specific information must be presented to demonstrate that a lesser distance will not result in unacceptable impacts."

It is considered that the existing separation and site topography will result on no negative impacts on the sensitive land uses within the buffer distance. Further should it be necessary a site analysis can be undertaken at the Local Structure Plan phase.

• DPIRD agrees agriculture is largely absent from the subject land.
• DPIRD's records shows the four lots composes two separate properties:
  o The property consisting of Lot 5 and Lot 250 is listed as a small landholding and a non-agricultural enterprise type.
  o The property consisting of Lot 253 and Lot 254 is listed as a small landholding and a lifestyle block enterprise type.
 	
In conclusion, DPIRD asks that the scheme amendment report seeks to ensure the future operation and potential of future expansion of the Talloman Rendering Facility in the Hazelmere Industrial Area is not impacted by urban development proposed by this scheme amendment.	

<u>Department of Health</u> *1. Wastewater Disposal* The DoH has no objection to the proposal, subject to all new development proposals being connected to reticulated sewerage in accordance with the Government Sewerage Policy. The DoH needs to be satisfied and notified that the additional loading of wastewater production from the proposal/s will be adequately managed by the service provider's existing and or upgraded wastewater treatment plant, pump stations and infrastructure to prevent overloading and risk to public health. *2. Public Health Impacts* The site has not been identified on the Department of Water and Environmental Regulation's Contaminated Sites Database, but the proponent should contain a Basic Summary of Records for the site to complete their enquiries. Irrespective of the above, the former depot and former market garden are land uses that may give rise to contamination. In addition, the site lies adjacent to the west of land that has been reported and classified as Contaminated – Remediation Required (DMO81371) based on the presence of landfill materials, including asbestos containing material, beneath the site. Metals, hydrocarbons (such as from diesel or oil) and per- and poly-fluoroalkyl substances are present in soil and/or groundwater beneath the site. Therefore, the site should be subject to a preliminary site investigation to identify any potential sources of contamination and allow for a preliminary assessment of the site's suitability for the proposed urban land use. Until potential contamination has been investigated, the DoH does not consider the current site suitable for any rezoning which allows for redevelopment for sensitive land uses. ***3. Medical Entomology***	The Basic Summary of Records found the following: *"A search of the department's records of known and suspected contaminated sites was undertaken however, our records indicate that as of 21/07/2023 this site has not been reported to the department as a known or suspected contaminated site either prior to or after the commencement of the Contaminated Sites Act 2003."* **Attachment 3** contains a copy of the Basic Summary of Records. The site is not registered on the Department of Water and Environmental Regulation's Contaminated Sited Database, this has been further confirmed by the Basic Summary of Records. The site is therefore suitable for the 'Urban' zoning with the specific contamination investigations and suitability of land uses more appropriate for discussion and further investigation during the Local Structure Planning phase. During this phase the desired development is more apparent and more relevant to determine the extent of remediation required (if any).

The subject land is in a region that occasionally experiences significant problems with nuisance and disease carrying mosquitoes. These mosquitoes can disperse several kilometres from breeding sites and are known carriers of Ross River (RRV) and Barmah Forest (BFV) viruses. Human cases of RRV and BFV diseases occur annually in this general locality. The subject land is also within 3km of mosquito breeding sites along the Helena River. Mosquitoes will disperse from these sites to the subject land under favourable environmental conditions. There may also be seasonal freshwater mosquito breeding habitat in close proximity to the subject land. Additionally, there is the potential for mosquitoes to breed in onsite infrastructure and constructed water bodies if they are poorly designed. Prior to future development, the DoH recommends a Mosquito Management Plan (MMP) be developed and approved by both the DoH and the Shire of Mundaring to ensure the risk to the community of exposure to nuisance and/or disease carrying mosquitoes has been considered. This MMP is to be approved by the local government and DoH prior to any subdivision	
<u>Department of Water and Environmental Regulation</u> The Department has identified that the proposal has the potential for impact on water values and management. While the Department does not object to the proposal, key issues and recommendations are provided below and these matters should be addressed: The Department has received the District Water Management Strategy (DWMS) associated with the Proposed Metropolitan Scheme Amendment for assessment and is yet to undertake an assessment of the document. Once the final version of the DWMS has been reviewed and approved, in conjunction with the Shire of Mundaring, the Department will provide support for the proposed Metropolitan Region Scheme Amendment. **DWER DWMS comments** 1. Provide general details of the types of commercial development proposed to be built in this area, the pollution issues associated with those land uses, and any specific management measures required to address those issues. 2. Identify assets including wetland types, their classification and buffers, regionally significant flora and fauna, and water-dependent threatened ecological communities. Include wetlands and an indication of ecological values and conditions. Identify the risks of the proposed land use on the water-dependent ecosystems.	The DWMS comments made by DWER are specifically related to the detailed design of the site in the future, wherein the required updates to the DWMS can occur concurrently along with the formal advertising of the proposed amendment. 1. An indicative layout and commercial use types will be provided in the updated DWMS based on the updated layout. 2. The DWMS provides the current DBCA wetland mapping. Updated environmental plans with buffers and surveyed features will be provided in the updated DWMS more details on risks and mitigations can also be provided. 3. A pre vs post volume assessment is not normally undertaken. The general assessment is pre vs post flow rates. The volumes will remain similar due to the infiltration of water post development, which mimics the predevelopment situation for small events.

3. Indicative water balance (pre- and post-development water balances can be presented together). This may be presented as a diagram including pre- and post-development volumes with explanatory notes. 4. Provide details of the current land uses. 5. Provide a figure showing the location of DWER bores used for comparison and compare hydrogeology of those bores. Provide all data and hydrographs of groundwater monitoring undertaken and of DWER's bore used for comparison. 6. Provide appropriate criteria for sub-soil drainage to be considered at LWMS stage (e.g. free-draining outlets, to be located at AAMGL or above, depending on impacts to the sites environmental assets). 7. Describe commitments and obligations for the next stage of the planning process. Identify issues that need specialised investigation and management for the subsequent LWMS. 8. Provide a completed copy of the DWER's DWMS Checklist. 9. It is unclear how much pre-development groundwater level monitoring has been undertaken and if two winter peaks have been captured. Further detail on this should be provided. In addition, provide greater details on when the future groundwater level monitoring will take place. 10. Conceptual designs of how the sites flood flows will interact with the foreshore area, where they will be compensated or detained, how this is landscaped and what it is used for, should be provided. Note that the buffer to Kadina Brook should not be utilised as POS and for stormwater treatment and detention. These uses should be provided outside of the buffer area. 11. Native vegetation surveys, areas of significance, where these will be retained and how water management affects those areas. 12. Contamination assessment – the site is adjacent to two contaminated sites and there is unknown fill on site. Further assessment of contamination issues should be undertaken at this stage. 13. Provide full details of previous water quality monitoring data. Additional surface water monitoring should be undertaken given the previous monitoring is over 10 years old. 14. Rehabilitation of the Kadina Brook foreshore area should be consistent a class A nature reserve and should not be hampered by potential bushfire impacts on the adjacent residential and commercial area. The bushfire impacts from a fully rehabilitated foreshore area should be assessed and then additional setback provided to the foreshore area if a reduction in risk is required. 15. Provide a copy of the geotechnical investigation already undertaken.	4. More details on current land uses can be provided in the updated DWMS. 5. Further details on DWER comparison bores can be provided. Any available information regarding on lot bores will also be included in the DWMS, noting that full hydrographs may not be available for the entire site. 6. Details to direct future detailed design in relation to subsoil drainage can be provided in the updated DWMS, noting that the depth to groundwater is such that high groundwater is likely to be low risk. 7. This has been provided in section 13. Further details can be provided on any specialist investigations. 8. This can be included as an appendix. 9. Further details of the groundwater monitoring to date can be provided. The level of monitoring is suitable for a DWMS, with the updated DWMS to detail that more testing needs to be undertaken as part of the LWMS. The current groundwater information can also be provided as an Appendix. 10. This level of detail is generally provided at the LWMS. Indicative locations for basins and flow paths can be provided. All treatment and detentions systems will be outside of the determined buffers. 11. The environmental assessments can be provided as an appendix. The DWMS will provide more details to how the proposed treatment of water and setbacks proposed are suitable to manage any risks to these ecosystems. It will include mapping of the buffers, revegetation areas and indicative locations of treatment areas. 12. Any further on site contamination aspects can be dealt with as part of the LWMS process. 13. Groundwater monitoring details can be provided in an Appendix of the updated DWMS. Surface water monitoring is not needed for the DWMS, however can be undertaken as part of the LWMS to determine any potential changes/issues. DWMS to be updated to note need for surface water monitoring. 14. Updated layout allows for an additional 10m revegetation to A class forest. DWMS to be updated with revised layout and revegetation line. 15. Geotech report to be provided as an Appendix to the updated DWMS.
<u>DPLH – Land Use Planning</u>	

Please find below find below preliminary comments/notes from the Metro Planning North East team on the proposed Rural to Urban MRS amendment for Helena Valley Road, Helena Valley: • Appears to be a formal MRS request not prelim comment. • Current/proposed Urban/Rural boundary does not align with existing cadastre boundaries. • Consider P&R/Helena River interface in concept planning. • MRWA road planning and associated land requirements for a new traffic bridge? • Road upgrading and land requirements/ availability of road connections to Helena Valley Road? • Road and Perth Airport noise impacts. • Concept planning to have regard to bushfire risk. • Local government planning for road connection to the north? • Concept planning to have regard to Western Power infrastructure extending through the land. • Local commercial strategy for context to consider commercial land uses.	The items raised by the Land Use Planning team have all been addressed either via the original MRS amendment document or this subsequent addendum.
<u>Main Roads Western Australia</u> Main Roads does not support the amendment to be formally advertised at this time for the following reasons. Main Roads has undertaken an investigation into the Bushmead Road overpass, as part of the proposed Midland Freight Rail Realignment (currently protected by PCA 152) being progressed by DPLH. The bridge needs to be raised to allow High Wide Load heavy vehicle freight access (10m high, 10m wide, up to 50m long) on Roe Highway. The planning options being considered are: • Option 1 – Raise the bridge on the current alignment. • Option 2 – Raise the bridge on an alignment to the north. Based on the current options, as planning progresses, the bridge has the potential to impact the proposed amendment areas. Access to the proposed amendment areas is likely to be difficult to achieve and should be identified and agreed upon, prior to the amendment being formally advertised.	Planning Control Area 152 does not impact the proposed amendment area, please see **Attachment 4**. Further the Midland Freight Rail Realignment can be pursued through the current 'Primary Regional Road' reservation of Helena Valley Road. The proposed amendment area is not impacted by this reservation, with only circa 1,363sqm of Lot 5 impacted adjoining Helena Valley Road and Roe Highway. Where the impacted land can be readily ceded at the time of the overpass upgrade. It is therefore, considered that the Amendment can continue as all overpass upgrades should be contained to the reservation area.
<u>Shire of Mundaring</u> **Strategic Planning Framework**	The MRS amendment document and the supporting Herring Storer Acoustics Environmental Acoustic Assessment report has been informed by the endorsed ANEF contour mapping contained within **Attachment 5**. Regardless, the westernmost sites are suitable for the 'Urban' zoning as commercial development can still occur, with the

Foothills Growth Strategy
The subject properties form part of Precinct 11 of the Foothills Growth Strategy, which is designated for 'medium density residential development and commercial mix'. The western-most extent of the Helena Valley study area adjacent to Roe Highway is within the ANEF 20-25 noise contour and is not suitable for residential land use unless measures are implemented in accordance with State Planning Policy 5.1.

The image which follows shows the current ANEF contours over the subject area obtained from the Perth Airport website, which are kept up to date in accordance with the Airports Act 1996. The contours shown throughout the MRS Amendment documentation are incorrect (the ANEF 20-25 area covers a larger amount of the subject area's western portion than indicated).

Foreshore Vision Plan
The Shire prepared a Foreshore Vision Plan over predominately State land for the area immediately to the north of the subject properties. The Shire invites the Department to consider this future significant social and ecological asset.

The plan illustrates how urban expansion could lead to the creation of reserve around the Helena River and be developed to simultaneously cater for recreational needs and deliver environmental benefits. How future development interfaces with this area, particularly as a non-residential interface will need to be taken into consideration by the proponent and WAPC.

Local Commercial Strategy
The Shire's Local Commercial Strategy establishes a hierarchy of centres in the Shire. Relative to Helena Valley, the Local Commercial Strategy contemplates the potential for a Light Industrial / Service Commercial centre in Helena Valley for the western portion of the subject area.

Although the site is reasonable close to Midland, due to the limited access to and from Roe Highway, the future 'non-residential' nature of the area will require careful consideration. Importantly, the Shire is unlikely to support light industrial or other uses that may conflict with the prevailing residential use and traffic.

North-East Sub-Regional Planning Framework
North-East Sub-Regional Planning Framework shows the subject properties as 'Urban Expansion' land –reflecting the proposed MRS zone. Considering all of the above and acknowledging that 'Urban' under the MRS provides for a range of non-residential zones under the Local Planning Scheme No.4, the proposal complies with the applicable strategic planning framework.

provided subdivision concepts to provide security that 'Residential' development will not be sought over those areas impacted by the ANEF contours.

Please see comments above regarding the upgrade to the overpass bridge.

The relevant approvals from Western Power for the relocation of the powerlines is appropriate to be dealt with at the Local Structure Planning Phase (detailed design), it is clear from the engineering services report provided that the area is capable of servicing the 'Urban' land uses. The subdivision concepts were prepared to assist in the preparation of the relevant consultant reports and to provide evidence that the site is suitable for the 'Urban' zoning. The issues with the current subdivision plans are capable of being addressed in the further detailed design phases and the Local Structure Plan.

We have addressed the Shire's other comments below with our response in red:

- It is recommended that the concept subdivision plan not form part of the MRS Scheme amendment documentation. Considering the impacts the future road upgrades and overhead transmission line may have in terms of the proposed lot and road configurations, there is currently too much uncertainty whether the proposed subdivision could occur in its current form. See comments above.
- The subdivision plan is to, where/if necessary, reflect the proposed road upgrades and alterations to the Primary Regional Road Reserve mentioned previously in this submission. The applicant is to liaise with MRWA and the Shire's Infrastructure Department regarding this matter. See comments above.
- If the overhead transmission line is unable to be relocated then the proposed residential areas will need to be amended accordingly to avoid the overhead transmission line from going through them. As evidenced by the ongoing subdivisions at the surrounding land holdings it is possible to accommodate the powerlines within the subdivision design.
- The site will require a comprehensive drainage and geotechnical investigation. Noted.
- At the subdivision stage the proponent will need to include information on dust management and noise management. Details on mosquito management may also be required. Noted.
- The south-western portion of the subject area contains remnant banksia woodland which is a federally protected TEC. Noted, the protected vegetation can be identified and protected during the Local Structure Planning Phase.

Foreshore Area for Kadina Brook

Kadina Brook flows through the northern portion of the subject area. The protection and management of riparian areas is essential for maintaining healthy watercourses. Protected foreshores preserve aquatic, littoral and terrestrial habitat for native flora and fauna while providing amenity and maintaining scenic quality and landscape values.

To ensure the ongoing protection of the foreshore it is recommended that it's area (generally the north-eastern portion of the subject area) remain zoned Rural under the MRS, and become a Regional Reserve for Park and Recreation purposes should the remainder of the area identified to become zoned Urban is approved.

Proposed Road Upgrades

According to the Transport Impact Assessment (TIA) provided by the applicant, Main Roads has advised that they have undertaken an investigation into the Bushmead Road overpass, as part of the proposed Midland Freight Rail Realignment being progressed by DPLH. As part of the project the bridge needs to be raised to allow High Wide Load vehicle freight access on Roe Highway.

The TIA goes on to say *"the bridge has the potential to impact the proposed amendment areas. Access to the proposed amendment areas is likely to be difficult to achieve and should be identified and agreed upon, prior to the amendment being formally advertised"*.

The widening of Roe Highway to 6 lanes and the lifting of Helena valley Road/Bushmead Road bridge to accommodate the future freight line will affect the Midland Road and Helena Valley Road Intersection, which will probably have to be redirected through the site and to the east of its current location. However, according to the TIA this upgrade has not been completely reflected in the prelodgement comment received from Main Roads.

As the above works will have implications for the Primary Regional Road Reserve adjacent to and within the subject area, and possibly for the proposed road configuration, it is recommended that the MRS amendment not proceed until access to the proposed amendment area is identified and agreed upon as recommended by the TIA. The applicant is to liaise with MRWA and the Shire's Infrastructure Department regarding this matter.

- Kadina Brook flows through the northern section of the subject area. The area surrounding the brook is a wetland area and listed as an ESA and possibly contains TEC's (banksia attenata woodlands). Noted.
- Any future subdivision and redevelopment of the subject area will require a Foreshore Management Plan to be prepared for the Shire's consideration and approval. Noted.
- Sewer connection required for all proposed lots. Noted, all lots can accommodate sewer as per the provided engineering services report.
- Further investigation required of the northern lots for possible contamination. See comments above.
- The proponent will need to ensure that fire access is possible. All Bushfire Requirements will be addressed in the future planning phases as per the requirements of the State Planning Policy.

The DWMS is to be updated with revised foreshore area and revegetation works, plus indicative stormwater treatment/detention areas.

Location of Western Power Infrastructure

According to the Engineering Services Report provided by the applicant, a Western Power overhead transmission line exists through the subject area. This will have implications for where future residential development may be able to occur. It is recommended that the MRS amendment not proceed until the necessary approvals are obtained from Western Power and the adjoining affected landowners for the relocation of the transmission line.

Proposed Subdivision Plan

Although comment is not being formally sought at this stage in relation to the proposed subdivision plan, the Shire advises the following:

- It is recommended that the concept subdivision plan not form part of the MRS Scheme amendment documentation. Considering the impacts the future road upgrades and overhead transmission line may have in terms of the proposed lot and road configurations, there is currently too much uncertainty whether the proposed subdivision could occur in its current form.
- The subdivision plan is to, where/if necessary, reflect the proposed road upgrades and alterations to the Primary Regional Road Reserve mentioned previously in this submission. The applicant is to liaise with MRWA and the Shire's Infrastructure Department regarding this matter.
- If the overhead transmission line is unable to be relocated then the proposed residential areas will need to be amended accordingly to avoid the overhead transmission line from going through them.
- The site will require a comprehensive drainage and geotechnical investigation.
- At the subdivision stage the proponent will need to include information on dust management and noise management. Details on mosquito management may also be required.
- The south-western portion of the subject area contains remnant banksia woodland which is a federally protected TEC.
- Kadina Brook flows through the northern section of the subject area. The area surrounding the brook is a wetland area and listed as an ESA and possibly contains TEC's (banksia attenata woodlands).
- Any future subdivision and redevelopment of the subject area will require a Foreshore Management Plan to be prepared for the Shire's consideration and approval.
- Sewer connection required for all proposed lots.
- Further investigation required of the northern lots for possible contamination.
- The proponent will need to ensure that fire access is possible around the foreshore pre and post subdivision and construction stages.

  Below is an image taken from a previously approved Foreshore Management Plan for the north-eastern portion of the subject area which identifies how such fire access could be possible. The wetland area on lot 254 has been fenced and set back a minimum of 20m from the edge of the (southernmost) vegetation. It also includes a gate wide enough to allow access for a fire vehicle. A recent site visit concluded that the fencing should be revised to what was originally agreed to in the Foreshore Management Plan. If necessary, the applicant is to liaise with the Shire's Environment department regarding this matter.

Attachment 1
Concept Plans

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Suite 15/29 Collier Road, Morley WA 6062
PO Box 688, Inglewood WA 6932
admin@dynamicplanning.net.au

1 PROPOSED CONCEPT SITE PLAN
1 : 1000

N

A	ISSUED FOR INFORMATION	CT	NP	30.06.2023
revision/ issue	description	drawn by	check by	date

project
44.23 HELEN VALLEY
location
LOT 5 + LOT 250 HELENA VALLEY

drawn: Author
checked: Checker
description: OVERALL SITE PLAN

Hodge Collard Preston ARCHITECTS
Third Floor, 38 Richardson Street, West Perth, WA 6005
PO Box 743, West Perth, WA 6872
Ph: (08) 9322 5144
Fax: (08) 9322 5740
Email: admin@hcparch.com

scale: 1 : 1000
date: 30.06.2023
project no: 44.23
dwg no: SK05
rev: A

Attachment 2
Bushfire Response Table

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admin@dynamicplanning.net.au

Submission	Comment	Action
Department of Biodiversity, Conservation and Attractions		
It is generally expected that foreshore reserves of this type of site should be vegetated to Class A – Forest.	The BMP has a 10m foreshore reserve based on the environmental advice. This was shown as revegetated land in Version B of the BMP but was removed as instructed by the project manager.	• The Environmental Assessment Report indicates that the boundary of the wetland foreshore is the extent of the existing vegetation and no additional area is required. • The BMP will reflect the final approval of the wetland foreshore definition.
DFES		
It is noted the BMP has been prepared in accordance with v1.3 of the Guidelines, which has now been rescinded. DFES have assessed the BMP against version 1.4 of the Guidelines and advise that the BMP should be updated.	The BMP has been prepared in accordance with Version 1.4 of the Guidelines as stated in Section 5.0. Item A3.7 Fire Service Access Route has been repeated in Table	• Table 4 BPC Compliance requires minor correction to the reference numbers.
Areas in Plot 11 have been excluded from classification with justification that a residential subdivision is taking place in the adjoining lot, however the aerial imagery submitted does not align with the proposed classification. A single photo (Photo ID 20) is provided however it is unclear if this is located accurately and does not clearly detail the extent of the subdivision works taking place. Further evidence is required to validate the exclusion of the overall area, or alternatively, modifications are required the Vegetation Classification Map and BHL map to show the worst-case scenario.	The aerial photo was taken in April 2022. An updated 2023 aerial photo is attached and this clearly shows the subdivision construction in Lot 252.	• The 2023 aerial photograph is attached. • BMP report plans to be revised to show the updated aerial photograph.
A Vegetation Classification Map in accordance with appendix Two of the Guidelines (pages 59 and 60) is required to validate the vegetation classification proposed. This should be provided in the form of a single figure detailing the proposed vegetation plots, contours, Photo IDs and aerial imagery.	Appendix Two of the Guidelines (pages 59 and 60) relates to a BAL Contour Map which is not being prepared for this strategic planning proposal. The location of the photographs were shown on a separate plan as to include them on the vegetation classification plan would become confusing because of the amount of detail.	• Combine Figure 5 Vegetation Classification and Figure 5 Photo Location. • Include slopes in Table 3.

Submission	Comment	Action
The submitted BMP does not provide the above information in one diagram to allow for validation. Further, the slope of each plot should be included in both the above diagram, and the vegetation outputs table. The submitted BMP details one slope only and does not provide each plot's slope in table 3.	There is no vegetation outputs table referencing the assigned BAL ratings as no BAL Contour Map has been prepared. The reference of slopes in a bushfire hazard level assessment is only relevant where the slope exceeds 10 degrees.	
There is no post development vegetation assessment to detail the changes required to achieve the BHL outputs provided in Figure 8. It is unclear which areas are required to be modified to achieve this outcome. DFES is unable to validate the post development BHL based on the information submitted.	Section 3.2 states that are Plot Numbers 6, 7, 8 and 9 will be required to be cleared for the development, noting that Plots 7 and 8 are grassland.	• Include a new plan (attached) showing the land to be modified to low threat state. • Include a new plan (attached) showing the revised vegetation classifications. • Update Figure 8 (now Figure 9) to show the "development site" (attached).
In the Photo ID table, photos 6-9 are classified as 'Excluded', however the description and images are consistent with Class A Forest. This is presumed to be a typographic error but should be updated.	These relate to Plot 4 which is referenced in Table 3 as Class Forest.	Correct the vegetation classification for photos 6 – 9 which is a typographic error.
A1.1 – not demonstrated - The BAL ratings cannot be validated, as the vegetation classification inputs require modification as per the above table. The assessment at this level should inform the design and layout of subdivision, and reduce the vulnerability of people and property form the impact of bushfire.	The BAL ratings cannot be validated as no BAL Assessment has been done. As indicated in Section 1.1 this is a bushfire hazard level assessment for a strategic planning proposal which does not require a BAL Assessment as documented in Table 1 of the Report.	No change required.
The BHL Map identifies areas of Extreme Hazard within developable areas (urban) of the subject lots.	The proposed lot layout is not known. The proposed Urban zoning under the MRS allows for multiple land uses including local public open space.	Show the outline of the "developable land" area on Figure 8 now Figure 9 (attached).
The BMP suggests development setbacks to ensure development is located outside of BAL-40 and BAL-FZ. However, lots should be located in areas with the least possible risk of bushfire to meet the intent of Element 1.	Acceptable Solution A1.1 Development location for Element 1 requires that the strategic planning proposal, subdivision and development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL–29 or below.	Show the outline of the "developable land" area on Figure 8 noting that this will have a moderate or low bushfire hazard level which complies the A1.1 and the objectives of SPP3.7.

DATE OF PHOTOGRAPHY: APRIL 2023

LEGEND

SUBJECT LAND

DEVELOPMENT SITE

150 ASSESSMENT BUFFER

LAND TO BE MODIFIED TO LOW FUEL STATE

FIGURE 4
PROPOSED CLEARING

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

N

Rev	Description	Date
A	Preliminary	6/10/2022
B	Rev Enviro	20/01/2023
C	Foreshore	16/06/2023
D	Updated aerial	19/07/2023

Job No 22-027

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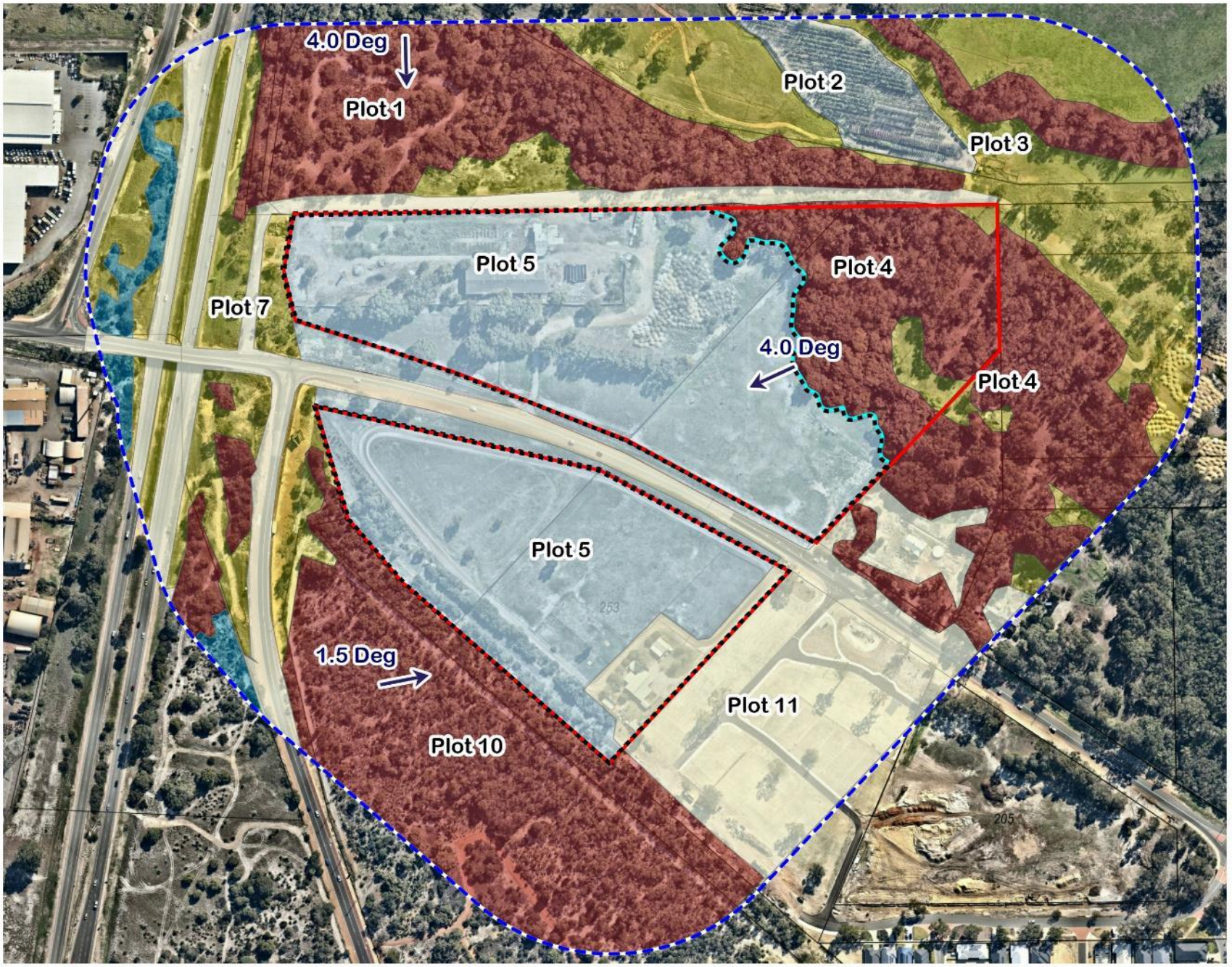
0418 954873



LEGEND

- SUBJECT LAND
- DEVELOPMENT SITE
- VEGETATION ASSESSMENT AREA (150m from the external boundary of the subject land)
- FORESHORE BOUNDARY
- VEGETATION PLOTS
- UPSLOPE
- VEGETATION CLASS
  - A FOREST
  - D SCRUB
  - G GRASSLAND
- EXCLUDED Cl 2.2.3.2
  - (f) MANAGED LAND
- MODIFIED TO LOW FUEL STATE

Location Details:	Lots 145, 230, 330, 335 Helena Valley Road
Assessment Date:	2/05/2022
Prepared by:	G Lush
Accreditation Level:	Level 2
Accreditation No:	BPAD 27682
Accreditation Expiry Date:	February 2024
Date of Aerial Photo:	April 2023

SCALE 0m 150m

FIGURE 8
MODIFIED VEGETATION CLASSIFICATION

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

N

Rev	Description	Date
A	Preliminary	6/10/2022
B	Rev Enviro	20/01/2023
C	Foreshore	16/06/2023
D	Updated aerial	19/07/2023

Job No 22-027

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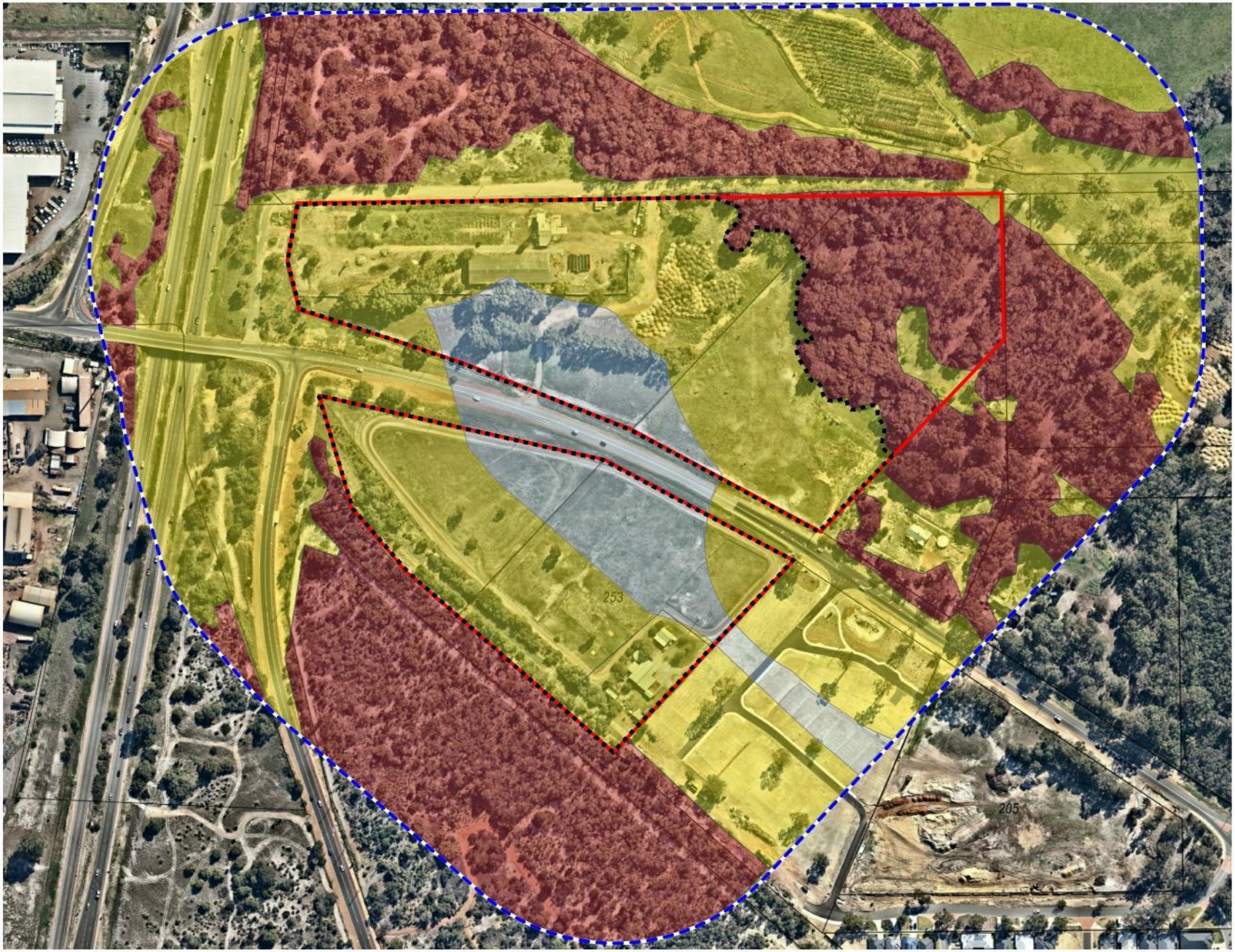

LEGEND

SUBJECT LAND

DEVELOPMENT SITE

ASSESSMENT AREA
(150m from the external boundary of the subject site)

BUSHFIRE HAZARD LEVEL

- EXTREME
- MODERATE
- LOW

Location Details:	Lots 145, 230, 330, 335 Helena Valley Road
Assessment Date:	2/05/2022
Prepared by:	G Lush
Accreditation Level:	Level 2
Accreditation No:	BPAD 27682
Accreditation Expiry Date:	February 2024
Date of Aerial Photo:	April 2023

SCALE 0m 150m

FIGURE 9
BUSHFIRE HAZARD LEVEL ASSESSMENT
DEVELOPED LAND

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

N

Rev	Description	Date
A	Preliminary	6/10/2022
B	Rev Enviro	20/01/2023
C	Foreshore	16/06/2023
D	Updated aerial	19/07/2023

Job No 22-027

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Attachment 3
Basic Summary of Records

(08) 9275 4433
Suite 15/29 Collier Road, Morley WA 6062
PO Box 688, Inglewood WA 6932
admin@dynamicplanning.net.au

Government of Western Australia
Department of Water and Environmental Regulation

Your ref: 451
Our ref: DMO 5490
Enquiries: Registrar
Phone: 1300 762 982
Fax: (08) 6364 7001
Email: info@dwer.wa.gov.au

Derek Bickley
Dynamic Planning & Developments
PO Box 688
Inglewood WA 6932

Dear Sir/Madam

BASIC SUMMARY OF RECORDS REQUEST

Thank you for your Basic Summary of Records request for the site consisting of the following parcel(s) of land:

- LOT 5 ON DIAGRAM 79613 as shown on certificate of title 2745/910 known as 145 Helena Valley Rd, Helena Valley WA 6056
- LOT 250 ON DEPOSITED PLAN 75907 as shown on certificate of title 2863/828 known as 230 Helena Valley Rd, Helena Valley WA 6056
- LOT 253 ON DEPOSITED PLAN 413196 as shown on certificate of title 2953/411 known as 330 Helena Valley Rd, Helena Valley WA 6056
- LOT 254 ON DEPOSITED PLAN 413196 as shown on certificate of title 2953/2known as 330 Helena Valley Rd, Helena Valley WA 6056

which Department of Water and Environmental Regulation (the department) received on 13/07/2023.

A search of the department's records of known and suspected contaminated sites was undertaken however, our records indicate that as of 21/07/2023 this site has not been reported to the department as a known or suspected contaminated site either prior to or after the commencement of the *Contaminated Sites Act 2003*.

For general enquiries, please contact the Registrar on 1300 762 982.

Yours sincerely

Penny Woodberry, Manager

CONTAMINATED SITES REGULATION
Delegated Officer under section 91
of the *Contaminated Sites Act 2003*

21/07/2023

Enc. Receipt Number RR034615

Attachment 4
Planning Control Area 152

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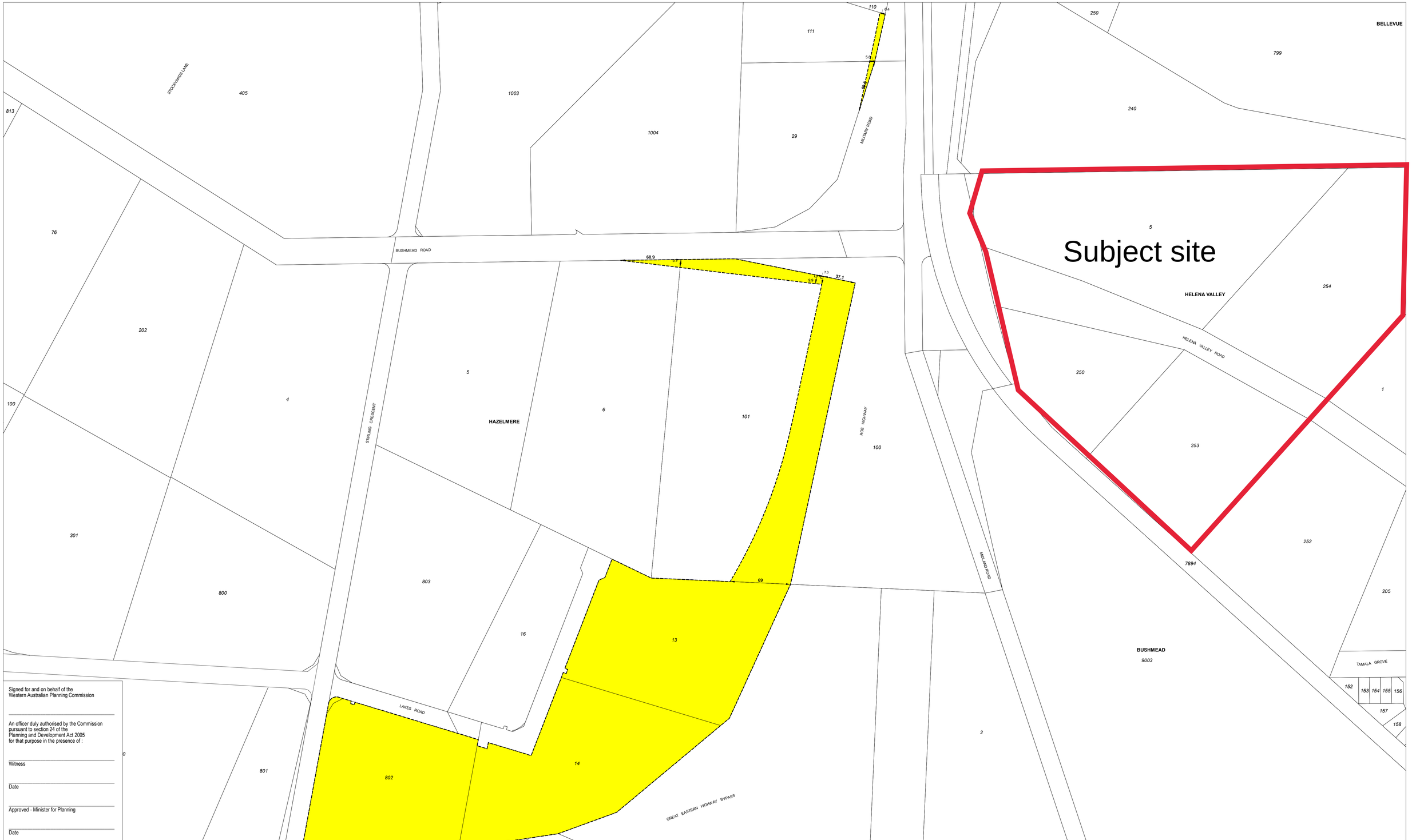

Signed for and on behalf of the
Western Australian Planning Commission

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

Witness

Date

Approved - Minister for Planning

Date

Planning control area
No. 152

MIDLAND FREIGHT RAIL REALIGNMENT

Western Australian Planning Commission

Created on date: Monday, 22 June 2020
Produced by Data Analytics, Department of Planning, Lands and Heritage, Perth WA
Base information supplied by Western Australian Land Information Authority SLIP 1096-2018-1

Legend

Planning control area

Program Manager: S. Luscombe
Geospatial Officer: J. Ballarotta
Examined: A. Power
Revised:
Version No: 1
Date: WAPC / 291.9.3
17 June 2020

N

0 40 80 120 160
metres

Plan Number

1.7955

3049 Sheet 2 of 3

File number: 835/02/21/0024
Plan reference:
Metropolitan Region Scheme
1:25,000 sheet 16

Amending plans:
1.7954 - 1.7956

Attachment 5
ANEF Contour Mapping

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PERTH AIRPORT ANEC 1 2040 FORECAST AIRCRAFT MOVEMENTS

Aircraft	Arrivals			Departures			All	Arrivals			Departures			All
	Day	Night	Total	Day	Night	Total		Day	Night	Total	Day	Night	Total	
	Runway 03							Runway 21						
1900D	0.37	0.00	0.37	0.23	0.09	0.32	0.68	0.36	0.00	0.36	0.32	0.08	0.40	0.76
717200	1.06	0.21	1.27	0.63	0.33	0.96	2.23	0.94	0.36	1.30	1.44	0.31	1.75	3.05
737800	3.17	0.50	3.67	0.92	1.32	2.24	5.91	1.72	0.92	2.63	2.77	1.28	4.04	6.68
737 MAX8	4.24	2.13	6.37	2.68	1.13	3.81	10.18	3.57	2.11	5.69	6.73	2.97	9.69	15.38
737 MAX9	3.09	5.17	8.26	2.50	2.62	5.13	13.39	3.15	4.07	7.22	6.04	5.40	11.44	18.66
777900	0.00	0.52	0.52	0.00	0.28	0.28	0.80	0.00	0.16	0.16	0.00	0.26	0.26	0.42
787-8/787-9	3.19	1.75	4.94	1.85	0.73	2.58	7.52	2.11	0.88	2.98	3.88	1.59	5.48	8.46
787-10	0.00	0.42	0.42	0.14	0.09	0.23	0.66	0.00	0.22	0.22	0.13	0.22	0.35	0.57
797	10.79	6.25	17.04	6.64	3.39	10.02	27.07	7.54	5.23	12.77	13.83	7.41	21.24	34.00
A220-100	9.68	1.79	11.47	4.46	3.39	7.85	19.32	6.97	3.14	10.12	11.19	3.26	14.45	24.57
A220-300	1.04	0.22	1.26	0.64	0.33	0.97	2.23	0.94	0.36	1.30	1.43	0.33	1.76	3.05
A319NEO	1.09	0.22	1.31	0.63	0.35	0.99	2.30	0.98	0.37	1.35	1.48	0.33	1.81	3.16
A320NEO	6.01	1.19	7.20	3.07	1.70	4.77	11.97	4.45	1.67	6.12	7.33	2.42	9.75	15.87
A321NEO	2.88	3.72	6.60	2.21	1.75	3.96	10.56	2.59	3.12	5.71	5.38	3.98	9.37	15.08
A330-800	2.50	0.83	3.33	1.33	0.62	1.95	5.28	1.74	0.74	2.48	2.91	1.29	4.20	6.67
A350-900	4.72	2.10	6.81	2.45	1.34	3.78	10.60	3.31	1.54	4.85	5.60	2.83	8.43	13.27
A350-1000	0.00	0.41	0.41	0.15	0.09	0.24	0.65	0.00	0.22	0.22	0.12	0.23	0.35	0.57
A380-800	0.38	1.16	1.55	0.12	0.88	1.00	2.55	0.71	0.70	1.42	0.62	1.57	2.20	3.61
BEC58P	0.57	0.28	0.85	0.49	0.19	0.68	1.53	0.60	0.21	0.81	0.77	0.18	0.95	1.76
CNA441	0.13	0.11	0.24	0.17	0.00	0.17	0.42	0.22	0.08	0.29	0.44	0.00	0.44	0.74
DHC6	0.37	0.00	0.37	0.22	0.09	0.31	0.69	0.36	0.00	0.36	0.32	0.08	0.40	0.75
DHC830	3.55	0.13	3.68	1.74	0.69	2.44	6.12	3.02	0.21	3.23	3.84	0.99	4.83	8.05
F100	5.03	0.76	5.79	2.20	1.78	3.98	9.77	3.65	1.39	5.04	5.44	1.69	7.13	12.17
F50	0.71	0.00	0.71	0.42	0.11	0.53	1.24	0.64	0.00	0.64	0.70	0.11	0.82	1.46
F70	4.95	0.79	5.74	2.11	1.84	3.95	9.69	3.67	1.39	5.06	5.36	1.78	7.14	12.20
GLEX	0.63	0.25	0.88	0.00	0.24	0.24	1.11	0.31	0.16	0.47	0.00	1.27	1.27	1.74
SF340	0.70	0.00	0.70	0.42	0.12	0.54	1.24	0.64	0.00	0.64	0.73	0.10	0.83	1.47
Total	**70.84**	**30.91**	**101.76**	**38.43**	**25.50**	**63.93**	**165.69**	**54.20**	**29.24**	**83.43**	**88.80**	**41.96**	**130.77**	**214.20**
	Runway 06							Runway 24						
1900D	0.03	0.00	0.03	0.22	0.09	0.31	0.34	0.29	0.00	0.29	0.02	0.00	0.02	0.31
717200	0.08	0.02	0.09	0.55	0.37	0.92	1.01	0.78	0.28	1.05	0.08	0.01	0.09	1.14
737800	0.22	0.03	0.26	0.74	1.43	2.18	2.43	1.37	0.71	2.08	0.14	0.04	0.18	2.26
737 MAX8	0.34	0.23	0.57	2.32	1.13	3.44	4.01	2.91	1.58	4.50	0.26	0.05	0.31	4.80
737 MAX9	0.22	0.60	0.82	2.21	2.86	5.07	5.89	2.58	3.11	5.68	0.24	0.10	0.34	6.03
777900	0.00	0.05	0.05	0.00	0.30	0.30	0.35	0.00	0.12	0.12	0.00	0.01	0.01	0.12
787-8/787-9	0.25	0.17	0.42	1.68	0.79	2.47	2.89	1.71	0.65	2.35	0.14	0.02	0.16	2.52
787-10	0.00	0.04	0.04	0.15	0.10	0.25	0.29	0.00	0.17	0.17	0.01	0.00	0.01	0.18
797	0.82	0.58	1.41	6.03	3.49	9.51	10.92	6.24	4.04	10.29	0.59	0.13	0.72	11.01
A220-100	0.67	0.13	0.80	3.73	3.74	7.47	8.27	5.66	2.45	8.10	0.61	0.10	0.71	8.81
A220-300	0.08	0.02	0.09	0.54	0.37	0.90	1.00	0.79	0.27	1.06	0.08	0.01	0.09	1.15
A319NEO	0.08	0.02	0.10	0.55	0.39	0.94	1.04	0.79	0.29	1.08	0.08	0.01	0.09	1.17
A320NEO	0.43	0.11	0.54	2.65	1.82	4.48	5.02	3.52	1.29	4.81	0.35	0.06	0.41	5.21
A321NEO	0.22	0.43	0.64	1.98	1.84	3.83	4.47	2.06	2.42	4.47	0.19	0.07	0.26	4.73
A330-800	0.19	0.10	0.29	1.15	0.66	1.81	2.09	1.44	0.59	2.03	0.15	0.02	0.18	2.21
A350-900	0.35	0.23	0.57	2.14	1.39	3.52	4.10	2.65	1.14	3.79	0.25	0.05	0.30	4.09
A350-1000	0.00	0.04	0.04	0.15	0.10	0.25	0.29	0.00	0.17	0.17	0.00	0.00	0.01	0.18
A380-800	0.02	0.19	0.21	0.09	0.90	0.99	1.20	0.57	0.48	1.05	0.01	0.03	0.04	1.10
BEC58P	0.04	0.02	0.06	0.48	0.22	0.69	0.76	0.48	0.15	0.63	0.03	0.01	0.04	0.67
CNA441	0.01	0.01	0.02	0.15	0.00	0.15	0.17	0.17	0.06	0.23	0.02	0.00	0.02	0.25
DHC6	0.03	0.00	0.03	0.23	0.09	0.32	0.35	0.29	0.00	0.29	0.01	0.00	0.02	0.31
DHC830	0.24	0.01	0.25	1.53	0.75	2.28	2.54	2.43	0.17	2.61	0.20	0.02	0.23	2.83
F100	0.35	0.05	0.40	1.86	1.93	3.79	4.19	2.93	1.08	4.02	0.29	0.05	0.34	4.36
F50	0.05	0.00	0.05	0.41	0.12	0.53	0.58	0.52	0.00	0.52	0.04	0.00	0.04	0.56
F70	0.35	0.05	0.40	1.81	2.00	3.81	4.22	2.95	1.09	4.04	0.29	0.05	0.34	4.38
GLEX	0.05	0.04	0.09	0.00	0.17	0.17	0.26	0.25	0.11	0.36	0.00	0.02	0.02	0.38
SF340	0.05	0.00	0.05	0.38	0.12	0.51	0.56	0.53	0.00	0.53	0.04	0.00	0.04	0.57
Total	**5.17**	**3.16**	**8.33**	**33.73**	**27.17**	**60.89**	**69.22**	**43.90**	**22.42**	**66.32**	**4.12**	**0.88**	**5.00**	**71.31**
	Helicopters													
EC130	1.29	0.08	1.37	1.29	0.08	1.37	2.74							

PERTH AIRPORT ANEC 2 2080 FORECAST AIRCRAFT MOVEMENTS

Aircraft	Arrivals			Departures			All	Arrivals			Departures			All
	Day	Night	Total	Day	Night	Total		Day	Night	Total	Day	Night	Total	
	Runway 03L							Runway 21R						
1900D	0.39	0.07	0.47	0.00	0.00	0.00	0.47	0.20	0.18	0.38	0.00	0.00	0.00	0.38
737800	1.58	0.32	1.89	1.24	1.72	2.97	4.86	1.65	0.83	2.49	1.65	0.90	2.55	5.04
737 MAX8	4.06	0.40	4.46	1.29	1.60	2.89	7.36	1.61	0.80	2.41	1.71	0.81	2.53	4.94
737 MAX9	8.25	7.88	16.12	2.87	1.32	4.19	20.32	2.26	2.97	5.23	2.97	1.80	4.77	10.00
777900	2.13	2.22	4.35	2.14	2.51	4.66	9.00	4.09	2.23	6.31	4.08	1.93	6.01	12.32
787-8/787-9	4.97	3.26	8.23	4.71	4.43	9.14	17.37	6.32	5.15	11.47	6.51	3.85	10.37	21.83
787-10	3.86	1.83	5.49	3.36	2.00	5.37	10.86	3.26	1.91	5.17	3.31	1.98	5.30	10.47
797	9.90	4.38	14.27	5.30	2.28	7.57	21.84	5.37	3.94	9.31	7.14	2.17	9.31	18.62
A220-100	2.96	0.00	2.96	2.58	2.68	5.26	8.22	2.43	0.00	2.43	3.49	1.37	4.86	7.30
A220-300	6.31	0.94	7.25	4.80	4.65	9.45	16.69	5.67	2.73	8.39	5.88	2.36	8.24	16.64
A319NEO	6.33	0.94	7.27	4.76	4.65	9.41	16.68	5.71	2.74	8.45	5.86	2.37	8.23	16.68
A320NEO	5.34	0.75	6.09	2.53	3.40	5.93	12.02	3.34	1.48	4.82	3.31	1.76	5.07	9.90
A321NEO	5.04	4.20	9.24	3.80	1.33	5.13	14.37	3.29	2.97	6.26	3.79	1.82	5.61	11.87
A330-800	2.50	1.14	3.64	0.37	0.57	0.93	4.57	0.29	0.64	0.93	0.52	0.32	0.84	1.77
A350-900	5.57	3.35	8.92	3.50	3.14	6.64	15.56	4.77	3.43	8.20	4.88	2.80	7.68	15.88
A350-1000	5.43	3.63	9.07	4.30	4.82	9.12	18.18	6.12	4.36	10.48	5.90	4.53	10.43	20.91
BEC58P	1.08	0.11	1.19	0.51	0.00	0.51	1.70	0.83	0.36	1.18	0.62	0.00	0.62	1.80
CNA441	0.30	0.02	0.32	0.16	0.00	0.16	0.48	0.32	0.08	0.40	0.16	0.00	0.16	0.56
DHC6	0.38	0.07	0.46	0.00	0.00	0.00	0.46	0.20	0.19	0.38	0.00	0.00	0.00	0.38
DHC830	4.75	0.35	5.10	1.39	0.12	1.52	6.61	3.88	0.49	4.37	0.39	0.00	0.39	4.77
F50	0.23	0.05	0.28	0.00	0.00	0.00	0.28	0.39	0.12	0.51	0.00	0.00	0.00	0.51
GLEX	0.74	0.29	1.03	0.00	0.42	0.42	1.45	0.00	0.30	0.30	0.00	1.36	1.36	1.66
SF340	0.23	0.05	0.28	0.00	0.00	0.00	0.28	0.39	0.12	0.51	0.00	0.00	0.00	0.51
Total	**82.32**	**36.05**	**118.37**	**49.60**	**41.66**	**91.27**	**209.63**	**62.38**	**38.01**	**100.39**	**62.20**	**32.12**	**94.32**	**194.71**
	Runway 03R							Runway 21L						
1900D	0.00	0.00	0.00	0.26	0.52	0.78	0.78	0.45	0.00	0.45	0.25	0.27	0.52	0.96
737800	1.01	0.24	1.25	0.63	0.43	1.06	2.31	1.26	0.75	2.01	0.86	0.20	1.06	3.07
737 MAX8	3.32	0.66	3.98	4.70	2.52	7.22	11.19	8.33	2.09	10.42	6.38	2.19	8.57	18.98
737 MAX9	9.23	4.88	14.10	18.60	15.90	34.50	48.61	22.33	19.30	41.63	22.43	11.88	34.30	75.93
787-8/787-9	1.62	0.02	1.64	1.39	0.14	1.52	3.16	2.22	0.10	2.32	2.54	0.10	2.63	4.95
797	17.32	6.13	23.44	25.06	9.24	34.30	57.74	26.96	17.73	44.68	30.87	9.66	40.53	85.21
A220-100	5.20	0.99	6.19	3.28	3.37	6.65	12.84	8.48	2.72	11.20	4.31	1.70	6.01	17.21
A220-300	6.58	1.59	8.17	5.96	4.84	10.80	18.97	10.32	4.55	14.87	7.74	2.45	10.19	25.06
A319NEO	6.55	1.60	8.15	6.02	4.83	10.85	19.00	10.28	4.52	14.81	7.76	2.43	10.19	25.00
A320NEO	4.35	0.93	5.27	5.46	2.87	8.33	13.61	9.50	3.22	12.72	7.14	2.36	9.50	22.22
A321NEO	3.55	1.89	5.44	7.23	6.22	13.44	18.89	8.70	7.55	16.25	8.64	4.62	13.26	29.51
A330-800	2.52	0.49	3.01	3.20	3.27	6.48	9.48	5.14	2.46	7.60	4.48	2.45	6.93	14.53
A350-900	2.69	0.51	3.20	3.34	3.47	6.81	10.01	5.52	2.63	8.16	4.70	2.61	7.31	15.46
BEC58P	0.00	0.00	0.00	0.51	0.45	0.95	0.95	0.54	0.00	0.54	0.60	0.23	0.83	1.37
CNA441	0.00	0.00	0.00	0.11	0.21	0.31	0.31	0.25	0.00	0.25	0.23	0.11	0.34	0.59
DHC6	0.00	0.00	0.00	0.27	0.51	0.79	0.79	0.45	0.00	0.45	0.25	0.26	0.51	0.96
DHC830	0.00	0.00	0.00	3.29	2.15	5.44	5.44	3.11	0.37	3.48	4.06	1.53	5.59	9.07
F50	0.00	0.00	0.00	0.24	0.46	0.70	0.70	0.25	0.00	0.25	0.11	0.23	0.34	0.59
GLEX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.60	0.00	0.00	0.00	0.60
SF340	0.00	0.00	0.00	0.24	0.46	0.69	0.69	0.25	0.00	0.25	0.11	0.23	0.34	0.59
Total	**63.93**	**19.92**	**83.85**	**89.79**	**61.84**	**151.63**	**235.49**	**124.94**	**68.00**	**192.93**	**113.45**	**45.50**	**158.95**	**351.88**
	Helicopters													
EC130	2.59	0.15	2.74	2.59	0.15	2.74	5.48							

Subject Site

ENDORSEMENT FOR TECHNICAL ACCURACY

ULTIMATE PRACTICAL CAPACITY ANEF

Date: 12 / 7 / 19

Executive General Manager, Air Navigation Services.

The aircraft noise contours on this chart have been calculated using an appropriate modelling process. Airservices Australia has, in accordance with the approved manner of endorsement, considered the physical ultimate capacity of the existing or proposed runway/s in its endorsement process.
The data input and assumptions made in that process are derived in part from external sources. Airservices Australia makes no warranty in respect of that information and excludes all liability for any loss arising from reliance on that information.

BUILDING SITE ACCEPTABILITY BASED ON ANEF ZONES
(FROM Australian Standard 2021-2015)

Building Type	ANEF Zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES:
1. The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 may be followed for building sites outside but near to the 20 ANEF contour.
2. Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate (see also Figure A1 of Appendix A).
3. There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases Table 2.1 should be used to determine site acceptability, but internal design noise levels within the specific spaces should be determined by Table 3.3.
4. This Standard does not recommend development in unacceptable areas. However, where the relevant planning authority determines that any development may be necessary within existing built-up areas designated as unacceptable, it is recommended that such development should achieve the required ANR determined according to Clause 3.2. For residences, schools, etc., the effect of aircraft noise on outdoor areas associated with the buildings should be considered.
5. In no case should new development take place in greenfield sites deemed unacceptable because such development may impact airport operations.

Legend
- ANEC 20
- ANEC 25
- ANEC 30
- ANEC 35

Coordinate Reference System: GDA94 / MGA zone 50

Scale @ A1 1:40000

Issued: 9 July 2019

Notes:
Component items in tables may not add to totals due to rounding.
Day is defined as 7 am to 7 pm (local) and night as 7 pm to 7 am (local).
ANEF contours modelled with AEDT 2d incorporating terrain data

ANEC	Runway End	Easting	Northing
		GDA 94 / Zone MGA 50	
ANEC 1	Runway 03	401690	6463665
	Runway 21	402571	6467361
	Runway 06	401625	6465632
	Runway 24	404178	6467206
	Helipad Area	402004	6466529
ANEC 2	Runway 03L	401690	6463665
	Runway 21R	402571	6467361
	Runway 03R	403397	6462199
	Runway 21L	404092	6465117
	Helipad Area	402004	6466529

N

0 1 2 3 4 km

Perth Airport Ultimate Practical Capacity ANEF

Appendix B
PGV Environmental Assessment Report (2023)

LOTS 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

ENVIRONMENTAL ASSESSMENT REPORT

Prepared for:	Dodd and Dodd Pty Ltd
Report Date:	13 April 2023
Version:	3
Report No.	2022-720

pgv ENVIRONMENTAL

CONTENTS

LIST OF ATTACHMENTS

Tables

Plates

Figures

Appendices

1 INTRODUCTION

1.1 Background

Lots 5, 250, 253 and 254 Helena Valley Road (the site) is located in the Shire of Mundaring, approximately 15km east-north-east of the Perth Central Business District (Figure 1). The site is 18.658ha (Figure 2) and straddles both sides of Helena Valley Road.

The site is proposed to be rezoned from 'Rural' to 'Urban' under the Metropolitan Region Scheme (MRS) to facilitate an urban residential and commercial development (Appendix 1).

This Environmental Assessment Report has been commissioned by Dodd and Dodd Pty Ltd to assess the environmental values of the proposed MRS Amendment area.

1.2 Scope of Works

The Environmental Assessment includes a desktop assessment and of the key environmental attributes of the site to ascertain the potential environmental limitations to development.

The Environmental Assessment includes the following:

- Database searches including:
  - Department of Water and Environmental Regulation Contaminated Sites and Water Information databases; and
  - Department of Aboriginal Affairs and National Heritage database.
- Physical characteristics including a description of:
  - Landform;
  - Drainage and water bodies; and
  - Geological, hydrogeological and hydrological characteristics;
- Recent and present land use including:
  - Surrounding land uses;
  - Assessment of current and historical activities on the subject site and surrounding areas which have the potential to result in contamination issues at the site;
- Flora and vegetation characteristics using the recent Detailed Flora and Vegetation Survey;
- Fauna habitats using the recent Basic Fauna Survey; and
- Implications, if any, under Western Australian policies and legislation such as the *Environmental Protection Act, 1986* and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*; and
- Other public information available.

The EAR does not address any potential noise impacts from Perth Airport.

The report outlines the environmental features that will need to be considered when planning for development of the site.

2 LEGISLATION, POLICY AND GUIDELINES

The environmental assessment of this site has taken into consideration the following legislation, policy and guidelines and these will guide the required and expected management outcomes from the Commonwealth, State and Local government agencies.

2.1 Zoning

The site is zoned 'Rural' in the Metropolitan Region Scheme (MRS) (National Map, 2022. The site is zoned 'Rural Residential R4' in the Shire of Mundaring Local Planning Scheme No. 4 (LPS) (WAPC, 2014).

2.2 Commonwealth Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important heritage places, ecological communities, flora and fauna that are defined in the Act as Matters of National Environmental Significance (MNES).

The Environmental Assessment identifies any MNES that may be impacted by development on the site.

2.3 State Legislation

2.3.1 *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is administered by the Department of Environment Regulation (DER). The Act provides for conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with it. The Act establishes head powers to provide mechanisms for the development of Environmental Protection Policies (EPP), the referral and assessment of proposals, the control of pollution and enforcement.

The Act also provides for an Environmental Protection Authority (EPA) that is a statutory authority and is the primary provider of independent environmental advice to Government (Environmental Protection Authority 2005). The EPA is assisted by the Office of the EPA (OEPA).

Under the EP Act, clearing of native vegetation requires a permit from DWER unless there is an exemption under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Proposals that have approval by means of a subdivision are exempt from requiring a clearing permit to clear native vegetation if implementing the subdivision in accordance with the subdivision conditions requires the clearing of native vegetation.

2.3.2 *Biodiversity Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) protects all native species and threatened ecological communities The BC Act recognises that activities involving the taking of flora or fauna (other than threatened species) and the disturbing of fauna (including threatened species) that are approved under the EP Act do not require further approval under the BC Act, if they are undertaken in

accordance with any biodiversity conservation conditions that are applied to an authorisation. These activities include clearing of native vegetation done in accordance with an implementation decision under Part IV of the EP Act.

2.3.3 *Aboriginal Heritage Act 1972*

The *Aboriginal Heritage Act 1972* (AHA) protects all Aboriginal sites whether or not they are known and registered under the AHA.

If any artefacts or other heritage values are discovered during clearing or construction works they will be required to be managed according to the AHA.

2.4 State Policy

2.4.1 State Planning Policy No. 2.8 Bushland Policy for the Perth Metropolitan Region

SPP 2.8 in conjunction with Bush Forever (Government of Western Australia, 2000) seeks to ensure the protection of at least 10 per cent of the original extent of each vegetation complex within the Perth Metropolitan Region. SPP 2.8 was developed to ensure that bushland protection and management issues are appropriately addressed and integrated as a part of future land use. Bush Forever identified approximately 51,200 hectares of regionally significant vegetation for retention. The management of these areas include reservation and acquisition by the State government, negotiated planning solutions with owners who are seeking urban and/or industrial development and advice, assistance and incentive programs to support private conservation.

The native bushland on the site has not been identified for protection under Bush Forever. Bush Forever Site 213, Bushmead Bushland, is to the south of the site.

2.4.2 State Planning Policy No. 2.9 Water Resources

SPP 2.9 aims to ensure the protection and appropriate management of water resources in line with state guidelines as included within the planning framework. The broad aims of this policy are to:

- Protect, conserve and enhance water resources;
- Assist in ensuring the availability of suitable water resources to maintain essential requirements for human and other biological life and to maintain or improve the quality and quantity of water resources; and
- Promote and assist in the management and sustainable use of water resources.

As a part of implementing this policy, the Better Urban Water Management framework was developed (WAPC, 2008). The framework provides detail on how water resources should be considered at each stage of planning by identifying the various actions and investigations required with regard to regional and local planning strategies, town planning schemes, structure plans, subdivisions, strata subdivision and development applications (WAPC, 2008).

2.4.3 Environmental Guidance for Planning and Development

The purpose of Environmental Protection Authority (EPA) Guidance Statement No. 33 *Environmental Guidance for Planning and Development* (EPA, 2008) is to outline the significance of environmental factors and to provide the key definitions associated with the environmental factors. Ensuring that environmental factors are considered in line with the EPA's principals and objectives and within the

planning framework is what this EAR is primarily targeted at. In particular, EPA Guidance Statement No. 33 aims to:

- Provide an overview to environmental protection processes and information;
- Describe the referral and environmental impact assessment process under Part IV of the EP Act; and
- Provide the EPA's position and advice on a range of environmental factors, outlining how to protect, conserve and enhance the environmental values.

2.5 Waterways Policy

Government policy and guidance relating to waterways foreshore areas is primarily administered by Department of Water and Environmental Regulation (DWER). A number of guidance documents assist with the determination of foreshore areas. These documents include:

- Operation Policy 4.3: *Identifying and establishing waterways foreshore areas* (DoW 2012);
- Guidance Note 6: *Identifying and establishing waterways foreshore areas* (DoW 2013); and
- Water Note 23: *Determining foreshore reserves* (WRC 2001).

2.6 Shire of Mundaring

The Shire of Mundaring has a number of Local Planning Policies (LPPs) that detail the City's expectations with regard to managing the environment during planning and development as well as the factors that need to be considered throughout the planning process. Key LPPs and other guidelines that are applicable to the site and the environmental values within the site are outlined below:

- Shire of Mundaring *Environmental Sustainability Policy* (Shire of Mundaring, 2018);
- Shire of Mundaring *Roadside Conservation Policy* (Shire of Mundaring, 2017);
- Shire of Mundaring *Local Biodiversity Strategy* (Shire of Mundaring, 2009)
- Shire of Mundaring *Environmental Management Plan* (Shire of Mundaring, 2012); and
- Shire of Mundaring *Local Planning Scheme No. 4* (WAPC, 2014).

3 EXISTING ENVIRONMENT

3.1 Land Use

Historical aerial photography shows that the site was largely cleared in 1953 (the oldest historical aerial photography available) (Plate 1). The original alignment of Helena Valley Road passed along the western boundary of what is now Lots 250 and 253. A large shed occurs on Lot 5.

Plate 1: Aerial Photograph from 1953 (Landgate, 2022)

Development on the site commenced between 1965 and 1970 (Plate 2) and some additional clearing has occurred.

Plate 2: Aerial Photograph from 1970 (Landgate, 2022)

The current alignment of Helena Valley Road was constructed between 1983 and 1985. Vegetation in the old road reserve has started to regrow in the 2000 aerial photograph (Plate 3). Vegetation has also started to grow more densely in the creekline in the north-east portion of the site (Kadina Brook). The large shed and outside hardstand areas are in operation on Lot 5.

Plate 3: Aerial Photograph from 2000 (Landgate, 2022)

The aerial photograph from 2022 shows the vegetation in the creekline has filled out substantially (Plate 4). The large shed has been removed from Lot 5 and the facility is no longer being used.

Plate 4: Aerial Photograph from 2017 (Landgate, 2022)

Horses are currently agisted on Lot 254 and have free access to the Kadina Brook floodplain.

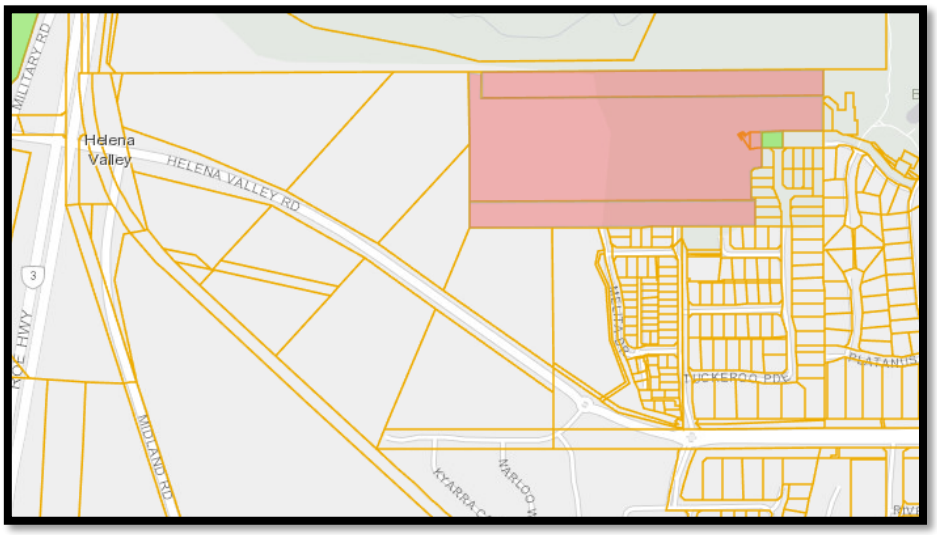
The site is not a registered contaminated site.

3.2 Surrounding Land Use

The site borders an unmade road reserve approximately 20m to the south and Bush Forever Site 213, Bushmead Bushland to the south of the road reserve. Rural lots occur to the east and north and Roe Highway and Midland Road are on the western boundary. There has been recent urban residential development to the south-east.

There is a registered contaminated site on the lot and unmade road reserves to the north-east of Lot 254 (denoted in red on Plate 5). According to the site contamination notice, the site was previously used as a sand quarry and once abandoned was used for uncontrolled landfill (DWER, 2022a).

Plate 5: Contaminated Site Mapping



3.3 Topography

The majority of the site is gently undulating with an elevation of approximately 16 to 20m Australian Height Datum (AHD), generally sloping down to the north-west. Kadina Brook and its floodplain are located in an incised valley approximately 4m below the natural surface to the south (Figure 2).

3.4 Geology and Soils

3.4.1 Geology

The site is located on the Pinjarra System, consisting of a poorly drained area of the Swan Coastal Plain with variable alluvial and aeolian soils (DPIRD, 2022). The Pinjarra Plain which is fluviatile in origin extends from the eastern side of the Bassendean Dunes to the western edge of the Darling Scarp, which joins the Ridge Hill Shelf and forms the denuded slope of the Darling Fault (Beard 1990).

3.4.2 Soils

The soil units located on the site is described as

- Pinjarra, Phase Gf7 (213Pj_Gf7) which is located on minor rises with deep, rapidly drained brownish, siliceous or bleached sands underlain by mottled yellow clay which are the soils mapped over most of the site;

- Pinjarra, Phase GF5 (213Pj_Gf5) which are associated with incised drainage channels with poorly drained gradational mottled yellow earths and mapped on the alignment of Kadina Brook; and
- Pinjarra, Phase Gf9 (213Pj_Gf9) which is located on minor sandy rises (aeolian deposits) with moderately deep well drained sands overlying gravelly mottled clay mapped in a small area in the norther part of the site (DPIRD, 2022).

The Land Degradation Risk Categories of the Pinjarra, Phase Gf7 are as follows:

- Water Erosion <3% of map unit has a high to extreme water erosion risk;
- Wind Erosion >70% of map unit has a high to extreme wind erosion risk;
- Waterlogging 10-30% of map unit has a moderate to very high waterlogging risk;
- Flooding <3% of the map unit has a moderate to high flood risk; and
- Salinity risk <3% of map unit has a moderate to high salinity risk or is presently saline (DPRID, 2021).

The Land Degradation Risk Categories of the Pinjarra, Phase Gf5 are as follows:

- Water Erosion 50-70% of map unit has a high to extreme water erosion risk;
- Wind Erosion <3% of map unit has a high to extreme wind erosion risk;
- Waterlogging >70% of map unit has a moderate to very high waterlogging risk;
- Flooding >70% of the map unit has a moderate to high flood risk; and
- Salinity risk 30-50% of map unit has a moderate to high salinity risk or is presently saline (DPRID, 2021).

The Land Degradation Risk Categories of the Pinjarra, Phase Gf9 are as follows:

- Water Erosion <3% of map unit has a high to extreme water erosion risk;
- Wind Erosion 50-70% of map unit has a high to extreme wind erosion risk;
- Waterlogging 3-10% of map unit has a moderate to very high waterlogging risk;
- Flooding <3% of the map unit has a moderate to high flood risk; and
- Salinity risk <3% of map unit has a moderate to high salinity risk or is presently saline (DPRID, 2021).

3.4.3 Acid Sulphate Soils

The southern part of the site is mapped as having a Moderate risk of Acid Sulphate Soils (ASS) (Plate 6). Wetland soils are often associated with ASS. The southern area is not identified as a wetland in the PGV Environmental Flora and Vegetation survey (2022). The risk in this area may be less than shown on the mapping. Conversely, Kadina Brook and its floodplain are not mapped as having an ASS risk. These areas are more likely to have a High to Moderate ASS risk.

Plate 6: Acid Sulphate Soil Risk Mapping (National Map, 2022)

3.5 Hydrology

Maximum groundwater is at approximately 8m to 10m AHD which is approximately 5m below ground level in Kadina Brook and 11 to 13m below the surface level in the remainder of the site. Groundwater generally flows to the north (DWER, 2022).

The site also contains a man-made dam on the southern side of Kadina Brook.

3.6 Kadina Brook

Kadina Brook runs through the north-eastern part of the site, predominantly on Lot 254. Kadina Brook merges with the Helena River a short distance to the north-west, west of the Roe Highway.

Kadina Brook is an ephemeral watercourse. The portion of Kadina Brook that runs through the site consists of a narrow, central creekline about 1m deep close to the northern boundary of the site (Plate 7). The Brook is flanked on its southern side by a flat to gently undulating floodplain.

The creekline contains Flooded Gum (*Eucalyptus rudis*) and Paperbark trees (*Melaleuca rhaphiophylla*) over mostly weed species (Plate 7).

Plate 7: Kadina Brook Central Creekline

The floodplain contains abundant Flooded Gum trees and areas of Paperbark over grassy weeds. The floodplain area was waterlogged and partially inundated during the site assessment on 9 September 2022.

Plate 8: Kadina Brook Floodplain

The land slopes up to the south to more elevated portions of the site. One seepage area was noted on Lot 254 with water flowing onto the floodplain (Plate 9).

Plate 9: Seepage onto the Floodplain

The DBCA mapping of wetlands on the Swan Coastal Plain maps one wetland on the site (UFI 15440). The wetland is continuous with several other wetlands mapped on properties to the north and east (Plate 10).

The wetland is mapped as a Conservation Category wetland (dark green on Plate 10) and is consistent with the location of Kadina Brook. The adjoining wetlands are mapped as Resource Enhancement (light green on Plate 10) and Multiple Use (blue on Plate 10).

Plate 10: Wetland Mapping

Definitions of the categories are outlined in Table 1.

Table 1: Management Categories and Objective for Wetlands

Management Category	General Description	Management Objectives	EPA Management Objectives (EPA, 2008)
Conservation Category Wetland (CCW)	Wetlands which support high levels of attributes and functions.	To preserve wetland attributes and functions through reservation in national parks, crown reserves, state owned land and protection under environmental protection policies.	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: • reservation in national parks, • crown reserves and State-owned land, • protection under Environmental Protection Policies, and • wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement Wetland (REW)	Wetlands which may have been partially modified but still support substantial ecological attributes and functions.	Priority wetlands. Ultimate objective is for management, restoration and protection towards improving their conservation value. These wetlands have the potential to be restored to conservation category. This can be achieved by restoring wetland structure, function and biodiversity. Protection is recommended through a number of mechanisms.	Priority wetlands. Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use Wetland (MUW)	Wetlands with few attributes which still provide important wetland functions	Use development and management should be considered in the context of water (catchment/strategic drainage planning), town (land use) and environmental planning through landcare.	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

Source: Wetlands of the Swan Coastal Plan Volume 2b (Hill *et al*., 1996) unless otherwise referenced

3.7 Flora

A Detailed Flora and Vegetation Survey of the site was conducted by PGV Environmental in 2022 (PGV Environmental, 2022). A total of 89 plant species were recorded during the flora survey (Appendix 2). This total consisted of 44 native species and 45 (50.6%) introduced species. The number and percentage of introduced species is very high and is a reflection of the overall Degraded condition of the vegetation.

No Threatened or Priority species were recorded on the site. There were three Declared Pests on the site being:

- Arum Lily (*Zantedeschia aethiopica*);
- Cotton Bush (*Gomphocarpus fruticosus*); and
- One-Leafed Cape Tulip (*Moraea flaccida*).

The exotic tree species planted on Lot 5 included Lemon-scented Gum (*Corymbia citriodora*), River Red Gum (*Eucalyptus camaldulensis*), Spotted Gum (*Corymbia maculata*) and River She-oak (*Casuarina cunninghamiana*).

3.8 Vegetation

3.8.1 Vegetation Complexes

Vegetation complexes are a very broad mapping unit based on landform and soils type. The vegetation complex mapped on the site is the Forrestfield Complex (Heddle *et al.*, 1980). The Forrestfield Complex ranges from open forest of *Corymbia calophylla* (Marri) – *Eucalyptus wandoo* (Wandoo) – *Eucalyptus marginata* (Jarrah) to open forest of *Eucalyptus marginata* (Jarrah) – *Corymbia calophylla* (Marri) – *Allocasuarina fraseria*na (Sheoak) – *Banksia* species. Fringing woodland of *Eucalyptus rudis* (Flooded Gum) in the gullies that dissect this landform (Heddle *et al.,* 1980).

Approximately 2,803ha of the original 22,813ha extent of the Forrestfield Complex remains on the Swan Coastal Plain, representing 12.29% (WALGA, 2018). The EPA considers that vegetation complexes with less than 10% remaining in constrained areas such as the Perth Metropolitan Region are regionally significant and that for these complexes there is a presumption that all areas of remnant native vegetation where less than 10% remains will be retained and conserved. The 11.9% retention amount for the Forrestfield Complex is above the 10% target.

3.8.2 Vegetation Types

Vegetation types are a finer level of vegetation description and mapping used for small scale sites, such as the survey area. Vegetation types are described based on the structure of the vegetation (eg. woodland, heath) and the dominant species in each structure.

Seven vegetation types were described and mapped on the site (Figure 3) being:

Xp *Xanthorrhoea preissii* Open Low Heath;
BmLl *Banksia menziesii/ *Leptospermum laevigatum* Low Open Woodland;
Ll **Leptospermum laevigatum* Tall Open Scrub;
ErMr *Eucalyptus rudis* Woodland over *Melaleuca rhaphiophylla* Low Open Woodland;

Er *Eucalyptus rudis* Woodland over weeds;
Mr *Melaleuca rhaphiophylla* Low Open Forest over weeds; and
Ew *Eucalyptus wandoo* Woodland over weeds (Appendix 2).

The site is too degraded to be representative of any State Listed Threatened Ecological Community or Priority Ecological Community and the small area of Banksia dominated vegetation was too degraded to be a part of the Federally listed *Banksia Woodlands of the Swan Coastal Plain* Threatened Ecological Community.

3.8.3 Vegetation Condition

The condition of the vegetation was assessed according to the system devised by Keighery and described in Bush Forever (Government of Western Australia, 2000) (Appendix 2)

Most of the areas of native vegetation on the site were rated as Degraded to Completely Degraded (Figure 4). Only one area close to Kadina Brook was rated as Very Good with some native understorey. The overall low quality is due to the vegetation in the old Helena Valley Road reserve being regrowth among dense Victorian Teatree and other weeds, and the vegetation associated with Kadina Brook being heavily grazed by horses.

3.9 Fauna

3.9.1 Fauna Habitat

Four fauna habitats occur on the site. The vegetation dominated by *Banksia* is described as Woodland habitat. The parkland cleared areas associated with the Kadina Brook floodplain are Open Woodland habitat. Kadina Brook provides creekline habitat and the paddock areas are Cleared habitat (Appendix 2).

The vegetation in all habitats is highly degraded with almost no native understorey. The Woodland habitat has connectivity with other parts of the Kadina Brook environment to the south-east and north-west and is therefore rated as Good Fauna Habitat. The remainder of the habitats on the site are considered to be Highly Degraded Fauna Habitat (Appendix 2).

3.9.2 Conservation Significant Species

Habitat on the site was identified for three listed species of Black Cockatoos being:

- Carnaby's Black Cockatoo (*Calyptorhynchus* (*Zanda*) *latirostris*)
- Baudin's Black Cockatoo (*Calyptorhynchus* (*Zanda*) *baudinii*)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

The Open Woodland Habitat containing Flooded Gum and Wandoo provides foraging habitat for Black Cockatoos as does the small area containing Banksia trees in the old road reserve (Valentine and Stock, 2008; Groom, 2011).

The Southern Brown Bandicoot, Quenda (*Isoodon fusciventer*) (Priority 4) could potentially occur on the site.

The Rainbow Bee-eater (*Merops ornatus*), listed Marine under the EPBC Act, may potentially utilise some sections of the site as part of a much larger home range though only likely to occur infrequently.

3.9.3 Pest Fauna

There are several pest species that may be present on the site being:

- Red foxes;
- Feral cats;
- European Rabbits;
- House Mice; and
- Black Rats (Appendix 2).

3.9.4 Black Cockatoo Habitat

Breeding

Black Cockatoos are known to breed in hollows of large eucalypts. The site is not known as a breeding site for Black Cockatoos (DoP, 2011; National Map, 2022). The nearest breeding site is approximately 14km to the east (National Map, 2022) (Appendix 2).

There were 8 trees recorded by PGV Environmental that meet the definition of breeding habitat or potential breeding habitat due to their DBH being >300mm for Wandoo and >500m for Marri (Figure 3, Appendix 2). The total consisted of 7 Wandoo trees and one Marri tree. None of the trees in the study area contained hollows (Appendix 2).

Roosting

Black Cockatoos are known to roost overnight in tall trees including native and introduced eucalypts and pine trees generally in close proximity to a fresh water source. The study area contains tall Jarrah trees, however no evidence of roosting was recorded during the survey.

The study area is not mapped as containing a recorded roosting habitat for Black Cockatoos but near several known sites (DoP, 2011; Peck *et al.,* 2018; National Map, 2022). The nearest roosting sites are reported to be around 1.2 km to the south-south-east, 1.5m to the north-east, 1 and 3.4km to the south-east (National Map, 2022) (Figure 5).

Foraging

The study area contains ten species that are recognised as are known to be used for foraging by Black Cockatoos. The total area of foraging habitat is 0.3156ha and consists mostly of Banksia trees and some *Eucalyptus todtiana* trees and one Marri tree (*Corymbia calophylla*) (Appendix 2).

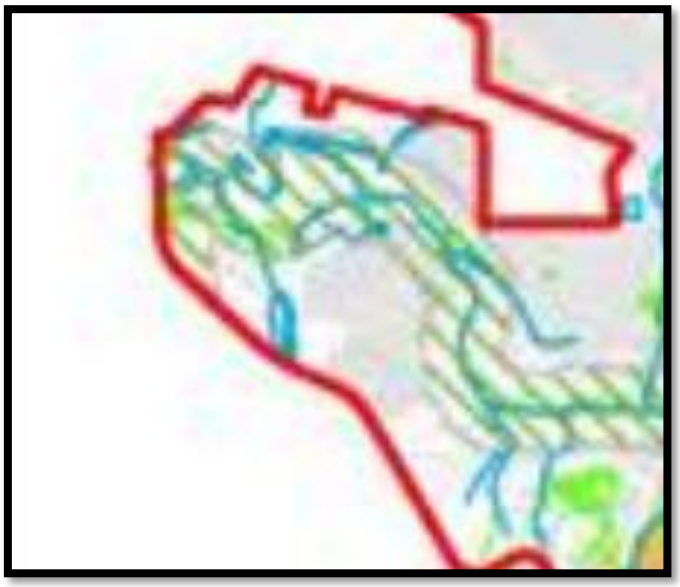
3.10 Ecological Linkages

The regrowth vegetation in the old Helena Valley Road reserve that is now part of Lot250 and 253 is adjacent to native vegetation in a parallel unmade road reserve that is 25m wide. The unmade road reserve is adjacent to the Bushmead Bushland Bush Forever site (Site 213). The vegetation in the part of the Bush Forever site closest to the old Helena Valley Road reserve is mapped as a Threatened Ecological Community (SCP 20a). The vegetation in the old road reserve on the site is considered to

be too degraded to form any significant ecological linkage value to the Bush Forever Site. In fact, the dominance of the very invasive Victorian Teatree suggests that the current vegetation in the old road reserve is a serious threat to the vegetation in the Bush Forever site.

The vegetation on the site associated with Kadina Brook is predominantly trees with almost no native understorey. The trees are part of an ecological corridor that is identified in the Shire of Mundaring Local Biodiversity Strategy (Plate 11; Shire of Mundaring, 2009) that continues along Kadina Brook to the north-west and south-east. The ecological corridor would be primarily for bird species in the tree canopy but could also be for some ground-dwelling animals such as Quenda.

Plate 11: Ecological Corridors as Shown in the Local Biodiversity Strategy



Source: Shire of Mundaring, 2009

3.11 Heritage

The site contains parts of two registered Aboriginal Heritage Sites being:

- 3966 Holding Paddock 1-4; and
- 3758 Helena River (Appendix 3).

There are three Aboriginal Heritage Places mapped on the boundary of the site being:

- 3518 Dinner Camp;
- 3974 WA Salvage-Ant Hill A,B & C; and
- 4337 Midland/Helena Valley Roads (Appendix 3).

Heritage sites can be listed under the following lists/registers:

- World Heritage Sites;
- National Heritage Sites;
- Commonwealth Heritage Sites;
- Sites on the register of the National Estate;
- Sites on the Western Australian Heritage Council Register; and

- Sites listed in the City of Swan Municipal Heritage Inventory List.

There are no listed Heritage Sites or Interim Heritage Sites on the site (National Map, 2022; Heritage Council of Western Australia, 2022; DAWE, 2022).

4 ENVIRONMENTAL ASSESSMENT

4.1 Proposed Development

The site is proposed to be subdivided for residential and commercial purposes. A Subdivision Concept Plan is provided in Appendix 4. The Concept provides for POS areas including a large POS to protect the Kadina Brook environment.

4.2 Land Use

The site has had some development previously and much of it has been cleared for many years. The previous and current land use is not considered to be a constraint to development of the site.

4.3 Surrounding Land Use

The land to the south-east of the site is being developed for urban purposes so there is not likely to be a conflict of land uses.

The interface to the Bush Forever site to the south may require some management to ensure the vegetation is protected during works which could be included as part of a Construction Environmental Management Plan. The contaminated land to the north-east is separated from the development by the Kadina Brook POS.

Surrounding land use is not an impediment to the proposed rezoning.

4.4 Topography

There are no significant topographic features in the area that are proposed to be developed. The portion of the Kadina Brook wetland with a steeply incised channel is proposed to be retained. Therefore, the site's topography is not an environmental constraint to development.

4.5 Geology and Soils

The Pinjarra geological unit is not constrained for development. The Pinjarra, Phase Gf7 soils are the only soils proposed to be disturbed for development.

These soils have a high risk of being susceptible to wind erosion and therefore dust controls will be required during construction. The area has a slight risk of waterlogging however this can be managed with appropriate stormwater controls. The site is not susceptible to waterlogging, flooding or risk of salinity.

Geotechnical investigations will need to be carried out to investigate any engineering constraints of the soils.

The ASS Risk on the development site is mapped as being Moderate (<3m from the surface) in the southern part but it is expected that the risk of ASS extends over the site. Investigations will be required once the level of soil disturbance is known. WAPC *Acid Sulphate Soils Planning Guidelines*

(WAPC, 2009) indicate that "*acid sulphate soils are technically manageable in the majority of cases*" which would be applicable to the site.

ASS Investigation and, if required, Management Plans should be prepared once the detailed design of soil disturbance on the site is finalised. This should be undertaken in accordance with the *Acid Sulphate Soils Guideline Series: Identification and Investigation of Acid Sulphate Soils and Acidic Landscapes* (DEC, 2009b) and *Treatment and Management of Soils and Water in Acid Sulphate Soil Landscapes* (DEC, 2011).

The risk of ASS can be managed in accordance with standard practices so the presence of ASS should not be an impediment to the proposed development of the site.

4.6 Hydrology

Groundwater is mapped in the area proposed for development as being 11 to 13m from the surface and is not a constraint to development. Stormwater management will be required to be addressed in accordance with *Better Urban Water Management* (WAPC, 2008). The District Water Management Strategy has adopted the following principles in design to protect groundwater and surface water quality and quantity:

DRAINAGE AND FLOOD MANAGEMENT STRATEGY

- *On lot and off lot detention systems, combined with treatment systems such as POS based bioretention gardens will capture and treat stormwater flows.*
- *On lot storage is to be in accordance with the Shire's guidelines. Where required and subject to detailed design, small lots may have a direct connection to the road network storm water system, after storage is exceeded on the lot.*
- *Flow rates leaving the site up to the 1% AEP event are to match or be lower than the pre development rate.*
- *POS based basins will detain flows to required levels, prior to discharge*
- *All storage is to have the ability to infiltrate stormwater at the base to allow systems to drain completely, minimising any standing water.*
- *All finished floor levels will be designed to maintain a clear separation of 300mm between the habitable floor level and the 1% AEP event flood level, generated on site. The site is to be designed to allow for safe flow paths of water throughout the development.*
- *All finished floor levels will be designed to maintain a clear separation of 500mm between the habitable floor levels and the modelled 1% AEP event flood level of the Kadina Brook and any other relevant large waterway/flowline.*

GROUNDWATER MANAGEMENT STRATEGY

- *Inflows to the groundwater are to be treated through bioretention media and plants within the basins, to improve the quality of water prior to it entering the groundwater.*
- *Where required, fill and subsoil systems will be used to achieve suitable separation between groundwater level and road infrastructure, houses and other sensitive infrastructure.*

- *Groundwater discharge regimes are to be generally maintained so that there are no negative impacts on the subject land or downstream significant ecosystems* (Oversby Consulting, 2023)

A Water Management Plan will be required at subdivision stage. The Water Management Plan will be required to address the protection of the water quality and quantity in Kadina Brook.

4.7 Kadina Brook

Kadina Brook is considered to be a waterway, rather than a basin type of wetland and, as such, management of the waterway is administered by DWER rather than DBCA. Waterways require a foreshore area between a proposed development and the waterway primarily to protect the creekline ecology but also to protect any fringing vegetation and habitat that is important to the waterway and to prevent flooding of adjoining areas. A foreshore area can also provide public recreational amenity and potentially have a stormwater drainage function.

Waterways do not have a minimum setback such as the 50m setback that exists with basin type wetlands. The setback is determined by assessing the biophysical criteria of the waterway and determining an appropriate setback to protect the waterway.

There are several guidance documents to assist with determining an appropriate setback as follows:

- *Operation Policy 4.3: Identifying and establishing waterways foreshore areas* (DoW 2012)
- *Guidance Note 6: Identifying and establishing waterways foreshore areas* (DoW 2013)
- *Water Note 23: Determining foreshore reserves* (WRC 2001)

A biophysical assessment was undertaken to determine an appropriate foreshore reserve on the southern side of Kadina Brook in the Amendment Area (Table 2).

Table 2: Biophysical Criteria and Assessment

Biophysical Factor	Assessment of Factor	Spatial Implications for Setback
Vegetation	The vegetation types in the area to the south of Kadina Brook include the following: • ErMr *Eucalyptus rudis* Woodland over *Melaleuca rhaphiophylla* Low Open Woodland • Er *Eucalyptus rudis* Woodland over weeds • Mr *Melaleuca rhaphiophylla* Low Open Forest over weeds • Ew *Eucalyptus wandoo* Woodland over weeds	The native vegetation types provide fauna habitat, erosion control and are part of a linkage along the Kadina Brook waterway. The understorey consists mostly of grassy weeds.

Biophysical Factor	Assessment of Factor	Spatial Implications for Setback
Hydrology	Kadina Brook is an ephemeral creekline that connects to the Helena River, a short distance to the north-west. On the site the brook contains a narrow, shallowly incised central creekline with a flat, broad floodplain that is partially waterlogged and inundated in winter/spring.	The floodplain is partially waterlogged/inundated in winter/spring which would limit public recreational amenity. Some drier areas occur under the native Flooded Gum and Wandoo and may be suitable for POS
Topography	The floodplain is flat close to Kadina Brook and then gently slopes up to the south. One short section at the eastern boundary on Lot 254 is steeper but not more than a 10% slope.	The foreshore setback does not need to be wide to protect any topographic features such as cliffs or valleys.
Soil Type	The soils associated with Kadina Brook are Pinjarra, Phase GF5 (213Pj_Gf5) which are associated with incised drainage channels with poorly drained gradational mottled yellow earths.	No spatial implications
Erosion	The narrow, shallowly incised central creekline and broad flat floodplain with heavy soils have a low potential for erosion to occur. The steeper parts of the site at the eastern boundary may be subject to erosion in large rainfall events	Native vegetation should be retained on the steeper parts of the site to prevent erosion
Function	Function of Kadina Brook is flood conveyance to Helena River.	Water conveyance function not impacted by foreshore setback width
Habitat	Part of an ecological fauna corridor along the Brook	The native vegetation in the area assessed is part of an ecological linkage along the Kadina Brook waterway.
Land Use	The area under the native trees and the dryland area to the south used to agist horses	The future function of the foreshore area will likely include some passive recreational value such as a pathway parallel with the southern boundary of the wetland and potentially some small grassed public use areas.

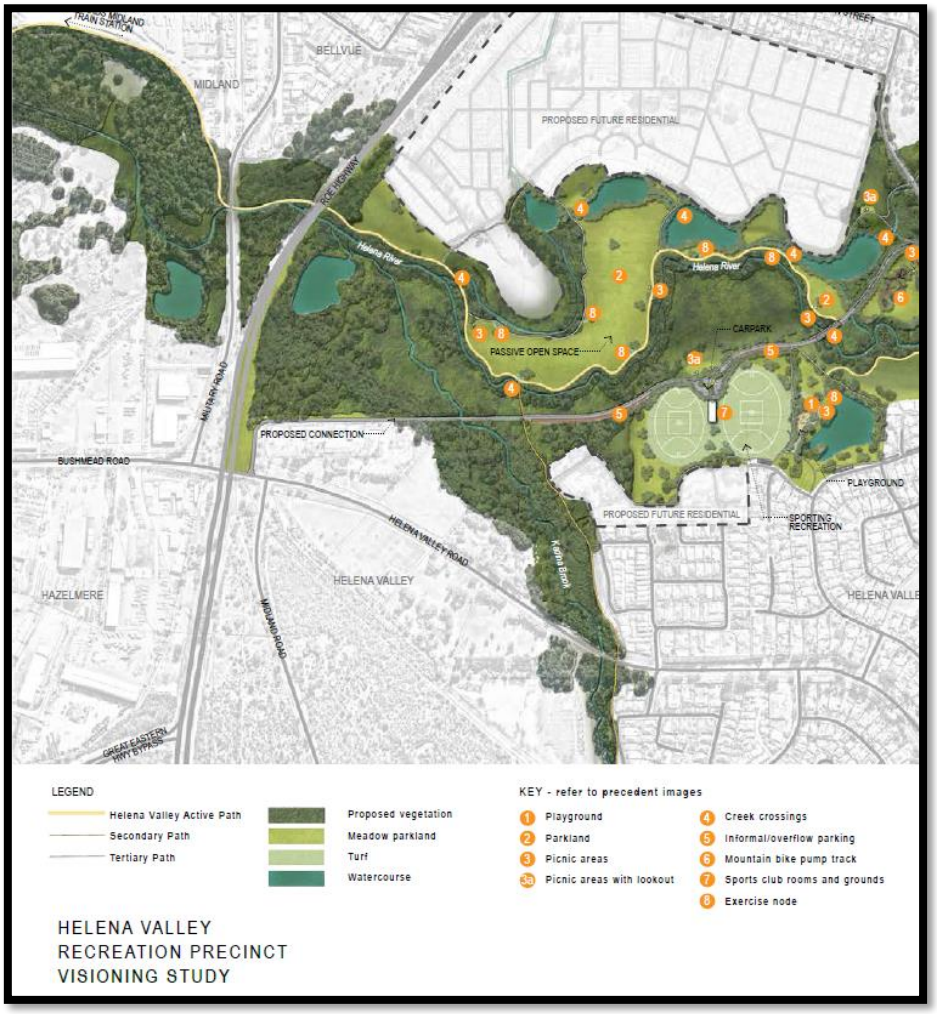
Based on the assessment provided in Table 2 an appropriate foreshore reserve is considered to be the outer extent of the native vegetation as shown in Figure 6.

Stormwater drainage basins should be contained outside the foreshore reserve, or alternatively the foreshore reserve could be widened to accommodate a drainage basin.

Drier areas within the foreshore reserve could be grassed for public amenity.

The proposed foreshore reserve is consistent with the Shire of Mundaring Foreshore Plan in the Foothills Growth Strategy (Plate 12, Shire of Mundaring, 2017).

Plate 12: Shire of Mundaring Foreshore Vision Plan (2017)



4.8 Flora and Vegetation

There is no native vegetation outside of the wetland that is in Very Good condition or better and there are no Threatened or Priority Flora species on the site. The native vegetation on the site is not considered to be an important remnant of the Forrestfield complex. The one area of Very Good vegetation is associated with Kadina Brook and therefore would be retained in POS. Therefore, no areas of vegetation outside of the Kadina Brook foreshore area are recommended for retention in a future development.

4.9 Fauna

The fauna habitat values on the site have been significantly impacted by clearing and grazing and most of the site is rated as Highly Degraded Fauna Habitat. The only area that provides Good Fauna Habitat is associated with Kadina Brook and its foreshore reserve and will be retained in the proposed development.

The small areas of native vegetation that may be cleared for development will contain some native species like reptiles and birds. Development approval is likely to require a Wildlife Management Plan

that details the relocation of native fauna prior to clearing and the management of clearing to mitigate risks to native fauna.

The proposed development retains habitat for Black Cockatoos including potential roosting habitat and seven out of the eight potential breeding habitat trees. The clearing of 0.3156 ha of foraging habitat and one potential breeding habitat tree is highly unlikely to be a significant impact and as such referral under the EPBC Act should not be required.

The impact of the proposed development on fauna is not likely to be significant

4.10 Ecological Linkages

The vegetation associated with Kadina Brook and its foreshore is proposed to be retained in POS which maintains the ecological linkage, consistent with the Shire of Mundaring Local Biodiversity Strategy. The proposed urban and commercial development would not impact on any other ecological linkages.

4.11 Heritage

The proposed development will not impact on the Heritage Places as mapped on the site but will require earthworks in Sites 3966 Holding Paddock 1-4 and 3758 Helena River.

Site 3966 is registered as an Artefacts Scatter. Proposed development may require consent under Section 18 of the AHA. The advice of a Heritage Consultant should be obtained to assist with this process.

5 SUMMARY AND CONCLUSION

5.1 Summary

The Environmental Assessment of the proposed urban and commercial development of Lots 5, 250, 253 and 254 Helena Valley Road, Helena Valley found the following:

- Previous land use has resulted in the site being largely cleared. The Kadina Brook environment has regenerated significantly over time since the past clearing;
- Native vegetation in the old Helena Valley Road reserve, which is now part of Lots 250 and 251 is infested with weeds, particularly the woody weed Victorian Teatree. The vegetation in the old road reserve does not contain any conservation significant plant species or ecological communities and is considered too degraded for retention in a future development;
- The vegetation at the northern end of the site (Flooded Gums, Paperbarks, Wandoo) is associated with Kadina Brook and its floodplain. The vegetation is part of an ecological linkage that runs along the length of Kadina Brook;
- The Kadina Brook foreshore reserve assessment resulted in an appropriate foreshore reserve being the outer extent of the native vegetation to the south of Kadina Brook. The foreshore reserve could contain some public amenity on the drier parts of the site. Stormwater drainage should be designed outside the foreshore reserve, or the foreshore reserve widened to accommodate a drainage basin;
- The hydrological values of the site will be managed in accordance with the principles in the District Water management Strategy. Additional detailed management will be in accordance with a Water Management Plan in accordance with Better Urban Water Management (WAPC, 2008) to ensure that the environmental values of Kadina Brook are maintained and appropriate controls to prevent downstream impacts and groundwater quantity and quality are not impacted by the proposed development;
- Habitat for conservation significant fauna species will be retained in the Kadina Brook system, including Wandoo and Flooded Gum habitat for Black Cockatoos;
- The retained vegetation in the Kadina Brook environment will maintain the ecological corridor with other sections of the Brook to the north-west and south-east;
- Fauna within the small areas of native vegetation that are likely to be cleared prior to development can be managed through a Wildlife Management Plan as a condition of development approval; and
- The Amendment Area contains two Aboriginal Heritage Sites and consent to disturb the sites is highly likely to be required under the AHA.

5.2 Conclusion

The proposed MRS Amendment from 'Rural' to 'Urban' on Lots 5, 250, 253 and 254 Helena Valley Road is not likely to have a significant impact on the environmental values of the site as the proposed development will retain Kadina Brook and an appropriate foreshore reserve. Mitigation of impacts such as the potential for ASS, dust, stormwater and fauna can be managed under management plans typical to urban development. Aboriginal heritage impacts will be required to be managed under a cultural management plan if consent is given to undertake the development.

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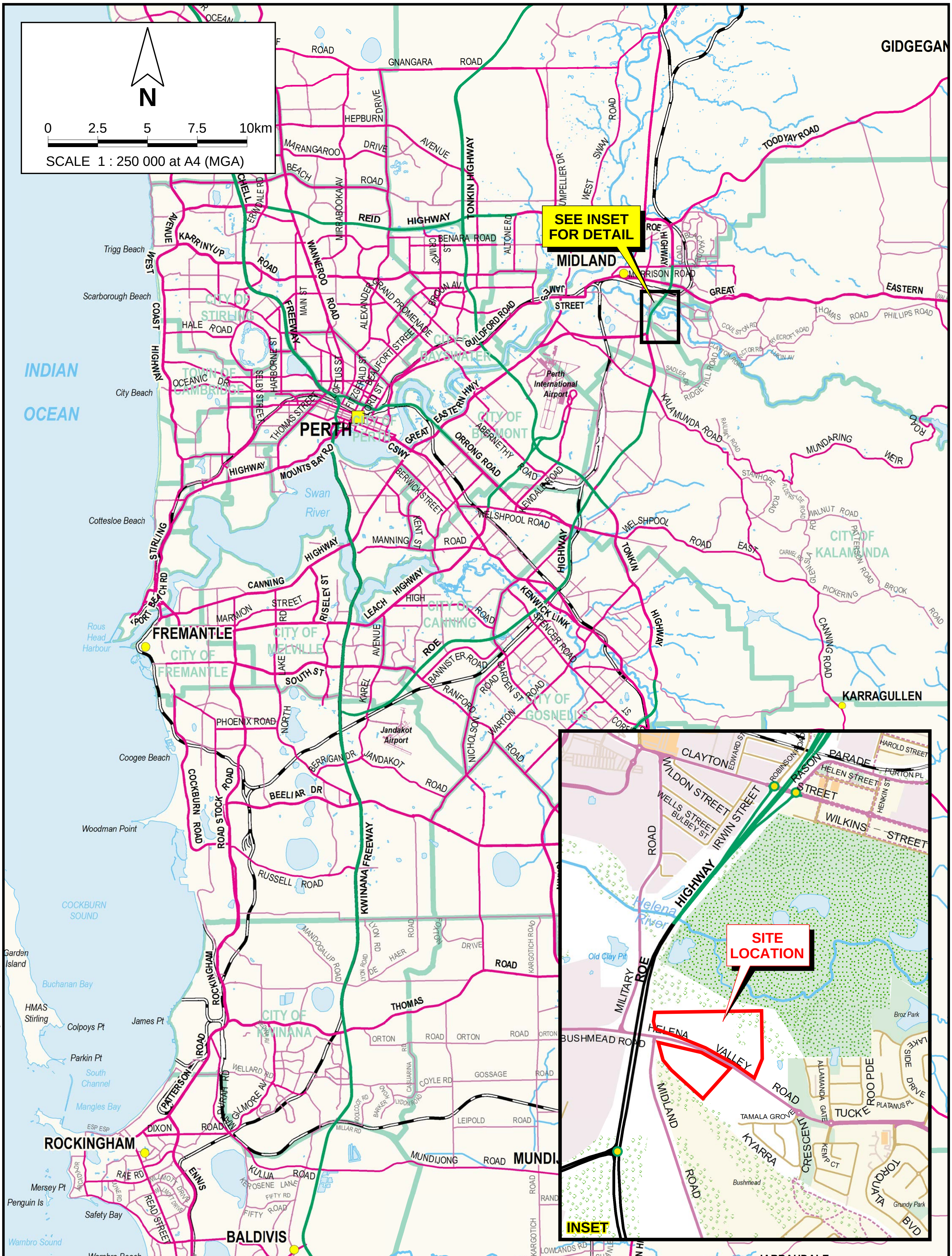
FIGURES



PINPOINT CARTOGRAPHICS (08) 9562 7136 2022-713-f01.dgn

PGV ENVIRONMENTAL

Dodd and Dodd Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
LOT 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

Drawn: P. van der Moezel	Date: 30 Nov 2022
Job: 10496 Rpt: 2022-713	Revision: A

SITE LOCATION

Figure 1

N

0 20 40 60 80 100m

SCALE 1 : 2 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Topographic Contour

CADASTRAL SOURCE: Landgate, November 2022.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2022.

pgv ENVIRONMENTAL

Dodd and Dodd Pty Ltd
ENVIORNMENTAL ASSESSMENT REPORT
LOT 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

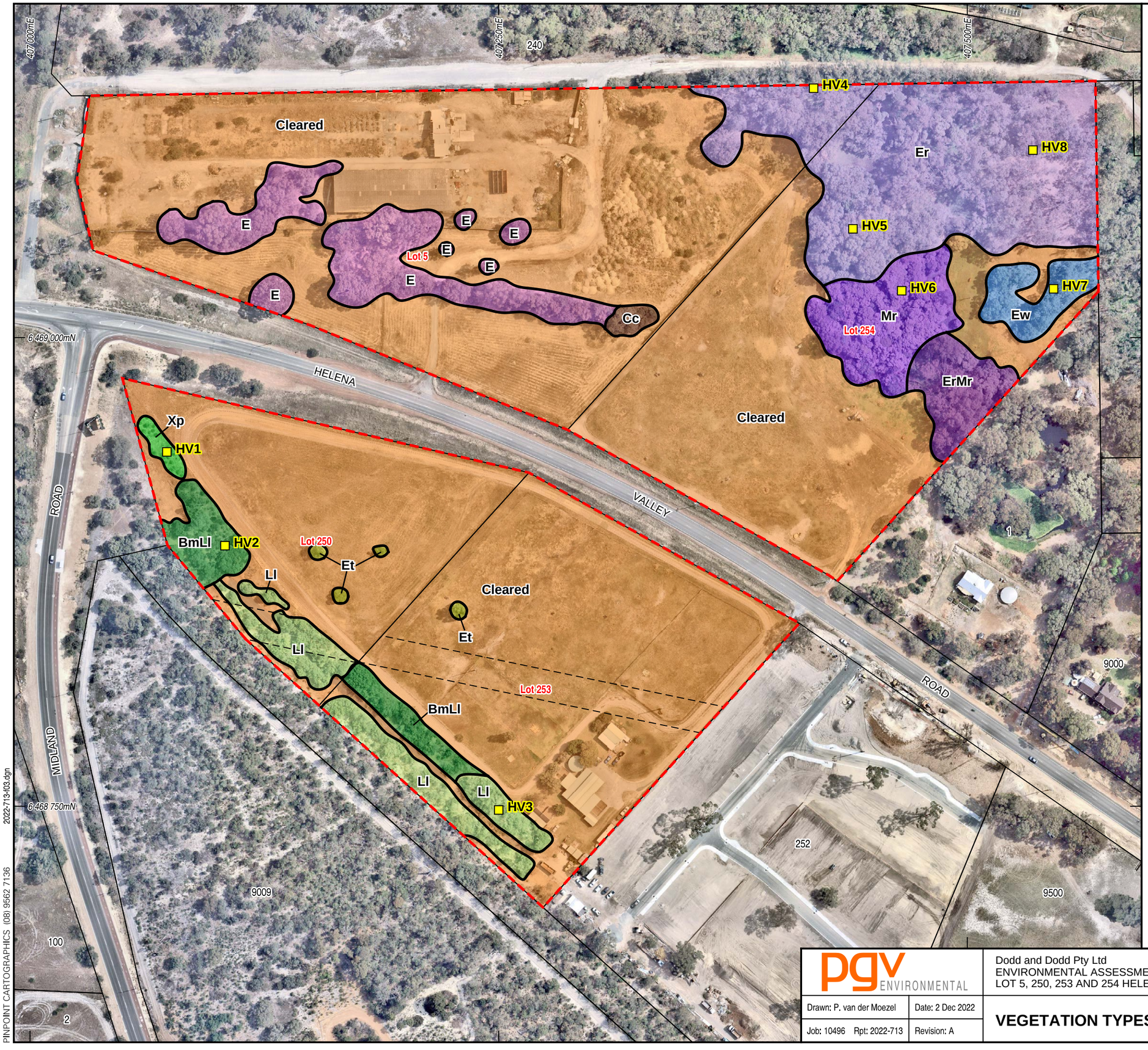
Drawn: P. van der Moezel | Date: 30 Nov 2022
Job: 10496 Rpt: 2022-713 | Revision: A

SITE BOUNDARY AND TOPOGRAPHY

Figure 2

2022-713-f02.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136



N

0 20 40 60 80 100m

SCALE 1 : 2 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Quadrat Location
- Vegetation Type Boundary
- **Et** Vegetation Type

Vegetation Types

Xp
Xanthorrhoea preissii Open Low Heath

BmLl
Banksia menziesii/**Leptospermum laevigatum* Low Open Woodland 2

Ll
**Leptospermum laevigatum* Tall Open Scrub

ErMr
Eucalyptus rudis Woodland over *Melaleuca rhaphiophylla* Low Open Woodland

Er
Eucalyptus rudis Woodland over weeds

Mr
Melaleuca rhaphiophylla Low Open Forest over weeds

Ew
Eucalyptus wandoo Woodland over weeds

Cc
Corymbia calophylla (Marri) tree

Et
Eucalyptus todtiana trees

E
Exotics

Cleared

CADASTRAL SOURCE: Landgate, November 2022.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2022.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2022-713-f03.dgn

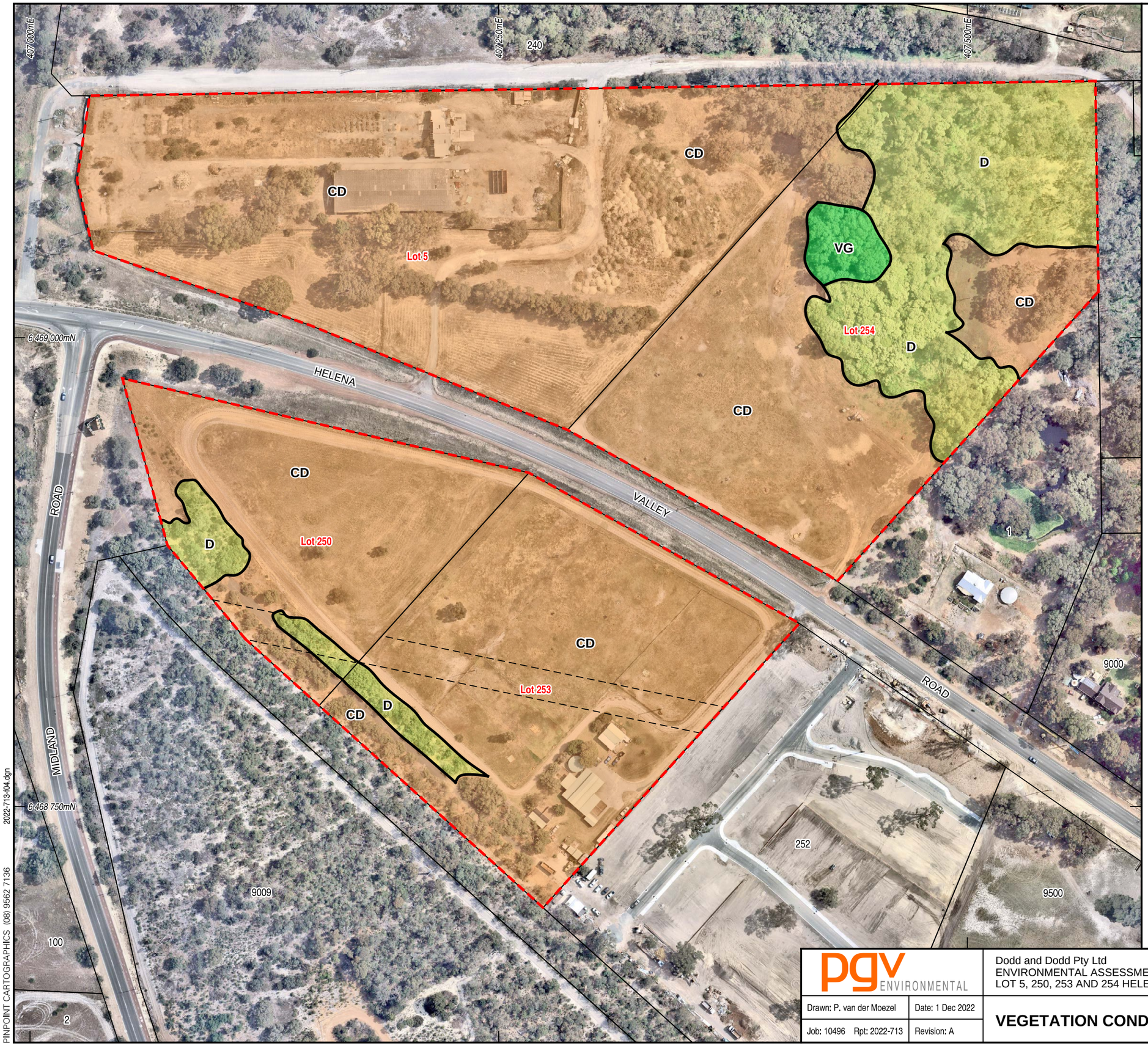
pgv ENVIRONMENTAL

Dodd and Dodd Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
LOT 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

Drawn: P. van der Moezel | Date: 2 Dec 2022
Job: 10496 Rpt: 2022-713 | Revision: A

VEGETATION TYPES

Figure 3



N

0 20 40 60 80 100m

SCALE 1 : 2 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Vegetation Condition Boundary
- VG Vegetation Condition

Vegetation Condition

- Very Good
- Degraded
- Completely Degraded

Vegetation Condition
(SOURCE: Bush Forever, Govt. of W.A., 2000)

P - Pristine
Pristine or nearly so, no obvious signs of disturbance.

Ex - Excellent
Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.

VG - Very Good
Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

G - Good
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
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
The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

Cl - Cleared
No native vegetation remaining.

CADASTRAL SOURCE: Landgate, November 2022.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2022.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2022-713-04.dgn

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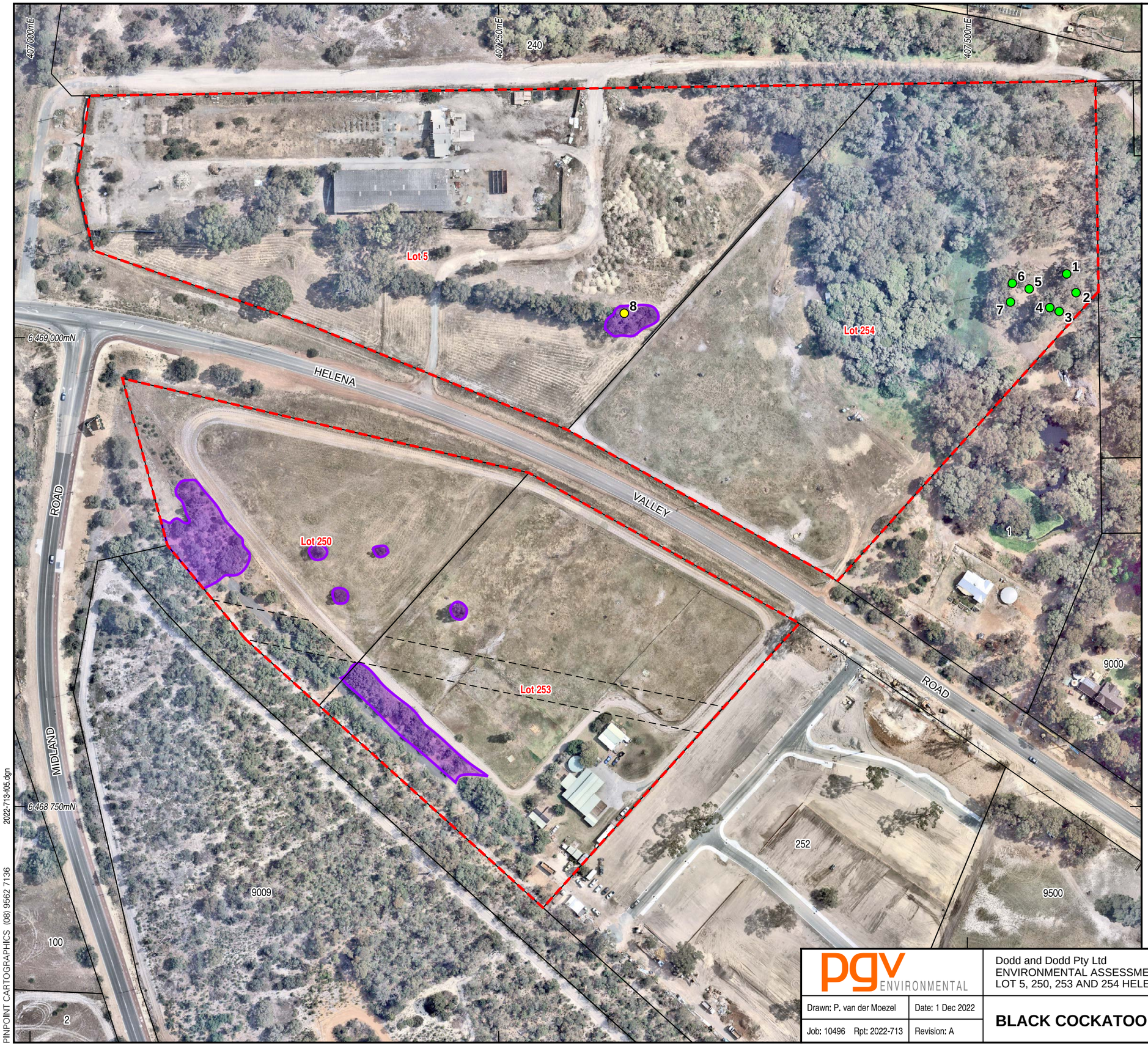
Dodd and Dodd Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
LOT 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

Drawn: P. van der Moezel | Date: 1 Dec 2022
Job: 10496 Rpt: 2022-713 | Revision: A

VEGETATION CONDITION

Figure 4



N

0 20 40 60 80 100m

SCALE 1 : 2 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Black Cockatoo Habitat

Habitat Trees

- Wandoo (*Eucalyptus wandoo*)
- Marri (*Corymbia calophylla*)
- 8 Tree Number

CADASTRAL SOURCE: Landgate, November 2022.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2022.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2022-713-I05.dgn

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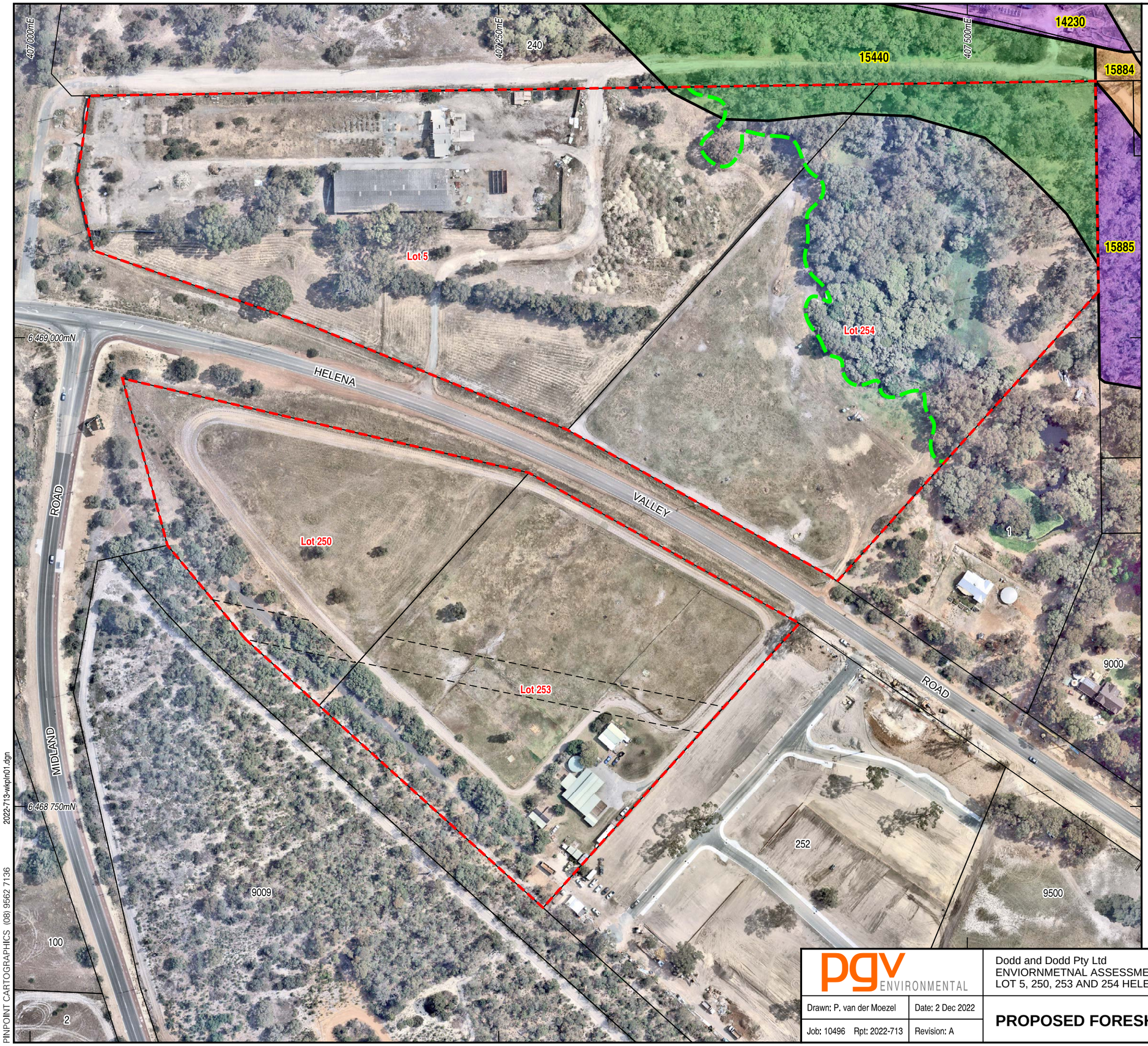
Dodd and Dodd Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
LOT 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

BLACK COCKATOO HABITAT

Figure 5



N

0 20 40 60 80 100m

SCALE 1 : 2 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Proposed Foreshore Reserve

Geomorphic Wetlands

- Conservation Category
- Resource Enhancement
- Multiple Use
- 15440 Wetland UFI Number

CADASTRAL SOURCE: Landgate, November 2022.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown October 2022.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2022-713-wkpln01.dgn

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Job: 10496 Rpt: 2022-713 | Revision: A

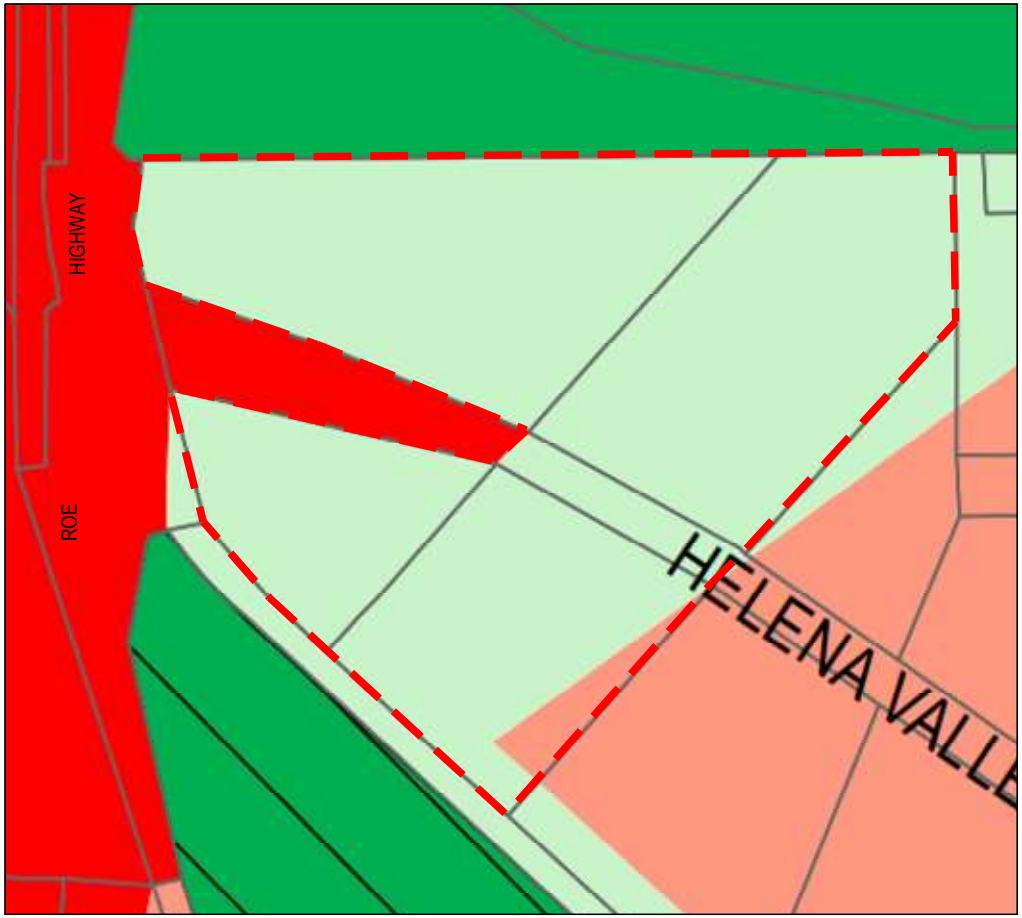
Dodd and Dodd Pty Ltd
ENVIORNMETNAL ASSESSMENT REPORT
LOT 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

PROPOSED FORESHORE RESERVE

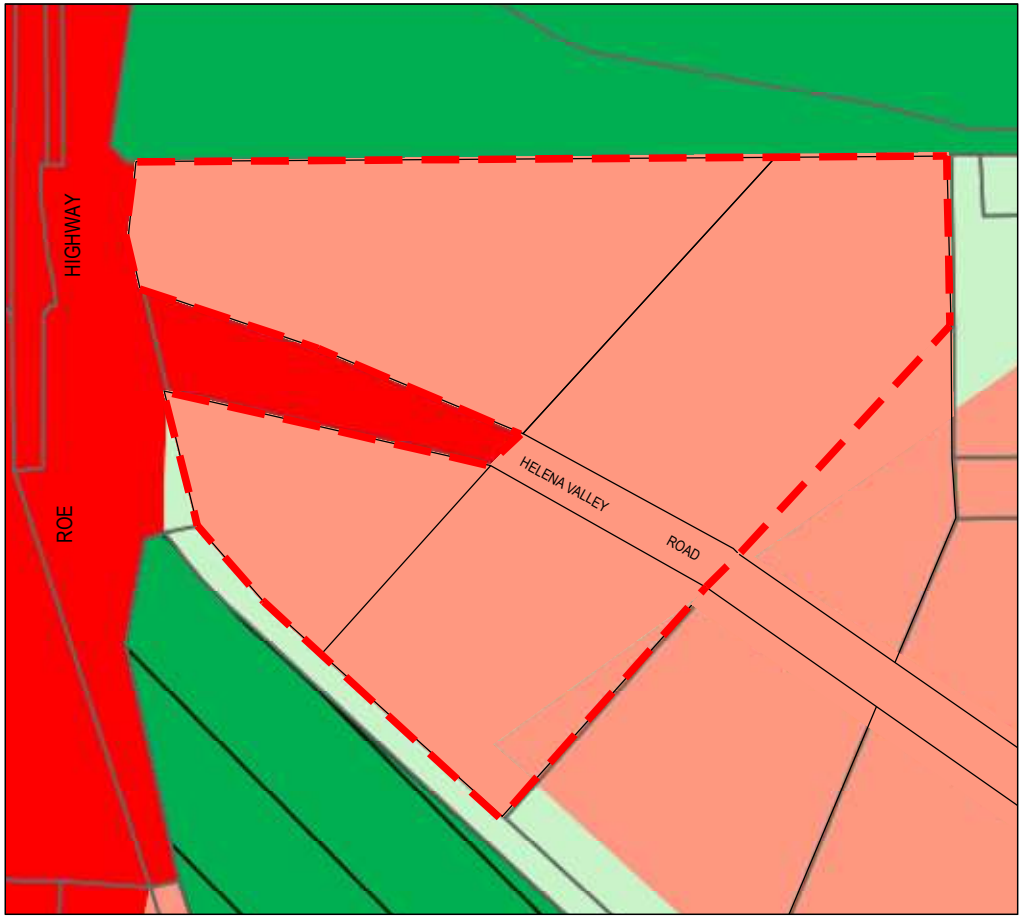
Figure 6

APPENDIX 1

Proposed MRS Amendment



EXISTING



PROPOSED

LEGEND:

Reserved Lands
- Parks and Recreation

Reserved Roads
- Primary Regional Roads

Zones
- Urban
- Rural

Subject Site

METROPOLITAN REGION SCHEME PLAN

LOTS 5, 250 & 251 HELENA VALLEY ROAD HELENA VALLEY

Planning Institute Australia

CPP CERTIFIED PRACTISING PLANNER

SCALE: 1:5000 @ A4

DATE: 16th JUNE 2022

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DYNAMIC PLANNING AND DEVELOPMENTS

N W E S

APPENDIX 2

Flora, Vegetation and Fauna Survey

LOTS 5, 250, 253 AND 254 HELENA VALLEY ROAD, HELENA VALLEY

FLORA, VEGETATION AND FAUNA SURVEY

Prepared for:	Dodd and Dodd Pty Ltd
Report Date:	6 December 2022
Version:	1
Report No.	2022-713

pgv ENVIRONMENTAL

CONTENTS

LIST OF ATTACHMENTS

Tables

Plates

Figures

Appendices

1 INTRODUCTION

1.1 Background

Lots 5, 250, 253 and 254 Helena Valley Road (the site) is located in the Shire of Mundaring, approximately 15km east-north-east of the Perth Central Business District (Figure 1). The site is 18.658ha (Figure 2) and straddles both sides of Helena Valley Road.

The site is proposed to be rezoned from 'Rural' to 'Urban' under the Metropolitan Region Scheme (MRS) to facilitate an urban residential and commercial development.

This Flora, Vegetation and Fauna Survey has been commissioned by Dodd and Dodd Pty Ltd to assess the environmental values of the proposed MRS Amendment area.

1.2 Scope of Works

1.2.1 Flora and Vegetation Survey

A Detailed Flora and Vegetation Survey was undertaken in accordance with the *EPA Technical Guidance: Flora and Vegetation Surveys* (EPA, 2016). The survey included the following:

- Desktop search and review of the Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority flora database;
- A search of Atlas of Living Australia for records pf Threatened or Priority species;
- A search of the Commonwealth Government's Protected Matters Search Tool to identify species potentially occurring within the area that are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Examination of historic and recent aerial photography and contour and soil maps to provisionally identify vegetation types and condition;
- Field survey using quadrats to record native and introduced species as well as a thorough site walkover of any areas of native vegetation;
- Recording of any significant plant species using a hand-held GPS;
- Description and mapping of vegetation types and vegetation condition; and
- Compilation of a flora list.

1.2.2 Fauna Survey

A Basic Fauna Survey was undertaken in accordance with EPA Technical Guidance *Fauna Surveys for Environmental Impact Assessment* (EPA, 2020). The survey included the following:

- A search of the DBCA Databases for the general area for Threatened and Priority Species;
- A search of the Atlas of Living Australia for Threatened and Priority Species;
- A search of the Commonwealth Government's Protected Matters Search Tool to identify species potentially occurring within the area that are protected under the EPBC Act or international migratory bird agreements (JAMBA/CAMBA);
- A review of studies previously undertaken in the vicinity of the site;
- A description of the fauna habitats present on the site from field surveys; and

- An assessment of the significance of the site for conservation significant species in a local and regional context.

As a component of the fauna survey a Black Cockatoo Habitat Assessment was undertaken to:

- Describe the Black Cockatoo habitat on the site;
- Determine the impact of potential development on Black Cockatoos if the site was to be cleared; and
- Assess the clearing in the context of the significance of the impact on Black Cockatoos.

2 EXISTING ENVIRONMENT

2.1 Land Use

Historical aerial photography shows that the site was largely cleared in 1953 (the oldest historical aerial photography available) (Plate 1). The original alignment of Helena Valley Road passed along the western boundary of what is now Lots 250 and 253.

Plate 1: Aerial Photograph from 1953 (Landgate, 2022)

Development on the site commenced between 1965 and 1970 (Plate 2) and some additional clearing has occurred.

Plate 2: Aerial Photograph from 1970 (Landgate, 2022)

The current alignment of Helena Valley Road was constructed between 1983 and 1985. Vegetation in the old road reserve has started to regrow in the 2000 aerial photograph (Plate 3). Vegetation has also started to grow more densely in the creekline in the north-east portion of the site (Kadina Brook).

Plate 3: Aerial Photograph from 2000 (Landgate, 2022)

The aerial photograph from 2022 shows the vegetation in the creekline has filled out substantially (Plate 4).

Plate 4: Aerial Photograph from 2017 (Landgate, 2022)

2.2 Topography

The majority of the site is gently undulating with an elevation of approximately 16 to 20m Australian Height Datum (AHD), generally sloping down to the north-west. Kadina Brook and its floodplain are located in an incised valley approximately 4m below the land to the south (Figure 2).

2.3 Geology and Soils

2.3.1 Geology

The site is located on the Pinjarra System, consisting of a poorly drained area of the Swan Coastal Plain with variable alluvial and aeolian soils (DPIRD, 2022). The Pinjarra Plain which is fluviatile in origin extends from the eastern side of the Bassendean Dunes to the western edge of the Darling Scarp, which joins the Ridge Hill Shelf and forms the denuded slope of the Darling Fault (Beard 1990).

2.3.2 Soils

The soil units located on the site is described as

- Pinjarra, Phase Gf7 (213Pj_Gf7) which is located on minor rises with deep, rapidly drained brownish, siliceous or bleached sands underlain by mottled yellow clay; and
- Pinjarra, Phase Gf9 (213Pj_Gf9) which is located on minor sandy rises (aeolian deposits) with moderately deep well drained sands overlying gravelly mottled clay (DPIRD, 2022).

2.4 Hydrology

Maximum groundwater is at approximately 8m to 10m AHD which is approximately 5m below ground level in Kadina Brook and 11 to 13m below the surface level in the remainder of the site. Groundwater generally flows to the north (DWER, 2022).

Kadina Brook runs through the north-eastern part of the site. Kadina Brook merges with the Helena River a short distance to the north-west west of the Roe Highway.

The site also contains a man-made dam on the southern side of Kadina Brook.

3 FLORA AND VEGETATION

3.1 Methodology

3.1.1 Database Searches

Searches of the following databases were undertaken prior to the site survey:

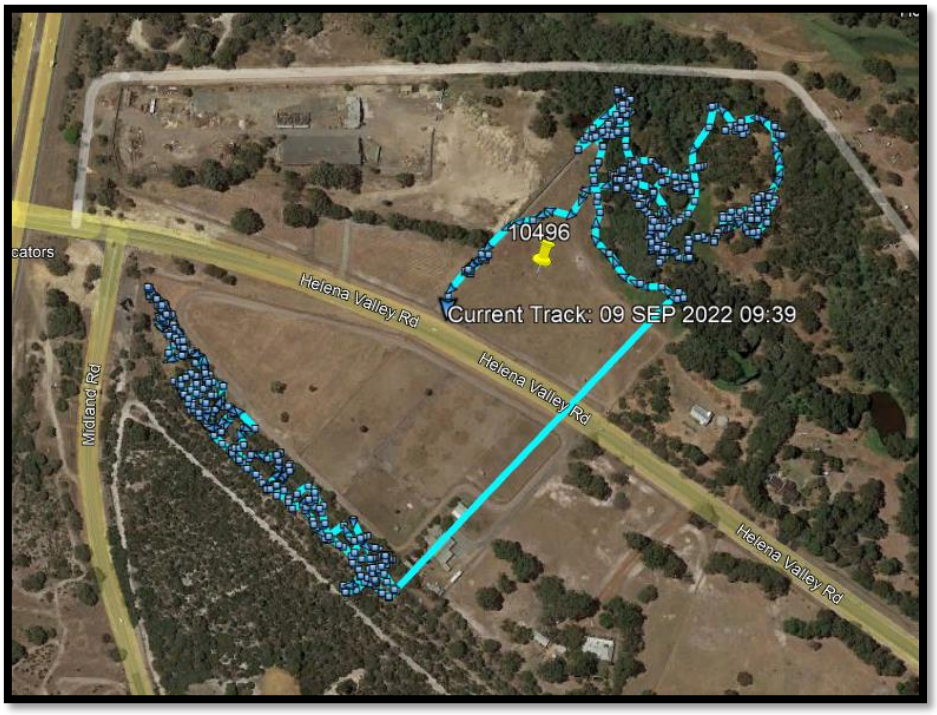
- DBCA Threatened and Priority Flora Databases including the WA Herbarium database (WAHerb) and Threatened (Declared Rare) and Priority Flora Species List (TFPL) (Appendix 1) for a radius of 10 km that provides a list of Threatened and Priority species recorded in the area;
- Atlas of Living Australia (ALA, 2022) (Appendix 2) which shows all species that have been recorded within a 10km radius of the site.
- The EPBC Act Protected Matters Search Tool (DCCEEW, 2022) (Appendix 3) which identifies species that are listed as Endangered, Threatened or Priority under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) could potentially have habitat within a 5km radius of the site.

3.1.2 Detailed Survey

The Detailed Flora and Vegetation Survey was undertaken on 9 September 2022.

The survey included sampling from eight 10m x 10m quadrats from within the different vegetation types as well as a thorough walk through the better condition native vegetation. The tracklog for the survey is shown on Plate 5.

Plate 5: Track Log



Information on flora composition and vegetation structure was recorded in the non-permanent quadrats.

Most plant species were identified in the field. Some specimens were photographed or taken for identification at the Perth Reference Herbarium or office using standard reference guides.

3.1.3 Survey Conditions

The conditions that the survey was undertaken in are presented in Table 1 in order to assess the adequacy of the survey. Rainfall for Perth (Measured at Perth Airport, Site Number 009021) was slightly below average in July being 124.2 mm compared to an average of 155.2 mm, above average for August in 2022 being 172.6 mm and September being 101.4 mm compared to mean values of 118.5 mm and 72.6 mm (BOM, 2022). The above average rainfall in August and September is not considered to be a constraint on the survey.

Table 1: Statement of Botanical Survey Conditions

Issue	Constraints (Y/N)*	Comment
Competency/experience of the consultant conducting the survey	No	Dr Paul van der Moezel has extensive botanical survey experience on the Swan Coastal Plain, including the Helena Valley/Bushmead area.
Proportion of the flora identified^	No	The timing of the survey in September was optimal to identify most flora species on the site including all potential Threatened and Priority Flora. No follow-up survey required.
Sources of information (historic/recent or new data)	No	The flora of the Swan Coastal Plain is well documented.
Proportion of the task achieved and further work that may need to be undertaken	No	No follow-up survey required as no Threatened Flora expected to occur in other seasons.
Timing/weather/season/cycle	No	The spring survey was optimal for most flora species. 2022 was a good year for ephemeral species.
Disturbances (Fire)	No	The site has not been recently burnt.
Intensity of survey (e.g. In retrospect was the intensity adequate)	No	The time spent on site, approximately 7 hours and relative ease of access made for a full coverage.
Completeness (e.g. was relevant area fully surveyed)	No	
Resources (e.g. degree of expertise available for plant identification)	No	Experienced botanist undertook most plant identifications on site.
Remoteness and/or access problems	No	Easily accessible site in the Perth Metropolitan Region.
Availability of contextual (e.g. bioregional) information for the study area.	No	WALGA statistics on remnant bushland

*Constraints have been rated as Significant, Moderate or No constraints

^Fungi and nonvascular flora (e.g. algae, mosses and liverworts) were not specifically surveyed for during the survey.

3.2 Desktop Studies

3.2.1 Flora Database Searches

The results from the database searches are shown in Table 2. There were 138 species identified in the database searches, 37 Threatened species and 101 Priority species. Table 2 also lists the likelihood that any of the conservation significant species identified in the database searches could occur on the site based on the soil types and vegetation condition.

Table 2: Identified Significant Flora Species and Likelihood of Occurring on the Site

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the site
Caladenia huegelii	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	Critically Endangered	Endangered	The Grand Spider-orchid prefers deep grey-white sand usually associated with the Bassendean sand-dune system, however, rare plants have been known to extend into the Spearwood system (in which calcareous yellow sands dominate) in some areas (DEC, 2009). This species generally does not survive in disturbed areas.	Unlikely – the site is located on the Pinjarra system which is not typical to the species
Calectasia cyanea	Blue Tinsel Lily	Critically Endangered	Critically Endangered	The Blue Tinsel Lily prefers white, grey or yellow sand or gravel. This species is restricted to Torndirrup National Park and Albany region of the South West Botanical Province (Barrett and Dixon, 2001).	No – this species does not occur on the Swan Coastal Plain
Calytrix breviseta subsp. *breviseta*	Swamp Starflower	Critically Endangered	Endangered	The Swamp Starflower occurs in sandy clay in swampy flats.	Highly Unlikely – this species does not occur on the Swan Coastal Plain
Drakaea elastica	Glossy-leafed Hammer Orchid	Critically Endangered	Endangered	The Glossy-leafed Hammer Orchid prefers low-lying situations adjoining winter-wet swamps and grows on bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps, typically in banksia (*Banksia menziesii, B. attenuata* and *B. ilicifolia*) woodland or spearwood (*Kunzea glabrescens*) thicket vegetation (DEC, 2009).	Unlikely – the habitat is not typical to this species
Eucalyptus x balanites	Cadda Road Mallee	Critically Endangered	Endangered	The Cadda Road Mallee prefers sandy soils with lateritic gravel.	Highly Unlikely – there is no lateritic habitat

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Grevillea thelemanniana	Spider Net Grevillea	Critically Endangered	Critically Endangered	Spider Net Grevillea occurs on sandy clay soil in flat seasonally wet damplands and limestone soils are associated with some of the sites (TSSC, 2018).	Unlikely – habitat not typical to the species
Hemiandra rutilans	Sargents Snakebush, Colourful Snakebush	Critically Endangered	Endangered	Sargents Snakebush grows in yellow/grey sand and was originally collected at Sand Springs, south-west of York, which is now extinct. The most recent confirmed location was south of Dowerin where it grew in low *Banksia prionotes* woodland with *Eremaea pauciflora*, *Nuytsia floribunda* and *Verticordia densiflora* (DEC, 2008).	Highly Unlikely – not suitable habitat
Ptilotus pyramidatus	Pyramid Mulla-mulla	Critically Endangered	Critically Endangered	The Pyramid Mulla-mulla in known from one location and occurs on seasonally inundated flat (floodplain) with *Melaleuca acutifolia, Verticordia plumosa* var. *brachyphylla*, *Hypocalymma angustifolium*, *Meeboldii cana, Chorizandra enodis*, rushes, sedges and species-rich native annual herbs and geophytes (DPaW, 2016a).	Highly Unlikely – not suitable habitat
Synaphea sp. Fairbridge Farm (D Papenfus 696)	Selena's Synaphea	Critically Endangered	Critically Endangered	Selena's Synaphea occurs in sandy soils with lateritic pebbles near winter-wet flats, in low woodland with weedy grasses.	Highly Unlikely – not lateritic habitat
Thelymitra dedmaniarum	Cinnamon Sun-orchid	Critically Endangered	Endangered	Cinnamon Sun-orchid is known from only two locations in the Gidgegannup area. It is confined to open wandoo woodland on red-brown sandy loam associated with dolerite and granite outcropping (DEC, 2012a).	Highly Unlikely – not suitable habitat

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the site
Trithuria occidentalis	Swan Hydatella	Critically Endangered	Endangered	Swan Hydatella grows partly submerged on the edge of shallow, winter-wet claypans in very open shrubland of Robin Redbreast Bush (*Melaleuca lateritica*) and numerous annual herbs.	Highly Unlikely – not suitable habitat
Austrostipa bronweniae		Endangered	Endangered	*Austrostipa bronwenae* is recorded from wetlands seasonally waterlogged muddy sand with *Gahnia trifida*, *Actinostrobus pyramidalis, Grevillea thelemanniana*, *Melaleuca viminea* subsp. *viminea* (Australian National Herbarium, 2009).	Unlikely – not typical habitat
Darwinia apiculata	Scarp Darwinia	Endangered	Endangered	The Scarp Darwinia grows in lateritic soils.	Highly Unlikely – not lateritic habitat
Diplolaena andrewsii	Native Wild Rose	Endangered	Endangered	The Native Wild Rose occurs on loam, clay in association with granite outcrops and hillsides.	Highly Unlikely – not suitable habitat
Diuris purdiei	Purdie's Donkey-orchid	Endangered	Endangered	Purdie's Donkey Orchid occurs in grey-black sand in moist winter-wet swamps with winter inundation in dense heath with scattered trees and amongst native sedges and dense heath with scattered emergent *Melaleuca preissiana*, *Eucalyptus calophylla*, *E. marginata* and *Nuytsia floribunda*.	Unlikely – not typical habitat
Drakaea micrantha	Dwarf Hammer-orchid	Endangered	Vulnerable	Dwarf Hammer-orchid usually occurs on cleared fire breaks or open sandy patches in Banksia, Jarrah and Sheoak woodlands or forest and often found under Spearwood thickets.	Highly Unlikely – not suitable habitat

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Eremophila glabra subsp. *chlorella*		Endangered	Endangered	*Eremophila glabra* subsp. *chlorella* occurs in sandy clay in winter-wet depressions associated with *Casuarina obesa, Viminaria juncea, Melaleuca lateritia, M. acutifolia, M. rhaphiophylla, M. viminea, M. teretifolia, M. brevifolia, Chorizandra enodis, Eucalyptus wandoo, E. loxophleba, Acacia saligna, A. microbotrya, Banksia telmatiaea, B. nivea subsp. nivea, Regelia ciliata, Petrophile seminuda, Verticordia densiflora var. densiflora* and *Calothamnus hirsutus* (DPaW, 2016b).	Highly Unlikely – not suitable habitat
Grevillea christineae	Christine's Grevillea	Endangered	Endangered	Christine's Grevillea prefers clay loam, sandy clay, often moist.	Highly Unlikely – not suitable habitat
Grevillea curviloba subsp. *incurva*	Narrow curved-leaf Grevillea	Endangered	Endangered	Narrow curved-leaf Grevillea prefers sand, sandy loam in winter-wet heath.	Highly Unlikely – not suitable habitat
Lepidosperma rostratum	Beaked Lepidosperma	Endangered	Endangered	Beaked Lepidosperma is found in peaty sand, clay associated with *Banksia telmatiaea* and *Calothamnus hirsutus*.	Highly Unlikely – not suitable habitat
Macarthuria keigheryi	Keighery's Macarthuria	Endangered	Endangered	Keighery's Macarthuria prefers white or grey sand on low-lying winter-wet damp sands growing among heathland, Jarrah and Sheoak/Banksia woodland and Banksia/Eucalypt Woodland (DEC, 2008).	Unlikely – not typical habitat
Thelymitra stellata	Star Sun-orchid	Endangered	Endangered	The Star Sun-orchid grows in gravelly loam among low heath and scrub in Eucalyptus marginata (Jarrah) and E. wandoo (Wandoo) woodland, and in low heath on lateritic hill tops.	Highly Unlikely – not suitable habitat

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the site
Acacia anomala	Grass Wattle, Chittering Grass Wattle	Vulnerable	Vulnerable	The Grass Wattle prefers lateritic soils and slopes.	Highly Unlikely – not lateritic habitat
Acacia aphylla	Leafless Rock Wattle	Vulnerable	Vulnerable	Leafless Rock Wattle occurs in sand, loam, clay loam on granite outcrops, hills.	Highly Unlikely – not suitable habitat
Andersonia gracilis	Slender Andersonia	Vulnerable	Endangered	Slender Andersonia occurs in white/grey sand, sandy clay, gravelly loam in winter-wet areas, near swamps. Vegetation type is low open heath with shrubs over sedges (DEC, 2006).	Highly Unlikely – not suitable habitat
Anigozanthos viridis subsp. *terraspectans*	Dwarf Green Kangaroo Paw	Vulnerable	Vulnerable	The Dwarf Green Kangaroo Paw occurs on grey sand, clay loam in winter-wet depressions.	Highly Unlikely – this species occurs north of Gingin
Anthocercis gracilis	Slender Tailflower	Vulnerable	Vulnerable	Slender Tailflower occurs in sandy or loamy soils near granite outcrops.	Highly Unlikely – not suitable habitat
Banksia mimica	Summer Honeypot	Vulnerable	Endangered	Summer Honeypot prefers white or grey sand over laterite, sandy loam.	Highly Unlikely – not suitable habitat
Chamelaucium lullfitzii	Gingin Wax	Vulnerable	Endangered	Gingin wax grows in white/yellow sand supporting open low woodland.	Highly Unlikely – not suitable habitat
Conospermum undulatum	Wavy-leaved Smokebush	Vulnerable	Vulnerable	Wavy-leaved Smokebush occurs on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers with a few records from slightly swampy habitat (DEC, 2009).	Possible
Darwinia meeboldii	Cranbrook Bell	Vulnerable	Vulnerable	The Cranbrook Bell occurs in peaty soils over quartzite on hill slopes.	No – this species occurs in the Great Southern

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Diuris drummondii	Tall Donkey Orchid	Vulnerable	Vulnerable	The Tall Donkey Orchid grows in low-lying depressions, swamps, in areas that contain surface water well into summer (Brown et al., 2013).	Highly Unlikely – habitat is too degraded
Diuris micrantha	Dwarf Bee-orchid	Vulnerable	Vulnerable	The Dwarf Bee-orchid is usually found on brown loamy clay in winter-wet swamps, in shallow water.	Highly Unlikely – not suitable habitat
Eleocharis keigheryi	Keighery's Eleocharis	Vulnerable	Vulnerable	Keighery's Eleocharis occurs in clay, sandy loam and is emergent in freshwater: creeks, claypans with *Melaleuca glateritia* and herbs such as *Wurmbea*, *Tribonanthes* and *Leptocarpus* spp.	Unlikely – not typical habitat
Gastrolobium lehmannii	Cranbrook Pea	Vulnerable	Vulnerable	The Cranbrook Pea occurs in red clay, laterite on low hilltop of breakaway.	No – this species occurs in the Great Southern
Grevillea flexuosa	Zig Zag Grevillea	Vulnerable	Vulnerable	Zig Zag Grevillea occurs in red-brown sand with laterite and gravel, sand over granite on ridgetop plateaus and associated breakaways.	Highly Unlikely – not suitable habitat and doesn't occur on the Swan Coastal Plain
Leucopogon cryptanthus	Small-flowered Leucopogon	Presumed Extinct	Extinct	Small-flowered Leucopogon was recorded amongst Eucalypts on orange-brown clay (Tasmanian Herbarium, 1979).	Highly Unlikely – not suitable habitat
Bolboschoenus fluviatilis	River Bulrush	Priority 1		River Bulrush occurs on the margins of wetlands and rivers.	Possible
Boronia humifusa		Priority 1		*Boronia humifusa* grows in gravelly clay loam over laterite in Jarrah-marri open forest.	Highly Unlikely – not lateritic habit
Calandrinia sp. Bayswater (C. Andrews s.n. 11/1902)		Priority 1		*Calandrinia* sp. Bayswater is known from Bayswater	Highly Unlikely – this species was last recorded in 1902 from Bayswater

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Drosera paleacea	Dwarf Sundew	Priority 1		Dwarf Sundew occurs in white sand, sandy clay.	Highly Unlikely – not suitable habitat and doesn't occur on the Swan Coastal Plain
Haloragis scoparia		Priority 1		*Haloragis scoparia* was recorded from an old lake bed that was winter wet in black calcareous clay over limestone (Western Australian Herbarium, 1994).	Highly Unlikely – not suitable habitat
Hydrocotyle striata		Priority 1		*Hydrocotyle striata* occurs in clay near springs.	Highly Unlikely – not suitable habitat
Lachnagrostis drummondiana		Priority 1		*Lachnagrostis drummondiana* is recorded from the Geraldton Hills.	Highly Unlikely – not within the species range habitat
Levenhookia preissii	Preiss's Stylewort	Priority 1		Preiss's Stylewort occurs in grey or black peaty sands in swamps.	Unlikely – not typical habitat
Senecio gilbertii		Priority 1		*Senecio gilbertii* grows in peaty sand near swamps on slopes.	Unlikely – not typical habitat
Thelymitra magnifica	Crystal Brook Star-orchid	Priority 1		The Crystal Brook Star-orchid occurs on stony ridges with granite outcrops (Brown et al., 2013)	Highly Unlikely – not suitable habitat
Thysanotus formosus		Priority 1		*Thysanotus formosus* occurs in clayey sand, sandy loam in situations often inundated in winter.	Highly Unlikely – not suitable habitat
Acacia benthamii		Priority 2		*Acacia benthamii* grows on sand, typically on limestone breakaways	Highly Unlikely – not suitable habitat
Andersonia longifolia		Priority 2		*Andersonia longifolia* occurs in sandy loam over sandstone, laterite gravel on breakaways, ridges.	Highly Unlikely – not lateritic habitat
Angianthus microcephalus		Priority 2		*Angianthus microcephalus* occurs in sandy or clayey soils on salt swamps and pans.	Highly Unlikely – not suitable habitat
Boronia ericifolia		Priority 2		*Boronia ericifolia* occurs in sandy loam, clay, laterite in low-lying spots.	Highly Unlikely – not lateritic habitat

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Calectasia grandiflora	Blue Tinsel Lily	Priority 2		Blue Tinsel Lily occurs in white, grey or yellow sand, sandy clay, gravel, laterite and granite in swampy areas, rock outcrops, flats, slopes and ridges.	Highly Unlikely – not suitable habitat
Comesperma griffinii		Priority 2		*Comesperma griffinii* grows in yellow or grey sand on plains.	Unlikely – not typical habitat
Epitriche demissus		Priority 2		*Epitriche demissus* grows in sandy and clayey soils on saline depressions, lake edges.	Highly Unlikely – not suitable habitat
Johnsonia pubescens subsp. *cygnorum*		Priority 2		*Johnsonia pubescens* subsp. *cygnorum* occurs on grey-white-yellow sand often overlying clays in Jarrah/Banksia woodland (Keighery, 2001) on flats on seasonally-wet sites	Highly Unlikely – not suitable habitat
Lepyrodia curvescens		Priority 2		*Lepyrodia curvescens* occurs in sand, laterite in seasonally inundated swampland.	Highly Unlikely – not lateritic habitat
Leucopogon cymbiformis		Priority 2		*Leucopogon cymbiformis* grows in white/grey or yellow sand, lateritic gravelly soils on sandplains, wet flats, foothills.	Highly Unlikely – not lateritic habitat
Melaleuca viminalis		Priority 2		*Melaleuca viminalis* is recorded from stony riverbed in rapids with sandstone rocks overlying volcanics, in the creekline of sandstone gorges in sand among rocks, and around a pool below a waterfall (Craven, Lepschi and Cowley, 2010).	Highly Unlikely – not suitable habitat
Phyllangium palustre		Priority 2		*Phyllangium palustre* occurs in clay on winter-wet claypans, low-lying seasonal wetlands.	Highly Unlikely – not suitable habitat
Poranthera moorokatta		Priority 2		*Poranthera moorokatta* grows in white silica sand and has been recorded in Banksia woodland and in a shallow dampland (Barrett, 2012).	Highly Unlikely – not suitable habitat

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Pterostylis frenchii	Tuart Rufous Greenhood	Priority 2		Tuart Rufous Greenhood grows in calcareous sand with limestone, laterite on flatlands and gentle slopes.	No – this species occurs in Harvey and Waroona
Ricinocarpos tuberculatus		Priority 2		*Ricinocarpos tuberculatus* grows in white/grey sand on coastal dunes.	No – this species occurs east of Beverley
Scaevola paludosa		Priority 2		*Scaevola paludosa* prefers sandy soils.	No – this species occurs east of Esperance
Schoenus loliaceus		Priority 2		*Schoenus loliaceus* occurs on sandy soils in winter-wet depressions.	Highly Unlikely – not suitable habitat
Stylidium falcatum	Slender Beaked Triggerplant	Priority 2		Slender Beaked Triggerplant occurs in sand, gravelly clay loam on plains, lateritic ridges.	No – this species occurs near Albany
Stylidium squamellosum	Maize Trigger Plant	Priority 2		Maize Trigger Plant grows in brown to red-brown clay loam on winter-wet habitats and depressions, open woodland, shrubland.	Highly Unlikely – not suitable habitat
Thelymitra variegata	Queen of Sheba	Priority 2		The Queen of Sheba orchid grows on sandy clay, sand and laterite. The orchid is found in banksia and Jarrah woodland (Brown *et al*., 2013)	Unlikely – not typical habitat
Thysanotus brachiatus		Priority 2		*Thysanotus brachiatus* grows in grey sand.	Unlikely – not typical habitat – generally occurs In Kulin and further east
Thysanotus sp. Badgingarra (E.A. Griffin 2511)		Priority 2		*Thysanotus* sp. Badgingarra grows in grey sand with lateritic gravel.	Highly Unlikely – not lateritic habitat
Acacia drummondii subsp. *affinis*		Priority 3		*Acacia drummondii* subsp. *affinis* grows in lateritic gravelly soils.	Highly Unlikely – not lateritic habitat
Acacia oncinophylla subsp. oncinophylla		Priority 3		*Acacia oncinophylla* subsp. *oncinophylla* occurs in granitic soils	Highly Unlikely – not granitic habitat

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Allocasuarina grevilleoides		Priority 3		*Allocasuarina grevilleoides* grows in sand over laterite, gravel.	Highly Unlikely – not lateritic habitat
Alyogyne sp. Great Victoria Desert (D.J. Edinger 6212)		Priority 3		*Alyogyne* sp. Great Victoria Desert occurs in black soils in fresh water swamps.	Highly Unlikely – not suitable habitat
Amanita carneiphylla	Miller's Pink-Gilled Lepidella	Priority 3		Miller's Pink-Gilled Lepidella is a deeply rooting species and grows in sandy soil.	Unlikely – not typical habitat
Amanita kalamundae	Kalamunda Lepidella	Priority 3		Kalamunda Lepidella is found In deep litter under *Eucalyptus patens* and *Agonis eriofolia* (Amanitaceae Org, 2018).	Highly Unlikely – not suitable habitat
Angianthus drummondii		Priority 3		*Angianthus drummondii* grows in grey or brown clay soils, ironstone on seasonally wet flats.	Highly Unlikely – not suitable habitat
Asteridea gracilis		Priority 3		*Asteridea gracilis* prefers sand, clay, gravelly soils.	Highly Unlikely – not suitable habitat
Babingtonia urbana	Coastal Plain Babingtonia	Priority 3		Coastal Plain Babingtonia occurs in orange sand, brown loam, white sandy clay on low flats, winter-wet swamps.	Highly Unlikely – not suitable habitat
Beaufortia purpurea	Purple Beaufortia	Priority 3		Purple Beaufortia occurs in lateritic or granitic soils on rocky slopes.	Highly Unlikely – not suitable habitat
Byblis gigantea	Rainbow Plant	Priority 3		The Rainbow Plant occurs in sandy-peat swamps in seasonally wet areas.	Highly Unlikely – not suitable habitat
Carex tereticaulis		Priority 3		*Carex tereticaulis* prefers black peaty sand.	Highly Unlikely – not suitable habitat
Chamaescilla gibsonii		Priority 3		*Chamaescilla gibsonii* grows in clay to sandy clay on winter-wet flats, shallow water-filled claypans.	Highly Unlikely – not claypan habitat
Comesperma rhadinocarpum	Slender-fruited Comesperma	Priority 3		Slender-fruited Comesperma occurs in sandy soils.	Unlikely – not typical habitat

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Conostylis bracteata		Priority 3		*Conostylis bracteata* occurs in sand, limestone on consolidated sand dunes.	Highly Unlikely – not suitable habitat
Cyathochaeta teretifolia		Priority 3		*Cyathochaeta teretifolia* occurs in grey sand, sandy clay on swamps, creek edges.	Highly Unlikely – not suitable habitat
Dampiera sericantha		Priority 3		*Dampiera sericantha* occurs in sand, sometimes with gravel on plains.	Highly Unlikely – not suitable habitat
Eryngium sp. *Subdecumbens* (G.J. Keighery 5390)		Priority 3		*Eryngium* sp. *Subdecumbens* grows in clay, grey sand on seasonally wet flats, claypans, swamps.	Highly Unlikely – not suitable habitat
Grevillea dissectifolia		Priority 3		*Grevillea dissectifolia* occurs in gravelly loam in moist areas and on roadsides.	Highly Unlikely – not suitable habitat
Haemodorum loratum		Priority 3		*Haemodorum loratum* prefers grey or yellow sand, gravel.	Highly Unlikely – not gravel habitat
Hakea longiflora		Priority 3		*Hakea longiflora* grows in white sand, loam, gravel, laterite on breakaways.	Highly Unlikely – not lateritic habitat
Halgania corymbosa		Priority 3		*Halgania corymbosa* prefers gravelly soils, soils over granite.	Highly Unlikely – not suitable habitat
Isopogon autumnalis		Priority 3		*Isopogon autumnalis* occurs in white, grey or yellow sand, often over laterite.	Highly Unlikely – not suitable habitat
Jacksonia gracillima		Priority 3		*Jacksonia gracillima* occurs in grey and brown well-drained sand.	Possible
Lasiopetalum glutinosum subsp. *glutinosum*		Priority 3		*Lasiopetalum glutinosum* subsp. *glutinosum* occurs in lateritic and granitic soils.	Highly Unlikely – not suitable habitat
Lepyrodia heleocharoides		Priority 3		*Lepyrodia heleocharoides* grows in moist peaty sand in dry or seasonally inundated heath or woodland, swamps.	Highly Unlikely – not suitable habitat

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Meionectes tenuifolia		Priority 3		*Meionectes tenuifolia* occurs on swamp margins on seasonally wet poorly drained flats or granite flats in shallow soils.	Highly Unlikely – not suitable habitat
Myriophyllum echinatum		Priority 3		*Myriophyllum echinatum* grows in clay on winter-wet flats.	Highly Unlikely – not suitable habitat
Pithocarpa corymbulosa		Priority 3		*Pithocarpa corymbulosa* occurs in gravelly or sandy loam amongst granite outcrops.	Highly Unlikely – not suitable habitat
Platysace ramosissima		Priority 3		*Platysace ramosissima* prefers sandy soils.	Possible
Schoenus benthamii		Priority 3		*Schoenus benthamii* prefers white, grey sand, sandy clay in winter-wet flats, swamps.	Highly Unlikely – not suitable habitat
Schoenus capillifolius		Priority 3		*Schoenus capillifolius* grows in brown mud on claypans.	Highly Unlikely – not suitable habitat
Schoenus pennisetis		Priority 3		*Schoenus pennisetis* occurs in grey or peaty sand, sandy clay in swamps, winter-wet depressions.	Highly Unlikely – not suitable habitat
Sporobolus blakei		Priority 3		*Sporobolus blakei* grows in red sandy clay, loam associated with creeks.	Highly Unlikely – this species occurs in Central Australia
Stackhousia sp. Red-blotched corolla (A. Markey 911)		Priority 3		*Stackhousia* sp. Red-blotched corolla is recorded from light brown yellow silty-gravel, with surface granite and lateritic gravel and cobbels, on a very steep slope (Western Australian Herbarium, 1996)	Highly Unlikely – not suitable habitat
Stylidium aceratum		Priority 3		*Stylidium aceratum* occurs in sandy soils in swamp heathland.	Highly Unlikely – not suitable habitat
Stylidium periscelianthum	Pantaloon Triggerplant	Priority 3		The Pantaloon Triggerplant occurs in loamy clay, moist soils pockets on wet flats, low granitic hills.	Highly Unlikely – not suitable habitat
Tetratheca pilifera		Priority 3		*Tetratheca pilifera* occurs in gravelly soils.	Highly Unlikely – not gravel habitat

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Thysanotus anceps		Priority 3		*Thysanotus anceps* grows on white or grey sand, lateritic gravel, laterite.	Highly Unlikely – not lateritic habitat
Tricostularia drummondii	Drummond's Tricostularia	Priority 3		Drummond's Tricostularia occurs in grey sand in Banksia Woodlands.	Possible
Verticordia serrata var. *linearis*		Priority 3		*Verticordia serrata* var. *linearis* grows in white sand, gravel in open woodland.	Highly Unlikely – not gravel habitat
Acacia oncinophylla subsp. *patulifolia*		Priority 4		*Acacia oncinophylla* subsp. *patulifolia* occurs on granitic soils, occasionally on laterite.	Highly Unlikely – not suitable habitat
Aponogeton hexatepalus	Stalked Water Ribbons	Priority 4		Stalked Water Ribbons grow in freshwater: ponds, rivers, claypans	Highly Unlikely – not suitable habitat
Boronia tenuis	Blue Boronia	Priority 4		Blue Boronia prefers laterite, stony soils, granite.	Highly Unlikely – not suitable habitat
Calothamnus accedens		Priority 4		*Calothamnus accedens* occurs in sandy soils over laterite on road verges.	Highly Unlikely – not lateritic habitat
Calothamnus brevifolius		Priority 4		*Calothamnus brevifolius* occurs in white/grey or yellow sand.	Highly Unlikely – outside of species range
Darwinia pimelioides		Priority 4		*Darwinia pimelioides* prefers loam, sandy loam on granite outcrops.	Highly Unlikely – not suitable habitat
Drosera occidentalis	Western Sundew	Priority 4		The Western Sundew occurs in sandy and clayey soils in swamps and wet depressions.	Highly Unlikely – not suitable habitat
Gastrolobium stipulare		Priority 4		*Gastrolobium stipulare* grows in yellow-grey sand, gravelly clay loam, laterite on slopes, ridges.	Highly Unlikely – not suitable habitat
Grevillea pimeleoides		Priority 4		*Grevillea pimeleoides* grows in gravelly soils over granite on rocky hillsides.	Highly Unlikely – not suitable habitat
Hibbertia montana		Priority 4		*Hibbertia montana* occurs in loam over granite, lateritic soils, gravel on granite rocks, lateritic ridges and boulders, hills.	Highly Unlikely – not suitable habitat

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Hydrocotyle lemnoides	Aquatic Pennywort	Priority 4		Aquatic Pennywort occurs in swamps	Highly Unlikely – not suitable habitat
Jacksonia sericea	Waldjumi	Priority 4		Waldjumi grows in calcareous and sandy soils.	Possible
Lasiopetalum bracteatum	Helena Velvet Bush	Priority 4		Helena Velvet Bush occurs in sandy clay, clay, lateritic gravel along drainage lines, creeks, gullies, granite outcrops.	Highly Unlikely – not suitable habitat
Lechenaultia longiloba	Scarlet Leschenaultia	Priority 4		Scarlet Leschenaultia grows in sand with lateritic gravel on undulating plains.	Highly Unlikely – not suitable habitat
Microtis quadrata	South Coast Mignonette Orchid	Priority 4		South Coast Mignonette Orchid occurs on clay based coastal flats (Brown *et al*., 2013).	Unlikely – not typical habitat
Ornduffia submersa		Priority 4		*Ornduffia submersa* grows in freshwater 0.05-0.6 m deep in pools, lakes, swamps, winter-wet depressions, claypans.	Highly Unlikely – not suitable habitat
Persoonia sulcata		Priority 4		*Persoonia sulcata* occurs in lateritic or granitic soils.	Highly Unlikely – not suitable habitat
Pimelea rara		Priority 4		*Pimelea rara* occurs in lateritic soils.	Highly Unlikely – not lateritic habitat
Schoenus griffinianus		Priority 4		*Schoenus griffinianus* grows in white sand in low heath (Wilson, 1997).	Highly Unlikely – not suitable habitat
Schoenus natans	Floating Bog-rush	Priority 4		Floating Bog-rush is an aquatic species that occurs in winter-wet depressions.	Highly Unlikely – not suitable habitat
Senecio leucoglossus		Priority 4		*Senecio leucoglossus* prefers gravelly lateritic or granitic soils with granite outcrops on slopes.	Highly Unlikely – not suitable habitat
Stylidium longitubum	Jumping Jacks	Priority 4		Jumping Jacks prefer sandy clay, clay in seasonal wetlands.	Highly Unlikely – not suitable habitat
Stylidium scabridum	Moth Triggerplant	Priority 4		Moth Triggerplant occurs in sand in open woodland or heath.	Highly Unlikely – not known on the Swan Coastal Plain

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act	Habitat*	Likelihood to occur on the site
Stylidium striatum	Fan-leaved Triggerplant	Priority 4		The Fan-leaved Triggerplant grows in brown clay loam over laterite on hillslopes in Jarrah/Marri forest, Wandoo woodland.	Highly Unlikely – not lateritic habitat
Thysanotus glaucus		Priority 4		*Thysanotus glaucus* occurs in white, grey or yellow sand, sandy gravel.	Unlikely – not typical habitat
Trithuria australis		Priority 4		*Trithuria australis* occurs in granite, clay in shallow pools, seasonal swamps.	Highly Unlikely – not suitable habitat
Verticordia lindleyi subsp. *lindleyi*		Priority 4		*Verticordia lindleyi* subsp. *lindleyi* prefers sand, sandy clay in winter-wet depressions.	Highly Unlikely – not suitable habitat

* sourced from Florabase as well as the DBCA database searches unless otherwise denoted

3.2.2 TEC/PEC Database Searches

A search of DBCA's Threatened (TEC) and Priority Ecological Communities (PEC) database was conducted within a radius of 10 km around the site (06-0919EC) (Appendix 5). Two Priority Ecological Communities were identified that are a federally listed TEC. The communities identified in the database searches are outlined in Table 3.

Table 3: TEC and PECs Identified in Database Searches

Number	Description	Conservation Status in Western Australia	Status under the EPBC Act
SCP3a	*Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (floristic community type 3a as originally described in Gibson et al. (1994))	Critically Endangered	Endangered
SCP3a	*Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (floristic community type 3a as originally described in Gibson et al. (1994))	Critically Endangered	Endangered
SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20c as originally described in in Gibson et al. (1994))	Critically Endangered	Endangered as part of the Banksia WL SCP
SCP02	Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson et al. (1994))	Endangered	
SCP20a	*Banksia attenuata* woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. (1994))	Endangered	Endangered
SCP20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson et al. (1994))	Endangered	Endangered as part of the Banksia WL SCP
SCP08	Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994))	Vulnerable	Critically Endangered
SCP21c	Low lying *Banksia attenuata* woodlands or shrublands	Priority 3	Endangered as part of the Banksia WL SCP
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	Priority 3	Vulnerable
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	Priority 3	Endangered
Central Granite Shrublands (Com 5, Markey)	Central Northern Darling Scarp Granite Shrubland Community	Priority 4	

3.3 Flora

A total of 89 plant species were recorded during the flora survey (Appendix 6). This total consisted of 44 native species and 45 (50.6%) introduced species. The number and percentage of introduced species is very high and is a reflection of the overall Degraded condition of the vegetation.

The plant Families with the highest representation of species were the Myrtaceae (Myrtle family – 16 species 13 native and 3 introduced), Poaceae (Grass family – 8 species all introduced), Fabaceae (Wattle and Pea family – 7 species, 4 native and 3 introduced), Iridaceae (Iris family – 7 species 1 native and 6 introduced) and Asteraceae (Daisy family – 6 species, all introduced).

No Threatened or Priority species were recorded on the site.

There were three Declared Pests on the site being:

- Arum Lily (*Zantedeschia aethiopica*);
- Cotton Bush (*Gomphocarpus fruticosus*); and
- One-Leafed Cape Tulip (*Moraea flaccida*).

Species richness in the 8 quadrats ranged from 7-18 (average 11.5) with 2-13 weed species (average 8.25) (Appendix 7). The average proportion of weed species in the quadrats was 70%.

The exotic tree species planted on Lot 5 included Lemon-scented Gum (*Corymbia citriodora*), River Red Gum (*Eucalyptus camaldulensis*), Spotted Gum (*Corymbia maculata*) and River She-oak (*Casuarina cunninghamiana*).

3.4 Vegetation

3.4.1 Vegetation Complexes

Vegetation complexes are a very broad mapping unit based on landform and soils type. The vegetation complex mapped on the site is the Forrestfield Complex (Heddle *et al.*, 1980). The Forrestfield Complex ranges from open forest of *Corymbia calophylla* (Marri) – *Eucalyptus wandoo* (Wandoo) – *Eucalyptus marginata* (Jarrah) to open forest of *Eucalyptus marginata* (Jarrah) – *Corymbia calophylla* (Marri) – *Allocasuarina fraseria*na (Sheoak) – *Banksia* species. Fringing woodland of *Eucalyptus rudis* (Flooded Gum) in the gullies that dissect this landform (Heddle *et al.,* 1980).

3.4.2 Vegetation Types

Vegetation types are a finer level of vegetation description and mapping used for small scale sites, such as the survey area. Vegetation types are described based on the structure of the vegetation (eg. woodland, heath) and the dominant species in each structure.

Seven vegetation types were described and mapped on the site (Figure 3). The vegetation types are described in Table 4. In addition, individual native trees of Marri and *Eucalyptus todtiana* and stands of exotic species were mapped.

Quadrat Data are in Appendix 7.

Table 4: Vegetation Types on the Site

Vegetation Type	Description	Photograph
Xp *Xanthorrhoea preissii* Open Low Heath	This vegetation type occurred at the western end of the old Helena Valley Road reserve. The *Xanthorrhoea preissii* shrubs were 1-1.5m high. Eleven of the other 12 species recorded in the quadrat were weed species with the most common being *Lolium rigidum, Hypochaeris glabra* and *Ehrharta calycina.* The soils are black sand, moist. Quadrat HV1 is representative of this vegetation type.	
BmLl *Banksia menziesii/ *Leptospermum laevigatum* Low Open Woodland	Occurs within the old Helena Valley Road reserve and is all in Degraded condition. *Banksia menziesii* trees are up to 4m high and relatively dense at 40%. *Allocasuarina fraseriana* is occasionally present also to 4m. Victorian Teatree (*Leptospermum laevigatum*) is common. Most of the understorey species are weeds with Annual and Perennial Veldtgrass (*Ehrharta longiflora, E. calcyina*) the most common. The soils are dark grey sand. Quadrat HV2 is representative of this vegetation type.	

Vegetation Type		Description	Photograph
Ll	**Leptospermum laevigatum* Tall Open Scrub	Most of the vegetation in the old Helena Valley Road reserve consists of the introduced Victorian Teatree (*Leptospermum laevigatum*) which occurs up to 5m high and quite dense at 50-70%. The understorey is sparse and predominantly weed species, with *Fumaria capreolata* very common. The soils are black sand. Quadrat HV3 is representative of this vegetation type.	
ErMr	*Eucalyptus rudis* Woodland over *Melaleuca rhaphiophylla* Low Open Woodland	Two areas containing this vegetation type occur on the southern banks of Kadina Brook. *Eucalyptus rudis* (Flooded Gum) is up to 28m high and moderately dense (25-40%). *Melaleuca rhaphiophylla* trees are 4-6m high and sparse. The understorey of one stand is almost completely Kikuyu Grass () with no native species. The other stand, picture right, has some native shrubs (*Taxandria linearifolia, Astartea affinis*) and sedges (*Lepidosperma tetraquetrum*) and ground covers (*Centella asiatica*). The soils are black, loamy sand, moist. Quadrats HV4 and 5 are representative of this vegetation type.	

Vegetation Type		Description	Photograph
Er	*Eucalyptus rudis* Woodland over weeds	Most of the flat floodplain through which the Kadina Brook watercourse runs contains Flooded Gums 25-28m high. Paperbarks are almost completely absent as are smaller native shrubs, sedges and herbs. Annual Veldtgrass (*Ehrharta longiflora*) dominates the understorey. A few native *Melaleuca teretifolia* shrubs occurred in the understorey which was predominantly weeds, including Annual Veldtgrass. The soils are dark brownish-black loamy sand and were waterlogged and partially inundated in September 2022. Quadrat HV8 is representative of this vegetation type.	
Mr	*Melaleuca rhaphiophylla* Low Open Forest over weeds	One stand of *Melaleuca rhaphiophylla* Low Open Forest occurred on the southern boundary of the Kadina Brook floodplain. No Flooded Gums occurred in this area. The *M. rhaphiophylla* trees were up to 8m high and quite dense The soils are dark brownish-black sand, partially inundated in September 2022. Quadrat HV6 is representative of this vegetation type.	

Vegetation Type	Description	Photograph
Ew *Eucalyptus wandoo* Woodland over weeds	One small stand of Wandoo (*Eucalyptus wandoo*) occurred on a slight rise within the Kadina Brook floodplain. The Wandoo trees are mature and appear to be natural rather than planted. The understorey is all weeds with Annual Veldtgrass the most common species. The soils are dark brownish-black sandy loam, not waterlogged Quadrat HV7 is representative of this vegetation type.	

3.4.3 Vegetation Condition

The condition of the vegetation was assessed according to the system devised by Keighery and described in Bush Forever (Government of Western Australia, 2000) (Table 5).

Table 5: Vegetation Condition Rating Scale.

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple 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.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Source: Government of Western Australia, 2000.

Most of the areas of native vegetation on the site were rated as Degraded to Completely Degraded (Figure 4). Only one area close to Kadina Brook was rated as Very Good with some native understorey. The overall low quality is due to the vegetation in the old Helena Valley Road reserve being regrowth among dense Victorian Teatree and other weeds, and the vegetation associated with Kadina Brook being heavily grazed by horses.

3.5 Conservation Significance of Flora and Vegetation

3.5.1 Flora

No Threatened or Priority species were recorded on the site.

3.5.2 Vegetation

Vegetation Complexes

The vegetation on the site is part of the Forrestfield complex. Approximately 2,803ha of the original 22,813ha extent of the Forrestfield Complex remains on the Swan Coastal Plain, representing 12.29% (WALGA, 2018). The EPA considers that vegetation complexes with less than 10% remaining in constrained areas such as the Perth Metropolitan Region are regionally significant and that for these complexes there is a presumption that all areas of remnant native vegetation where less than 10%

remains will be retained and conserved. The 11.9% retention amount for the Forrestfield Complex is above the 10% target.

The survey area contains very little intact native vegetation. The predominant Degraded and Completely Degraded areas containing native trees and very little to no native understorey have no conservation significance in terms of protecting good quality vegetation within the vegetation complex.

Threatened and Priority Ecological Communities

The site is too degraded to be representative of any State Listed TEC.

There are areas on the site that contain Banksia tree species that may be part of the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (Banksia Woodland TEC) (Figure 3). The community is listed as Endangered under the EPBC Act but is listed as a Priority Ecological Community at State level.

For an area containing Banksia trees to be defined as the Banksia Woodland TEC it needs to meet several criteria. An assessment of the BmLl vegetation is made against these criteria in Table 6.

One of the criteria is for the vegetation to be in at least Good condition. The areas of *Banksia menziesii* woodland in the old Helena Valley Road reserve are in Degraded condition. Therefore, these areas do not meet the minimum criteria for inclusion in the Banksia Woodland TEC.

Ecological Linkages

The regrowth vegetation in the old Helena Valley Road reserve is adjacent to native vegetation in a parallel unmade road reserve that is 25m wide. The unmade road reserve is adjacent to the Bushmead Bushland Bush Forever site (Site 213). The vegetation in the part of the Bush Forever site closest to the old Helena Valley Road reserve is mapped as a Threatened Ecological Community (SCP 20a). The vegetation in the old road reserve is considered to be too degraded to form any significant ecological linkage value to the Bush Forever Site. In fact, the dominance of the very invasive Victorian Teatree suggests that the current vegetation in the old road reserve is a serious threat to the vegetation in the Bush Forever site.

The vegetation on the site associated with Kadina Brook is predominantly trees with almost no native understorey. The trees are part of an ecological corridor that continues along Kadina Brook to the north-west and south-east. The ecological corridor would be primarily for bird species in the tree canopy but could also be for some ground-dwelling animals such as Quenda.

Table 6: Assessment of the Banksia Woodland of the Swan Coastal Plain TEC.

Feature	Characteristic	EmLl Vegetation Type
Banksia Species	The patch must include at least one of the following diagnostic species: • *Banksia attenuata* (Candlestick Banksia) • *Banksia menziesii* (Firewood Banksia) • *Banksia prionotes* (Acorn Banksia) • *Banksia ilicifolia* (Holly-Leaved Banksia).	Contains *Banksia menziesii*
Vegetation Structure	• A distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall) typically dominated or codominated[3] by one or more of the *Banksia* species (*B. attenuata, B. menziesii, B. ilicifolia, B. prionotes*). • An emergent tree layer of medium or tall (>10 m) height *Eucalyptus* or *Allocasuarina* (Sheoak) species may sometimes be present above the *Banksia* canopy. • An understorey that is often highly species-rich consists of: – A layer of sclerophyllous shrubs of various heights; and, – A herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses. The development of a ground layer may vary depending on the density of the shrub layer and disturbance history.	*Banksia menziesii* the main tree species present. Several *Allocasuarina fraseriana, Eucalyptus todtiana* present. Understorey contains very few native species and is not highly species-rich.
Vegetation Condition	An area of Banksia woodland needs to be at least in Good condition to be considered the TEC.	Condition rating is Degraded
Patch Size	The Banksia woodland TEC needs to meet a minimum 'patch' size depending on its condition to qualify as the TEC, as follows: • 'Pristine' – no minimum patch size • 'Excellent' – 0.5ha • 'Very Good' – 1ha • 'Good' – 2ha	The condition rating is below the minimum requirement for the TEC
Conclusion		**The vegetation does not meet the criteria of Banksia Woodlands of the Swan Coastal Plain TEC.**

4 FAUNA

4.1 Methodology

A Basic Fauna Survey was undertaken in accordance with EPA Technical Guidance *Fauna Surveys for Environmental Impact Assessment* (EPA, 2020). Desktop studies were undertaken to identify habitats and potential threatened species that may occur on the site. A site reconnaissance was conducted by PGV Environmental on 9 September 2022. The inspection included traversing the site on foot.

4.2 Desktop Studies

Desktop studies were undertaken to identify conservation significant species potentially present on the site. A search of the DBCA Database in a 10 km radius from the site (Appendix 8), Atlas of Living Australia database in a radius 10km from the site (Appendix 2) and the EPBC Act Protected Matters Search Tool (Appendix 3) in a 5km radius from the site identified threatened species of fauna previously recorded in the search area or potentially having habitat in the search area (Table 7).

Table 7: List of Fauna Species Identified from Fauna Database Searches

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act
Bettongia penicillata ogilbyi (Listed as *Bettongia penicillata* under the EPBC Act)	Woylie, Brush-tailed Bettong	Schedule 1 - CR	Endangered
Calidris ferruginea	Curlew Sandpiper	Schedule 1 - CR	Critically Endangered
Calidris tenuirostris	Great Knot	Schedule 1 - CR	Marine/ Migratory
Cherax tenuimanus	Margaret River Hairy Marron	Schedule 1 - CR	Critically Endangered
Dasyornis longirostris	Western Bristlebird	Schedule 1 - CR	Endangered
Numenius madagascariensis	Eastern Curlew	Schedule 1 - CR	Critically Endangered
Pseudemydura umbrina	Western Swamp Tortoise	Schedule 1 - CR	Critically Endangered
Pseudocheirus occidentalis	Western Ringtail Possum, Ngwayir	Schedule 1 - CR	Critically Endangered
Botaurus poiciloptilus	Australasian bittern	Schedule 2 - EN	Endangered
Calidris canutus	Red Knot	Schedule 2 - EN	Marine/ Migratory
Calyptorhynchus (Zanda) baudinii	Baudin's Black Cockatoo	Schedule 2 - EN	Endangered
Calyptorhynchus (Zanda) latirostris	Carnaby's Black Cockatoo	Schedule 2 - EN	Endangered
Galaxiella nigrostriata	Black-stripe Minnow	Schedule 2 - EN	Endangered
Leioproctus douglasiellus	A Short-tongued Bee	Schedule 2 - EN	Critically Endangered
Myrmecobius fasciatus	Numbat, Walpurti	Schedule 2 - EN	Endangered
Neopasiphae simplicior	A Short-tongued Bee	Schedule 2 - EN	Critically Endangered

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act
Rostratula australis (Rostratula benghalensis australis)	Australian Painted Snipe	Schedule 2 - EN	Endangered Marine/ Migratory
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	Schedule 3 - VU	Vulnerable
Dasyurus geoffroii	Chuditch, Western Quoll	Schedule 3 - VU	Vulnerable
Falco hypoleucos	Grey Falcon	Schedule 3 - VU	Vulnerable
Leipoa ocellata	Mallee Fowl	Schedule 3 - VU	Vulnerable
Macrotis lagotis	Bilby, Dalgyte, Ninu	Schedule 3 - VU	Vulnerable
Setonix brachyurus	Quokka	Schedule 3 - VU	Vulnerable
Sternula nereis nereis (Sterna nereis nereis)	Australian Fairy Tern	Schedule 3 - VU	Vulnerable
Westralunio carteri	Carter's Freshwater Mussel	Schedule 3 - VU	Vulnerable
Charadrius leschenaultii	Greater Sand Plover	Schedule 3 - VU Schedule 5 - IA	Marine/ Migratory
Actitis hypoleucos	Common Sandpiper	Schedule 5 - IA	Marine/ Migratory
Apus pacificus	Fork-tailed Swift	Schedule 5 - IA	Marine/Migratory
Arenaria interpres	Ruddy Turnstone	Schedule 5 - IA	Marine/ Migratory
Calidris acuminata	Sharp-tailed Sandpiper	Schedule 5 - IA	Marine/ Migratory
Calidris alba	Sanderling	Schedule 5 - IA	Marine/ Migratory
Calidris melanotos	Pectoral Sandpiper	Schedule 5 - IA	Marine/ Migratory
Calidris ruficollis	Red-necked Stint	Schedule 5 - IA	Marine/ Migratory
Calidris subminuta	Long-toed Stint	Schedule 5 - IA	Marine/ Migratory
Hirundapus caudacutus	White-throated Needletail	Schedule 5 - IA	Marine/ Migratory
Hydroprogne caspia (Sterna caspia)	Caspian Tern	Schedule 5 - IA	Marine/ Migratory
Limosa lapponica	Bar-tailed Godwit	Schedule 5 - IA	Marine/ Migratory
Limosa limosa	Black-tailed Godwit	Schedule 5 - IA	Migratory/ Marine
Macronectes giganteus	Southern Giant Petrel	Schedule 5 - IA	Endangered/ Migratory/ Marine
Macronectes halli	Northern Giant-Petrel	Schedule 5 - IA	Vulnerable/ Migratory/Marine
Motacilla cinerea	Grey Wagtail	Schedule 5 - IA	Migratory/ Marine
Pandion cristatus (Pandion haliaetus)	Osprey	Schedule 5 - IA	Marine/ Migratory
Plegadis falcinellus	Glossy Ibis	Schedule 5 - IA	Marine/Migratory
Pluvialis squatarola	Grey Plover	Schedule 5 - IA	Marine/ Migratory
Thalasseus bergii (Sterna bergii)	Crested Tern	Schedule 5 - IA	Marine/ Migratory
Tringa glareola	Wood Sandpiper	Schedule 5 - IA	Marine/ Migratory
Tringa nebularia	Common Greenshank	Schedule 5 - IA	Marine/ Migratory

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	Schedule 5 - IA	Marine/ Migratory
Cacatua pastinator pastinator	Muir's Corella	Schedule 6 - CD	Vulnerable
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale, Wambenger	Schedule 6 - CD	
Falco peregrinus	Peregrine Falcon	Schedule 7 - OS	Marine/ Migratory
Ardea alba	Great Egret, White Egret		Marine
Egretta sacra	Eastern Reef Egret, Eastern Reef Heron		Marine
Halobaena caerulea	Blue Petrel		Vulnerable/ Marine
Himantopus himantopus	Black-winged Stilt		Marine
Merops ornatus	Rainbow Bee-eater		Marine
Pachyptila turtur subsp. subantarctica	Fairy Prion (southern)		Vulnerable
Recurvirostra novaehollandiae	Red-necked Avocet		Marine/ Migratory
Ixobrychus flavicollis australis (southwest subpop.)	Australian Black Bittern (southwest pop)	Priority 1	
Kawaniphila pachomai	Grey Vernal Katydid (southwest)	Priority 1	
Austrosaga spinifer	Spiny Katydid (Swan Coastal Plain)	Priority 2	
Glossurocolletes bilobatus (Previously Leioproctus bilobatus)	A Short-tongued Bee (southwest)	Priority 2	
Acanthophis antarcticus	Southern Death Adder	Priority 3	
Australotomurus morbidus	Cemetery Springtail, Guildford Springtail	Priority 3	
Ctenotus gemmula (Swan Coastal Plain pop)	Jewelled South-west Ctenotus	Priority 3	
Geotria australis	Pouched Lamprey	Priority 3	
Hylaeus globuliferus	Woolybush Bee	Priority 3	
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider	Priority 3	
Lerista lineata	Perth Slider, Lined Skink	Priority 3	
Neelaps calonotos	Black-striped Snake	Priority 3	
Ctenotus delli	Dell's Ctenotus, Darling Range Heath Ctenotus	Priority 4	
Falsistrellus mackenziei	Western False Pipistrelle	Priority 4	
Hydromys chrysogaster	Water-rat, Rakali	Priority 4	

Scientific Name	Common Name	Conservation Status (WA)	Status under EPBC Act
Isoodon fusciventer	Southern Brown Bandicoot, Quenda	Priority 4	
Ixobrychus dubius	Australian Little Bittern	Priority 4	
Notamacropus eugenii derbianus	Tammar Wallaby	Priority 4	
Notamacropus irma	Western Brush Wallaby	Priority 4	
Oxyura australis	Blue-billed Duck	Priority 4	
Platycercus icterotis xanthogenys	Western Rosella (inland ssp)	Priority 4	
Synemon gratiosa	Graceful Sun-moth	Priority 4	

Fauna are classified under five different Priority codes and rare and endangered fauna are classified under the *Wildlife Conservation (Specially Protected Fauna) Notice 2014* into five schedules of taxa. These are outlined in Appendix 4.

4.3 Fauna Habitat

Four fauna habitats occur on the site. The vegetation dominated by *Banksia* is described as Woodland habitat (Plate 6). The parkland cleared areas associated with the Kadina Brook floodplain are Open Woodland habitat (Plate 7). Kadina Brook provides creekline habitat (Plate 8) and the paddock areas are Cleared habitat (Plate 9).

Plate 6: Woodland Fauna Habitat

Plate 7: Open Woodland Fauna Habitat

Plate 8: Cleared Fauna Habitat

Plate 9: Creek Fauna Habitat

Fauna habitat can be assessed using a number of factors including, the size of the habitat, the level of habitat connectivity, availability of specific resources (e.g. tree hollows) and overall vegetation quality. The habitat was assessed according to the following categories:

High Quality Fauna Habitat – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.

Very Good Fauna Habitat - These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally affected by disturbance.

Good Fauna Habitat – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.

Disturbed Fauna Habitat – These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.

Highly Degraded Fauna Habitat – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. Limited or

no fauna habitat connectivity. Faunal assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance. (Coffey Environments, 2009).

The vegetation in all habitats is highly degraded with almost no native understorey. The Woodland habitat has connectivity with other parts of the Kadina Brook environment to the south-east and north-west and is therefore rated as Good Fauna Habitat. The remainder of the habitats on the site are considered to be Highly Degraded Fauna Habitat.

4.4 Conservation Significant Species

Outlined below in Table 7 is a short description of the preferred habitat for each of the species that were identified in the DBCA Database Search (Appendix 8), Atlas of Living Australia Species Report (Appendix 2) and the EPBC Protected Matters Search Tool (Appendix 3) in Table 6. The preferred habitat has been compared to the habitats on the site described above and the likelihood of each species to be present was determined. Marine and pelagic species have not been included.

Table 9: Preferred Habitat of Conservation Significant Fauna Species

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Schedule 1 – Critically Endangered			
Bettongia penicillata ogilbyi (Bettongia penicillata)	Woylie, Brush-tailed Bettong	The Woylie habitat types ranged from forest to grassland, coastal and inland. During the day the Woylie shelters under patches of dense undergrowth, logs and rock-cavities and occasionally in burrows.	Highly Unlikely – the site is too disturbed
Calidris ferruginea	Curlew Sandpiper	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms.	Highly Unlikely – not typical habitat and site is too open
Calidris tenuirostris	Great Knot	The Great Knot winters in Australia, occurring in sheltered coastal habitats such as inlets, bays, harbours, estuaries and lagoons with large intertidal mud and sandflats, oceanic sandy beaches with nearby mudflats, sandy spits and islets, muddy shorelines with mangroves and occasionally exposed reefs or rock platforms. It roosts in refuges such as shallow water in sheltered sites, on coastal dunes or on saltflats amongst mangroves during high tides (BirdLife International, 2015a).	Highly Unlikely – not suitable habitat
Cherax tenuimanus	Margaret River Hairy Marron	The Margaret River Hairy Marron occurs in fresh water in the Margaret River Area.	Highly Unlikely – outside of species range
Dasyornis longirostris	Western Bristlebird	The Western Bristlebird is restricted to floristically diverse low dense coastal heathland.	Highly Unlikely – not suitable habitat

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Numenius madagascariensis	Eastern Curlew	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets.	Highly Unlikely – not suitable habitat
Pseudemydura umbrina	Western Swamp Tortoise	The Western Swamp Tortoise is restricted to very few wild populations. During winter and spring, the tortoises live in the water. This species is carnivorous feeding on insects, larvae and tadpoles (Burbidge and Kuchling, 1994). In the drier, hotter months they shelter under leaf litter and in holes and aestivate (sleep).	Highly Unlikely – not suitable habitat
Pseudocheirus occidentalis	Western Ringtail Possum, Ngwayir	The Western Ringtail Possum is a medium sized nocturnal marsupial. This species occurs in and near coastal Peppermint Tree (*Agonis flexuosa*) forest and Tuart (*Eucalyptus gomphocephala*) dominated forest with a Peppermint Tree understorey.	Highly Unlikely – not suitable habitat
Schedule 2 – Endangered			
Botaurus poiciloptilus	Australasian bittern	The Australasian Bittern occurs mainly in densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands.	Highly Unlikely – the site is too open
Calidris canutus	Red Knot	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	Highly Unlikely – not suitable habitat
Calyptorhynchus baudinii	Baudin's Black Cockatoo	Baudin's Black-Cockatoo mainly occurs in eucalypt forests, especially Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*), also Karri (*Eucalyptus diversicolor*) forest, often feeding in the understorey on proteaceous trees and shrubs, especially banksias (SEWPaC, 2012).	Possible vagrant visitor to the site
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	Carnaby's Cockatoo is found in the south-west of Australia from Kalbarri through to Ravensthorpe. It has a preference for feeding on the seeds of Banksia, Hakea, Eucalyptus, Grevillea, Pinus and Allocasuarina spp. It is nomadic often moving toward the coast after breeding. Nesting mostly occurs in smooth-barked trees (e.g. Salmon Gum, Wandoo, Red Morrell) (SEWPaC, 2012).	Likely to occur intermittently on the site

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Galaxiella nigrostriata	Black-stripe Minnow	The Blackstriped Dwarf Galaxias is found only in coastal wetlands of south-west Western Australia. During summer when ephemeral pools dry out, Blackstriped Dwarf Galaxias burrow into the moist soil below and aestivate until the rains return in autumn (Fishes of Australia, 2015).	Highly Unlikely – not coastal wetland habitat
Leioproctus douglasiellus	A Short-tongued Bee	The short-tongued bee species is only known from three locations within the Perth metropolitan area ranging from Cannington to Forrestdale. Specimens have been collected on two plant species, *Goodenia filiformis* and *Anthotium junciforme* (TSSC, 2013) and with pollen from *Philotheca spicata*, *Patersonia occidentalis*, two species of *Stylidium*, a species of *Scaevola* and species from Fabaceae and Myrtaceae (DBCA, 2018).	Highly Unlikely – not suitable habitat
Myrmecobius fasciatus	Numbat, Walpurti	Numbats occur in eucalypt forests and woodlands dominated by *Eucalyptus marginata, Corymbia calophylla and Eucalyptus wandoo*.	Highly Unlikely – the site is too disturbed
Neopasiphae simplicior	A Short-tongued Bee	The Short-tongued Bee species is restricted in range, thought to only occur in a single location within the bushland of the Forrestdale Lake Nature Reserve adjacent to Forrestdale Lake and the Armadale Golf Course, with a previous population known from Cannington. It has been collected at flowers of *Goodenia filiformis, Lobelia tenuior, Angianthus preissianus* and *Velleia* sp. It occurs in two TECs, Type 8 and Type 10a. Males roost overnight in flowers of Asteraceae (Houston, 2000).	Highly Unlikely – not suitable habitat
Rostratula australis (Rostratula benghalensis australis)	Australian Painted Snipe	The Australian Painted Snipe has been recorded at wetlands in all states of Australia but is most common in eastern Australia. It generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. It also uses inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include a cover of vegetation, including grasses.	Highly Unlikely – the site is too disturbed

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Schedule 3 – Vulnerable			
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	Forest Red-tailed Black Cockatoos frequent the humid to sub-humid south-west of Western Australia from Gingin in the north, to Albany in the south and west to Cape Leeuwin and Bunbury (SEWPaC, 2012). It nests in tree hollows with a depth of 1-5m, that are predominately Marri (Corymbia calophylla), Jarrah (Eucalyptus marginata) and Karri (Eucalyptus diversicolor) and it feeds primarily on the seeds of Marri.	Likely to be an intermittent visitor
Dasyurus geoffroii	Chuditch, Western Quoll	The Chuditch have been known to occupy a wide range of habitats including woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. They are opportunistic feeders, and forage on the ground at night, feeding on invertebrates, small mammals, birds and reptiles.	Highly Unlikely – not suitable habitat
Falco hypoleucos	Grey Falcon	The Grey Falcon favours timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined watercourses, but frequents other grassland and woodland habitats (Birdlife International, 2014a).	Highly Unlikely – not typical habitat and last recorded in 1929
Leipoa ocellata	Mallee Fowl	Mallee fowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards in mallee bushland.	No – not mallee habitat
Macrotis lagotis	Bilby, Dalgyte, Ninu	The greater Bilby is a nocturnal omnivorous marsupial that shrub species, such as *Acacia kempeana* and A. *hilliana*, which have root-dwelling larvae that provide a constant food source for the Greater Bilby. They also utilise Spinifex hummocks which are quite uniform and discrete, providing runways between hummocks, enabling easier movement and foraging.	No – outside of species range
Setonix brachyurus	Quokka	Quokkas were originally very common on the Swan Coastal Plain, however, their distribution is now limited to Rottnest Island and a few isolated areas in the south-west of WA. On the mainland, they prefer densely vegetated areas around wetlands and streams, whereas on Rottnest Island they inhabit low scrubby coastal vegetation where water is not readily available year-round.	No - thought to be locally extinct and the site is too disturbed
Sternula nereis nereis (Sterna nereis nereis)	Australian Fairy Tern	The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation.	Highly Unlikely – not suitable habitat

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Westralunio carteri	Carter's Freshwater Mussel	Carter's Feshwater Mussel is South-West Western Australia's only freshwater mussel (Murdoch University & SERCUL, 2012). Carter's Freshwater Mussel occurs in freshwater streams, rivers, reservoirs and lakes (ICUN, 2015b) and is intolerant to dehydration for more than three days and salinity (Murdoch University & SERCUL, 2012).	Highly Unlikely – not suitable habitat
Schedule 5 – International Agreement			
Charadrius leschenaultii	Greater Sand Plover	In Australasia, the Greater Sand Plover is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons.	Highly Unlikely – not coastal habitat
Actitis hypoleucos	Common Sandpiper	The Common Sandpiper is mostly found around muddy margins or rocky shores. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands.	Unlikely – not typical habitat and the site is too disturbed
Apus pacificus	Fork-tailed Swift	The Fork-tailed Swift is almost exclusively aerial and is not known to breed in Australia. They are seen in inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. *Apus pacificus* subsp. *pacificus* is the only subspecies to migrate to Australia.	Highly Unlikely – may fly overhead but unlikely to land
Arenaria interpres	Ruddy Turnstone	The Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches.	Highly Unlikely – not suitable habitat
Calidris acuminata	Sharp-tailed Sandpiper	The Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	Unlikely – not typical habitat and the dam is too disturbed
Calidris alba	Sanderling	Sanderlings occur on most of the coast from Eyre to Derby, and also around Wyndham. They are more often recorded on the south and southwest coasts, north to around southern Shark Bay, with more sparsely scattered records further north in Gascoyne and Pilbara Regions and the Kimberley Division.	Highly Unlikely – not suitable habitat
Calidris melanotos	Pectoral Sandpiper	The Pectoral Sandpiper prefers shallow fresh to saline wetlands and is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Unlikely – not typical habitat and the site is too disturbed

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Calidris ruficollis	Red-necked Stint	The Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores.	Highly Unlikely – not suitable habitat
Calidris subminuta	Long-toed Stint	The Long-toed Stint prefers shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds. The species is also fond of areas of muddy shoreline, growths of short grass, weeds, sedges, low or floating aquatic vegetation, reeds, rushes and occasionally stunted samphire.	Unlikely – not typical habitat and the site is too disturbed
Hydroprogne caspia (Sterna caspia)	Caspian Tern	The Caspian Tern is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred.	Highly Unlikely – not suitable habitat
Limosa lapponica	Bar-tailed Godwit	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	Highly Unlikely – not suitable habitat
Limosa limosa	Black-tailed Godwit	The Black-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh.	Highly Unlikely – not suitable habitat
Motacilla cinerea	Grey Wagtail	The Grey Wagtail is mostly recorded in coastal areas in Western Australia (ALA, 2015) however is widespread. There is non-breeding habitat only in Australia and the species has a strong association with water, particularly rocky substrates along water courses but also lakes and marshes.	Highly Unlikely – not suitable habitat
Pandion cristatus (Pandion haliaetus)	Osprey	Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They feed on fish, especially mullet where available, and rarely take molluscs, crustaceans, insects, reptiles, birds and mammals.	Highly Unlikely – not suitable habitat
Plegadis falcinellus	Glossy Ibis	The Glossy Ibis is the smallest ibis known in Australia. This species preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation but do not breed in South-west Western Australia.	Unlikely – not typical habitat and the site is too disturbed

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Pluvialis squatarola	Grey Plover	Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons.	Highly Unlikely – not coastal habitat
Thalasseus bergii (Sterna bergii)	Crested Tern	The Crested Tern occurs in coastal areas (Birdlife Australia, 2018).	Highly Unlikely – not coastal habitat
Tringa glareola	Wood Sandpiper	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums Eucalyptus camaldulensis and often with fallen timber.	Highly Unlikely – not suitable habitat
Tringa nebularia	Common Greenshank	The Common Greenshank is a wader and does not breed in Australia. This species can be found in many types of wetlands and has the widest distribution of any shorebird in Australia. This species typically feeds on molluscs, crustaceans, insects, and occasionally fish and frogs.	Highly Unlikely – not suitable habitat
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks.	Highly Unlikely – not suitable habitat
Schedule 6 – Conservation Dependent			
Cacatua pastinator pastinator	Muir's Corella	Muir's Corella occurs in eucalyptus woodlands that are dominated by White Gum (*Eucalyptus wandoo*), Marri (*Corymbia calophylla*), or Jarrah (*Eucalyptus marginata*). The subspecies often occurs in farmland, especially in croplands and sometimes pasture, where there are ample watering points and some nearby large trees for roosting or breeding.	Unlikely – species generally occurs in the Wheatbelt
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale, Wambenger	Southern Brush-tailed Phascogales are arboreal marsupials which require tree hollows in suitable woodland or forest and rely on abundant invertebrate prey to sustain populations (Pescott, 2012).	Highly Unlikely – not suitable habitat and too disturbed

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Schedule 7 – Other Specially Protected Species			
Falco peregrinus	Peregrine Falcon	The Peregrine Falcon is found in a variety of habitats but nests on high cliff ledges or artificial structures. It feeds primarily on small-medium sized birds, but occasionally taking insects, such as moths, cicadas and locusts (Birdlife Australia, 2012).	Highly Unlikely – not suitable habitat
Marine			
Ardea alba	Great Egret, White Egret	The Eastern Great Egret has been reported in a wide range of wetland habitats and usually frequents shallow waters. This species feeds on fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals.	Highly Unlikely – not suitable habitat
Egretta sacra	Eastern Reef Egret, Eastern Reef Heron	The Eastern Reef Egret nests in trees in island woodlands, or on the ground under shrubs or rock ledges and feeds on small fish, crustaceans and insects (Birdlife Australia, 2014).	Highly Unlikely – not suitable habitat
Himantopus himantopus	Black-winged Stilt	The Black-winged Stilt is found near coastal lagoons and shallow freshwater or brackish pools with extensive areas of mudflats, salt meadows, saltpans, coastal marshes and swamps (Birdlife International, 2014b).	Highly Unlikely – not suitable habitat
Merops ornatus	Rainbow Bee-eater	Populations of the Rainbow Bee-eater that breed in northern Australia are considered to be resident, and in many northern localities the Rainbow Bee-eater is present throughout the year. The Rainbow Bee-eater nests in a burrow dug in the ground. It is found across the better-watered parts of WA including islands preferring lightly wooded, sandy country near water.	Possible intermittent visitor
Recurvirostra novaehollandiae	Red-necked Avocet	The Red-necked Avocet occurs in wetland areas including bogs, marshes, swamps and Permanent Saline, Brackish or Alkaline Lakes (Birdlife International, 2014c).	Highly Unlikely – not suitable habitat
Priority 1			
Ixobrychus flavicollis australis (southwest subpop.)	Australian Black Bittern (southwest pop)	The bittern sub-species prefer wetland habitats with dense fringing vegetation. They are found in reed beds along water bodies. They inhabit ponds, lakes, streams and marshes. Their breeding habitat is mostly reed beds. The subspecies I. f. australis is distributed in New Guinea, Bismarck Archipelago and Australia (BirdLife International, 2015b).	Highly Unlikely – not suitable habitat
Kawaniphila pachomai	Grey Vernal Katydid (southwest)	The *Kawaniphila pachomai* species of cricket has been recorded in Karragullen and Witchcliffe which are forested areas.	Highly Unlikely – not suitable habitat

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Priority 2			
Austrosaga spinifer	Spiny Katydid (Swan Coastal Plain)	The Austrosaga spinifer species of cricket is recorcded from Cervantes (Rentz, 1996).	Highly Unlikely – not recorded in the area
Glossurocolletes bilobatus (Previously Leioproctus bilobatus)	A Short-tongued Bee (southwest)	The *Glossurocolletes bilobatus* bee species is known to utilise the yellow flowering pea, *Gompholobium aristatum* (Phoenix, 2010).	Highly Unlikely – not suitable habitat
Priority 3			
Acanthophis antarcticus	Southern Death Adder	Southern Death Adders inhabit a range of habitats, including rainforest, scrubland, semi arid zones and rocky outcrops. Typically during the day they remain mostly buried beneath sand, soil or debris, with just the tail and top of the head exposed. They do not actively hunt their prey but are cryptic snakes which sit motionlessly, sometimes for months on end, constantly watching for any animal which unwittingly comes within striking distance (Pilbara Pythons, 2014).	Unlikely – the site is too disturbed
Australotomurus morbidus	Cemetery Springtail, Guildford Springtail	The Cemetery Springtail is known from four locations in Perth in relatively undisturbed bushland in pale soils in *Banksia* and *Eucalyptus* woodland (Greenslade and Jordan, 2014).	Highly Unlikely – the site is too disturbed
Ctenotus gemmula (Swan Coastal Plain pop)	Jewelled South-west Ctenotus	The Jewelled south-west Ctenotus inhabits sand plains with heaths. It is also found in Banksia or Mallee woodlands (ICUN, 2015).	Highly Unlikely – not suitable habitat
Geotria australis	Pouched Lamprey	The Pouched Lamprey is spawned in freshwater systems and then migrate to sea before returning to freshwater to spawn and die (OzFishNet, 2014).	No – not suitable habitat
Hylaeus globuliferus	Woolybush Bee	The Woolybush Bee is thought to favour flowers of *Adenanthos cygnorum* for feeding, but has also been recorded on *Banksia attenuata*.	Unlikely – not typical habitat
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider	The Swan Coastal Plain Shield-backed Trapdoor Spider arranges fallen twigs from the sheoak tree around the rim of its burrow entrance, enabling it to feel the vibrations of unsuspecting prey that wander by (Curtin, 2018).	Highly Unlikely – not suitable habitat
Lerista lineata	Perth Slider, Lined Skink	The Lined Skink is a burrowing species that occurs in pale sandy soils with coastal heath and shrubland areas in isolated populations in the south-west and mid-west coast of Western Australia. It feeds on termites and other small insects (AROD, 2014).	Highly Unlikely – not suitable habitat

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Neelaps calonotos	Black-striped Snake	The Black-striped snake has a limited distribution, inhabiting areas with sandy soils that support heathlands and Banksia/Eucalypt Woodlands (Nevill, 2005) on the Swan Coastal Plain generally in the lower west coast from Lancelin to Mandurah (Storr et al, 1999).	Unlikely – not typical habitat
Priority 4			
Ctenotus delli	Dell's Ctenotus, Darling Range Heath Ctenotus	Dell's Ctenotus is found in the north Darling Range of south-western WA in dry sclerophyll forests on stony hills and ranges (Cogger, 2014).	Highly Unlikely – not suitable habitat
Falsistrellus mackenziei	Western False Pipistrelle	The Western False Pipistrelle occurs in high rainfall Jarrah, Karri and Tuart forests and coastal woodlands. They roost in hollows of trees, branches and stumps, and are insectivorous, feeding at night between the canopy and understorey of tall forest trees (Environment Australia, 1999).	Highly Unlikely – not suitable habitat
Hydromys chrysogaster	Water-rat, Rakali	The Water Rat generally prefers wetland habitats characterised by dense, low-lying vegetation (0–30 cm from ground), low-density canopy cover and shallow, narrow water bodies (Speldewinde et al., 2013).	Highly Unlikely – not suitable habitat
Isoodon fusciventer	Southern Brown Bandicoot, Quenda	Southern Brown Bandicoots are small grey marsupials that prefer dense scrub (up to one metre high). Their diet includes invertebrates (including earthworms, adult beetles and their larvae), underground fungi, subterranean plant material, and very occasionally, small vertebrates (DEC, 2012b).	Possibly intermittently present on the site
Ixobrychus dubius	Australian Little Bittern	The Australian Little Bittern is mainly found in freshwater wetlands, where they inhabit dense emergent vegetation of reeds and sedges, and inundated shrub thickets. They are also occasionally found in brackish and saline wetlands such as mangrove swamps, Juncus-dominated salt marsh and the wooded margins of coastal lagoons (Naturewatch NZ, 2014).	Highly Unlikely – not suitable habitat
Notamacropus eugenii derbianus	Tammar Wallaby	The Tammar Wallaby prefers dense, low vegetation for daytime shelter and open grassy areas for feeding. This species inhabits coastal scrub, heath, dry sclerophyll forest and thickets in mallee and woodland (DEC, 2012c).	Unlikely – the site is too disturbed
Notamacropus irma	Western Brush Wallaby	The Western Brush Wallaby is a medium sized marsupial and its optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets (DEC, 2012d).	Unlikely – the site is too disturbed

Scientific Name	Common Name	Habitat*	Likelihood to Occur on the Site
Oxyura australis	Blue-billed Duck	The Blue-billed Duck is found on terrestrial wetlands in temperate regions, that are freshwater to saline, and may be natural or artificial. It nests in rushes, sedges, Lignum *Muehlenbeckia cunninghamii* and paperbark *Melaleuca* (Birdlife International, 2015c). The species is almost completely aquatic, and is seldom seen on land. Non-breeding flocks, often with several hundred individuals, congregate on large, deep open freshwater dams and lakes in autumn (Birds in Backyards, 2015).	Highly Unlikely – not suitable habitat
Platycercus icterotis xanthogenys	Western Rosella (inland ssp)	The wheatbelt subspecies of Western Rosella lives in woodland, and its persistence is associated with habitat remnants. The main food of this subspecies is the seeds of casuarinas, but it also takes seeds from grass, weedy herbs and fruit. This species nests in tree hollows (SEWPaC, 2000).	Highly Unlikely – not suitable habitat and outside of the species main range
Synemon gratiosa	Graceful Sun-moth	The Graceful Sun-moth is a diurnal moth with dull coloured brown to black forewings and brightly coloured orange hind wings. The larvae burrow into the rhizomes of *Lomandra maritima* and *Lomandra hermaphrodita* exclusively and therefore require the presence of one or both of these species to be present in an area (Bishop *et al*., 2011).	No – no suitable habitat

* Habitat descriptions from DoEE (2016) SPRAT Database unless otherwise denoted

Habitat on the site was identified for three listed species of Black Cockatoos being:

- Carnaby's Black Cockatoo (*Calyptorhynchus* (*Zanda*) *latirostris*)
- Baudin's Black Cockatoo (*Calyptorhynchus* (*Zanda*) *baudinii*)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

The Open Woodland Habitat containing Flooded Gum and Wandoo provides foraging habitat for Black Cockatoos as does the small area containing Banksia trees in the old road reserve (Valentine and Stock, 2008; Groom, 2011). Detailed analysis of the Black Ccokatoo habitat on the site is provided in Section 5.

The Southern Brown Bandicoot, Quenda (*Isoodon fusciventer*) (Priority 4) could potentially occur on the site.

The Rainbow Bee-eater (*Merops ornatus*), listed Marine under the EPBC Act, may potentially utilise some sections of the site as part of a much larger home range though only likely to occur infrequently.

4.5 Pest Fauna

There are several pest species that may be present on the site outlined in Table 9.

Table 2: Pest Species Likely to Occur on the Site

Taxa	Family	Species Name	Common Name
Mammalia	Canidae	*Vulpes vulpes*	Red fox
	Felidae	*Felis catus*	Feral cat
	Leporidae	*Oryctolagus cuniculus*	European Rabbit
	Muridae	*Mus musculus*	House Mouse
		Rattus rattus	Black Rat

4.6 Biodiversity Value

The EPA's (2002) *Terrestrial Biological Surveys as an Element of Biodiversity Protection Position Statement No. 3* indicated an ecological assessment of a site must consider its biodiversity value at the genetic, species and ecosystem levels; and its ecological functional value at the ecosystem level. The vegetation on the site is largely undisturbed, however there is likely to be introduced feral species such as foxes, cats and rabbits which would have modified the fauna assemblage from pre-European settlement.

5 BLACK COCKATOO HABITAT ASSESSMENT

5.1 Black Cockatoo Species

5.1.1 Carnaby's Black Cockatoo (Zanda (Calyptorhynchus) latirostris)

Carnaby's Black Cockatoo is found in the south-west of Australia from Kalbarri through to Ravensthorpe. It has a preference for feeding on the seeds of *Banksia, Hakea, Eucalyptus, Grevillea, Pinus* and *Allocasuarina* spp. It is nomadic, often moving toward the coast after breeding. It breeds in tree hollows that are 2.5 – 12m above the ground and have an entrance of 23-30cm with a depth of 1-2.5m. Nesting mostly occurs in smooth-barked trees (e.g. Salmon Gum, Wandoo, Red Morrell). Eggs are laid from July to October, with incubation lasting 29 days (DoE, 2014).

The study area Is inside the boundary of the modelled distribution for Carnaby's Black Cockatoos (SEWPaC, 2012). The study area is shown as being within the buffer of a confirmed roost site but is not within a confirmed breeding area (National Map, 2022).

5.1.2 Baudin's Black Cockatoo (Zanda (Calyptorhynchus) baudinii)

Baudin's Black Cockatoo is most common in the far south-west of Western Australia. It is known to breed from the southern forests north to Collie and east to near Kojonup. Baudin's Black Cockatoo is typically found in vagrant flocks and utilises the taller, more open Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) woodlands where it feeds mainly on Marri seeds and various Proteaceous species (Johnstone, Johnstone and Kirkby, 2011).

The study area is outside the modelled 'distribution for Baudin's Black Cockatoos however the species may be a vagrant visitor to the study area (SEWPaC, 2012).

5.1.3 Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

Forest Red-tailed Black Cockatoos are endemic to the humid to sub-humid south-west of Western Australia (SEWPaC, 2012). The range of Forest Red-tailed Black Cockatoos is bound by Gingin in the north to Mt Helena, Christmas Tree Well, West Dale, North Bannister, Mt Saddleback, Kojonup, Rocky Gully, upper King River and Green Range (east of Albany) (SEWPaC, 2012; DoE, 2014). It nests in tree hollows with a depth of 1-5m, that are predominately Marri, Jarrah and Karri (*E. diversicolor*) and it feeds primarily on the seeds of Marri and Jarrah (Johnstone, Johnstone and Kirkby, 2011).

The study area is inside the modelled distribution for Forest Red-tailed Black Cockatoos (SEWPaC, 2012).

5.2 Methodology

5.2.1 Habitat definitions

Breeding Habitat

'Breeding habitat' is defined as trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR have a DBH of 500mm or greater (DAWE, 2022).

Past studies have found that on average hollow openings are 25 cm x 27 cm (Saunders *et al.,* 1982, Saunders and Dawson, 2017) and 30 cm x 34 cm (Johnstone *et al*., 2013). The height of a hollow

entrance off the ground is on average 19.384 m (Johnstone *et al*., 2013). Nearly all hollows that are used for nesting by Black Cockatoos are located in the main trunk and have a vertical aspect (Johnstone *et al*., 2013, Saunders and Dawson, 2017). Black Cockatoos are large birds with shoulders that are about 100 mm wide, therefore they require hollows with an entrance bigger than this (as shown above they are typically much larger), but the internal dimensions (depth and floor base) need to be much larger in order for it to be suitable to lay eggs in and for adults to be able to move around.

Previous research has found for Carnaby's Black Cockatoo a mean depth of 1.2 m and a floor diameter of 40 cm is required in order for it to be suitable to lay eggs in and for adults to be able to move around (Johnstone *et al*., 2013, Saunders and Dawson 2017).

The Black Cockatoo Referral Guidelines define trees of certain species with a DBH of 300 to 500mm or greater, dependent on the tree species, as breeding habitat regardless of the presence or not of hollows. The theory behind this definition is the concept that while the trees may not currently contain hollows, they are mature enough that in the next 50 years or so a hollow might form and be of use to Black Cockatoos for the purposes of breeding.

Roosting Habitat

'Roosting habitat' is usually evident due to the presence of Black Cockatoos in the survey area in the evening and early morning and if there are scats or moulted feathers under the roosting area. Black Cockatoos utilise a wide range of native and non-native trees, situated within a variety of land-use types. Roosting habitat is generally in tall (average of > 25 m) tree species that have relatively thick trunks (average DBH of 1 m) and medium foliage density (average of 50%), and that are not too densely forested amongst other trees (average tree crown connectivity of 20 %) (Le Roux, 2017). Black cockatoos rely upon the availability of suitable night roosting sites in proximity to foraging resources, and particularly access to water within 2 km of the roost site (SEWPaC, 2012).

Foraging Habitat

'Foraging habitat' for Black Cockatoos is determined from the plant species that are present on the study area and evidence of feeding such as direct observation of birds or by chewed nuts and cones. Foraging plants utilised by each species of Black Cockatoo varies, with Carnaby's Black Cockatoo foraging on Eucalypts, pines and proteaceous species, whereas Forest Red-tailed Cockatoos prefer Eucalypts and Allocasuarina and many exotic species and Baudin's prefer mostly seeds of Marri and Jarrah, also Allocasuarina cones (DAWE, 2022).

5.2.2 Site Survey

PGV Environmental undertook a Black Cockatoo habitat assessment on 9 September 2022 in accordance with the Black Cockatoo Referral Guidelines (DAWE, 2022) and the methodology outlined in the SPRAT Database for each of the Black Cockatoo species.

The study area was traversed on foot and information on Black Cockatoo foraging, roosting and breeding habitat was assessed. The extent, type and quality of the vegetation present, including the presence and extent of plants known to be used by Black Cockatoos was recorded.

5.3 Black Cockatoo Habitat

5.3.1 Breeding

Black Cockatoos are known to breed in hollows of large eucalypts. The site is not known as a breeding site for Black Cockatoos (DoP, 2011; National Map, 2022). The nearest breeding site is approximately 14km to the east (National Map, 2022).

There were 8 trees recorded by PGV Environmental that meet the definition of breeding habitat or potential breeding habitat due to their DBH being >300mm for Wandoo and >500m for Marri (Figure 3, Appendix 2). The total consisted of 7 Wandoo trees and one Marri tree. None of the trees in the study area contained hollows.

5.3.2 Roosting

Black Cockatoos are known to roost overnight in tall trees including native and introduced eucalypts and pine trees generally in close proximity to a fresh water source. The study area contains tall Jarrah trees, however no evidence of roosting was recorded during the survey.

The study area is not mapped as containing a recorded roosting habitat for Black Cockatoos but near several known sites (DoP, 2011; Peck *et al.,* 2018; National Map, 2022). The nearest roosting sites are reported to be around 1.2 km to the south-south-east, 1.5m to the north-east, 1 and 3.4km to the south-east (National Map, 2022) (Figure 4).

5.3.3 Foraging

The study area contains ten species that are recognised as are known to be used for foraging by Black Cockatoos (Table 10) (Davies 1966; Saunders 1980; Johnstone and Storr 1998; Johnstone and Kirkby 1999; Valentine and Stock, 2008; Groom 2011; Johnstone *et al*., 2011; SEWPaC, 2012; Johnstone, *et al.*, 2013; Groom, 2015; Johnstone *et al*., 2016; DAWE, 2022). Some of the species were only represented by one or a few plants such as Marri, Jarrah, Coastal Blackbutt, *Banksia attenuata* and *B. ilicifolia.* Therefore, the main area of foraging habitat is the *Banksia menziesii/Leptospermum laevigatum* Low Open Woodland. *Banksia menziesii* trees are foraged by Carnaby's Black Cockatoos and not the other two species. The total area of foraging habitat is 0.3156ha (Figure 6).

Table 10: Foraging Species for Black Cockatoos

Species	Common Name	Carnaby's Black Cockatoo	Baudin's Black Cockatoo	Forest red-tailed Black Cockatoo
Allocasuarina fraseriana	Slender Banksia	✓		✓
Banksia attenuata	Slender Banksia	✓	✓	
Banksia ilicifolia	Holly-leaved Banksia	✓	✓	
Banksia menziesii	Firewood Banksia	✓	✓	
Casuarina cunninghamiana	River Sheoak	✓		✓
Corymbia calophylla	Marri	✓	✓	✓
Eucalyptus marginata	Jarrah	✓	✓	✓
Eucalyptus todtiana	Coastal Blackbutt	✓	✓	✓
Eucalyptus wandoo	Wandoo	✓	✓	✓
Xanthorrhoea preissii	Grass Tree	✓	✓	✓

The foraging habitat value was not able to be worked out using the scoring tool in the revised Black Cockatoo Referral Guidelines (DAWE, 2022) as the tool can only applies to sites equal to or larger than 1ha. The extent of foraging habitat on the site is calculated to be 0.3156ha.

6 SUMMARY AND CONCLUSION

6.1 Summary

The Flora, Vegetation and Fauna survey of the proposed MRS Amendment Area for Lots 5, 250, 253 and 254 Helena Valley Road, Helena Valley found the following:

- Native vegetation occurs on about 2.8ha of the 18.6ha site;
- Six native vegetation types and one non-native vegetation type were recorded and mapped on the site. Three of the vegetation types were regrowth vegetation in the old Helena Valley Road reserve which is not part of Lots 250 and 254. Four vegetation types were associated with the Kadina Brook environment;
- Most of the vegetation was rated as Degraded to Completely Degraded due to the absence of any native understorey. One area of Very Good *Melaleuca rhaphiophylla* Forest was recorded along Kadina Brook;
- A total of 89 plant species were recorded in the flora survey with 44 native species and 45 (50.5%) introduced species. No Threatened or Priority flora were recorded on the site;
- The small areas of *Banksia menziesii/Leptospermum laevigatum* Low Open Woodland in the old Helena Valley Road reserve is Degraded and therefore does not meet the minimum condition rating to be the Banksia Woodlands of the Swan Coastal Plain Ecological Community;
- The Woodland habitat on the site is considered Good Fauna Habitat due to the connectivity to other vegetation along Kadina Brook. The remainder of the fauna habitats are considered to be Highly Degraded Fauna Habitat;
- The vegetation in the old Helena Valley Road reserve contains a dense cover of Victorian Teatree which is very invasive in dry, sandy soils. The Victorian Teatree is considered a threat to the Threatened Ecological Community (SCP 20a) that occurs in the Bushmead Bushland Bush Forever site located 25m from the site;
- The vegetation in the Kadina Brook environment provides an ecological corridor along other sections of the Brook to the north-west and south-east. The corridor would be predominantly for birds and potentially Quenda;
- The site contains 0.3156ha of foraging habitat for Carnaby's Black Cockatoos and eight potential breeding habitat trees (7 Wandoo and 1 Marri). No trees contained any hollows, therefore breeding does not currently occur on the site;
- The proposed development would clear 0.3156ha of Carnaby's Black Cockatoo foraging habitat and one potential breeding habitat tree;
- The clearing of more than 1ha of Black Cockatoo foraging habitat and one breeding habitat tree may have a significant impact on Carnaby's Black Cockatoo. The amount of foraging habitat is below the threshold level and a single potential breeding habitat tree is a very low impact. Therefore, referral under the Commonwealth EPBC Act may not be required; and
- The site also contains habitat suitable for the Southern Brown Bandicoot (*Isoodon fusciventer*), and Rainbow Bee-eater (*Merops ornatus*).

6.2 Conclusion

The proposed development of Lots 5, 250, 253 and 254 Helena Valley Road is likely to clear all the vegetation in the old Helena Valley Road reserve that is now within Lots 250 and 254. As this vegetation does not have any flora or vegetation values of conservation significance the clearing is considered acceptable.

The proposed development is unlikely to require the clearing of any of the vegetation associated with Kadina Brook.

Therefore, the proposed MRS Amendment to enable urban and commercial development should not have any adverse impacts on the flora, vegetation or fauna values of the site.

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