



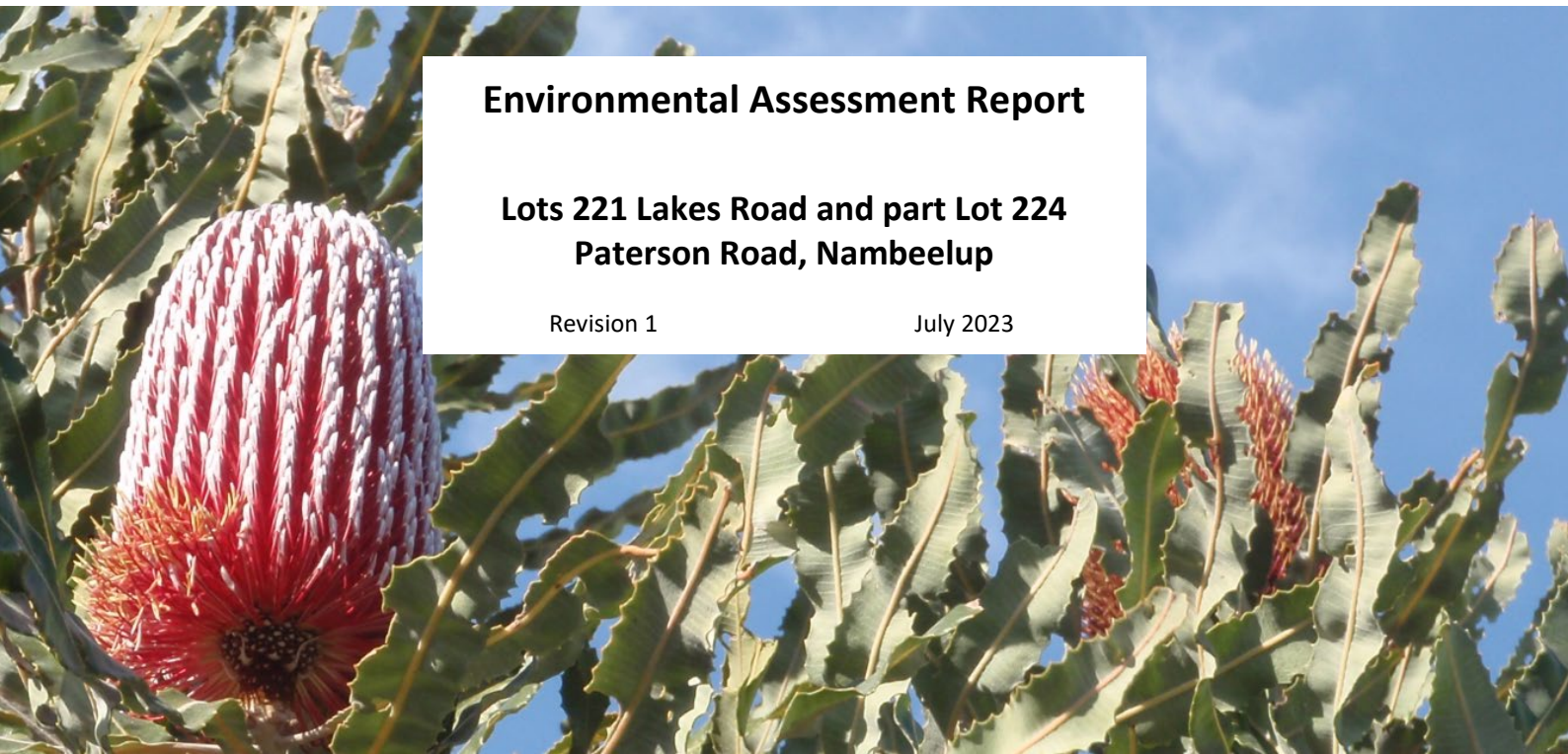
COTERRA  
ENVIRONMENT

## **Environmental Assessment Report**

**Lots 221 Lakes Road and part Lot 224  
Paterson Road, Nambeelup**

Revision 1

July 2023



CALIBRE | COMMITMENT | COLLABORATION

**This report was prepared by:** Coterra Pty Ltd trading as COTERRA ENVIRONMENT  
**ABN:** ABN: 92 143 411 456  
**Our Ref:** DBANAM08  
**Author(s):** C. Rea and K. Watts  
**Reviewer:** K Watts  
**Report Version:** Revision 1  
**Date:** July 2023

**This report was prepared for:**  
Nambeelup Joint Venture  
PO Box 7010  
Cloisters Square, PERTH WA 6850  
&  
Lot 224 landowners  
PO Box 48, PINJARRA WA 6208

# Contents

<b>Executive Summary .....</b>	<b>6</b>
<b>1 Introduction.....</b>	<b>8</b>
1.1 Project Description .....	8
1.2 Town Planning.....	8
1.2.1 Nambeelup Industrial Area: District Structure Plan .....	8
1.2.2 Peel Region Scheme rezoning .....	8
1.2.3 Shire of Murray Town Planning Scheme rezoning .....	8
1.2.4 Local Structure Plan.....	9
1.3 Purpose of this Report .....	9
<b>2 Key Guidance Documents .....</b>	<b>10</b>
2.1 <i>Environmental Protection Act 1986</i> .....	10
2.2 <i>Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992</i> .....	10
2.3 EPA Guidance Statement No. 33 – Environmental Guidance for Land Development .....	10
2.4 Peel Region Scheme Floodplain Management Policy .....	10
2.5 State Planning Policy 2.1: Peel – Harvey Coastal Plain Catchment .....	11
2.6 State Planning Policy 4.1: State Industrial Buffer Policy .....	11
2.7 Water Quality Improvement Plan for the Rivers and Estuary of the Peel - Harvey System – Phosphorus Management .....	12
2.8 Murray Drainage and Water Management Plan .....	12
2.9 Swan Bioplan – Peel Regionally Significant Natural Areas .....	12
2.10 <i>Environment Protection and Biodiversity Conservation Act 1999</i> .....	12
2.11 Shire of Murray Local Planning Policy – Biodiversity Protection.....	13
2.12 Shire of Murray Local Biodiversity Strategy .....	13
<b>3 Existing Environment .....</b>	<b>14</b>
3.1 Surrounding Land Use .....	14
3.2 Topography, Landforms and Soils .....	14
3.2.1 Topography .....	14
3.2.2 Landforms and Soils .....	14
3.3 Acid Sulfate Soils .....	14
3.4 Hydrology .....	15
3.4.1 Groundwater .....	15
3.4.2 Wetlands .....	15
3.4.3 Nambeelup Brook (Floodplain) .....	15
3.4.4 Surface Water and Drainage .....	16
3.5 Vegetation and Flora .....	16
3.5.1 General .....	16
3.5.2 Vegetation Type and Condition.....	17
3.5.3 Banksia Woodlands of the Swan Coastal Plan.....	19
3.5.4 Regionally Significant Natural Areas .....	20
3.5.5 Local Natural Areas .....	20
3.6 Fauna and Habitat .....	21
3.7 Bush Fire Risk .....	22
3.8 Cultural Heritage .....	23



<b>4</b>	<b>Impacts and Management .....</b>	<b>24</b>
4.1	Vegetation and Flora .....	24
4.2	Fauna and Habitat .....	25
4.3	Wetlands .....	25
4.3.1	Conservation Category Wetland UFI 4835 .....	25
4.3.2	Conservation Category Wetland UFI 14424 .....	26
4.3.3	Resource Enhancement Category Wetlands .....	26
4.3.4	Nambeelup Brook .....	26
4.4	Drainage and Nutrient Management .....	26
4.4.1	Better Urban Water Management Reporting .....	27
4.4.2	District Scale Drainage Design .....	27
4.4.3	Local Scale Stormwater Design .....	27
4.4.4	Local Scale Design Criteria .....	27
4.4.5	Nutrient Load Target and Modelling Results .....	29
4.5	Acid Sulfate Soils .....	29
4.6	Contamination .....	29
<b>5</b>	<b>IMPLEMENTATION STRATEGY .....</b>	<b>30</b>
5.1	Overview .....	30
5.1.1	Vegetation .....	30
5.1.2	Wetlands .....	30
5.1.3	Drainage Design and Nutrient Retention .....	30
5.2	Future Environmental Management Items .....	30
<b>6</b>	<b>References .....</b>	<b>32</b>

## Tables

Table 3-1	Bassendean Central and South Vegetation Complex Statistics .....	16
Table 3-2	Vegetation Units (FVC, 2020) .....	17
Table 3-3	Vegetation Condition (FVC, 2020) .....	18
Table 3-4	Banksia Woodland TEC Diagnostics (FVC, 2020) .....	19
Table 3-5	Fauna database search results and species habitat requirements of additional species not identified in the 2007 survey .....	22

## Plates

Plate 3-1	Shire of Murray Local Natural Area mapping .....	20
Plate 3-2	BushFire Prone Areas .....	23



## Figures

Figure 1	Site Location
Figure 2	Aerial Photograph
Figure 3	Topography, Landform and Soils
Figure 4	Acid Sulfate Soils Mapping
Figure 5	Wetlands
Figure 6	Floodplain
Figure 7	Vegetation Types
Figure 8	Vegetation Condition
Figure 9	Regionally Significant Natural Areas
Figure 10	Proposed Open Space and Key Environmental Features

## Appendices

Appendix 1	Nambeelup Industrial Area District Structure Plan
Appendix 2	Local Structure Plan
Appendix 3	Groundwater and Surface Water Monitoring Sites and Data (JDA, 2016)

## Executive Summary

Lot 221 Lakes Road and part Lot 224 Paterson Road, Nambeelup ('the site') has been rezoned from Rural to Industrial under the Peel Region Scheme to facilitate industrial subdivision and development of this land in accordance with the Nambeelup Industrial Area District Structure Plan, effective 14 May 2020 (PRS Amendment 046/41). The subsequent Shire of Murray Town Planning Scheme No. 4 Amendment 311 was gazetted on 13 November 2020. The project is now progressing with the Local Structure Plan assessment and approvals stage.

Historically, the site has been used primarily for cattle grazing and hay production as part of a dairy farming operation (Bioscience, 2008a). Grazing activities currently occur on site through a lease agreement.

The Nambeelup region is characterised by seasonally high groundwater levels, with extensive areas of palusplain wetlands and sumplands present. However many artificial and natural drainage lines currently export sufficient water to allow year-round rural activities; this drainage water ultimately flows directly to the Peel Inlet – Harvey Estuary.

The Nambeelup Industrial Area District Water Management Strategy (JDA, 2016) was prepared to support the Nambeelup Industrial Area District Structure Plan and was endorsed by the Department of Water. The District Water Management Strategy demonstrated that the land is capable of supporting industrial development and identifies broad water sensitive design and best practice water management outcomes. A Local Water Management Strategy has now been prepared to support the Structure Plan stage of the project (JDA, 2022).

There are two Resource Enhancement Wetlands (UFI 4834 and 14438) and two Conservation Category Wetlands (UFI 4835 and UFI 14424) mapped within the site. Nambeelup Brook is an ephemeral waterway and intersects the site along the southern boundary for approximately 350m. Wetland 4835 and Nambeelup Brook are identified within the Swan Bioplan as a Regionally Significant Natural Areas.

The site is predominantly cleared, with pockets of remnant vegetation remaining. Remnant vegetation onsite generally comprises Banksia/Eucalyptus woodland vegetation within the dryland areas and Melaleuca woodland vegetation within the wetland areas.

A Flora and Vegetation Study was conducted in 2020 to update the previous vegetation condition mapping (Bioscience, 2008b), and determine the presence of any threatened and priority ecological communities, namely 'Banksia woodlands of the Swan Coastal Plain Ecological Community (Banksia woodlands TEC) – Commonwealth TEC (Endangered) (Focused Vision Consulting, 2020).

Updated vegetation condition assessment identified that the remnant vegetation areas ranged from 'Good' to 'Completely Degraded' condition. Preliminary analysis determined that one vegetation unit (BmAfKg) has been determined to be likely representative of Banksia woodlands TEC (Focused Vision Consulting, 2020).

The total area that has been allocated to 'Open Space' for recreation/conservation within Lot 221 is approximately 39.69 ha, which includes both wetland and dryland remnant vegetation types. The vegetation associated with Nambeelup Brook, which is to the south of the District Structure Plan area boundary, will also be preserved. Vegetation associated with the Conservation Category Wetlands and Resource Enhancement Wetlands (and associated buffers), and vegetation present along portions of Nambeelup Brook which have been identified within the Swan Bioplan as a Regionally Significant Natural Area are included within the vegetation retention areas.

To ensure the future viability of retained vegetated and revegetated areas the following management strategies are proposed:

- Delineation of public open space areas containing retained vegetation and revegetation zones with a road separation to the industrial lots.
- Design of the retained vegetation areas in as regular a shape as possible, minimising the area to edge ratio.



- Set controlled groundwater levels at the Average Annual Maximum Groundwater Level (AAMaxGL) beside wetland ecological buffers to prevent water levels rising in wetlands.
- Preparation of a Public Open Space Management Plan at subdivision stage which will provide details vegetation management, access control (during construction and post-construction), dieback control and management, fire management, and interface management.
- Preparation of a Foreshore Management Plan at subdivision stage to detail, amongst other items, surface stabilisation, proposed infill planting works, plant species, target densities, weed control and access management including fencing and pathways for the Nambeelup Brook foreshore/buffer area.

This Environmental Assessment Report has been prepared to identify the key environmental features of the site and to outline how the structure plan design and associated management actions address the potential environmental impacts.

# 1 Introduction

## 1.1 Project Description

Lot 221 Lakes Road and part Lot 224 Paterson Road, Nambeelup ('the site') has been rezoned under the Peel Region Scheme from 'Rural' to 'Industrial' to facilitate industrial subdivision and development of this land (WAPC, 2019). The site (approximately 201 ha) is within the Shire of Murray, bordered by Paterson Road to the west and Lakes Road to the north (Figure 1 and Figure 2).

Historically, the site has used primarily for cattle grazing and hay production as part of a dairy farming operation (Bioscience, 2008a). Grazing activities currently occur on site, through a lease agreement.

The Nambeelup region is characterised by seasonally high groundwater levels with extensive areas of palusplain wetlands and sumplands present. However many artificial and natural drainage lines currently export sufficient water to allow year-round rural activities; this drainage water ultimately flows directly to the Peel Inlet – Harvey Estuary.

## 1.2 Town Planning

### 1.2.1 Nambeelup Industrial Area: District Structure Plan

In 2016, the Western Australian Planning Commission (WAPC) released the Nambeelup Industrial Area (NIA) District Structure Plan (DSP). The DSP provides overall guidance for future industrial development and infrastructure provision for the area (including the site) and also provides the opportunity to progress further detailed planning, environmental, and infrastructure servicing investigations required for its implementation.

The DSP (WAPC, 2016) allocates the site as future Industrial with an Open Space precinct traversing through the middle of the site (Appendix 1).

A District Water Management Strategy (DWMS) has also been developed for the NIA by JDA (2016).

### 1.2.2 Peel Region Scheme rezoning

In accordance with the NIA DSP (Section 1.2.1), the site was rezoned from 'Rural' to 'Industrial' under the Peel Region Scheme (PRS), to allow for future industrial development. The rezoning was identified in PRS Amendment 046/41, effective 14 May 2020 (WAPC, 2019).

The Environmental Protection Authority (EPA) identified that this amendment did not require assessment, and that potential significant effects associated with clearing of vegetation and fauna habitat, nutrient export and Aboriginal heritage sites can be managed through the implementation of the NIA DSP, and environmental values will be retained within open space (EPA, 2019).

### 1.2.3 Shire of Murray Town Planning Scheme rezoning

An amendment to the Shire of Murray Town Planning Scheme No. 4 has been initiated to also rezone the landholdings to Industrial (Amendment No. 311). The EPA advised that this amendment did not require assessment (via correspondence dated 28 February 2020). The EPA identified three preliminary environmental factors relevant to the scheme amendment, namely inland waters, flora and vegetation, and terrestrial fauna. The EPA concluded that the scheme amendment can be managed to meet the EPA's objectives through planning controls within the scheme, including:

- Development and implementation of environmental and water management strategies
- Retention, protection and management of ecological linkages
- Retention, protection and management of wetlands and Nambeelup Brook, including buffer requirements.

This amendment was gazetted on 13 November 2020.

#### **1.2.4 Local Structure Plan**

Based on the progress of the above scheme amendments, the project is now progressing with the Local Structure Plan (LSP) assessment and approvals stage. The LSP has been prepared to guide the proposed layout of the development onsite. The key components of the LSP include:

- Approximately 107 ha of industrial and service commercial land.
- Approximately 39.69 ha of Public Recreation / Conservation reserves which incorporate environmental features including CCW wetlands, Banksia TEC vegetation and Nambeelup Brook.
- Drainage infiltration areas located within reserves including roadside swales and infiltration areas.

A copy of the LSP layout is included in Appendix 2.

### **1.3 Purpose of this Report**

This Environmental Assessment Report (EAR) has been prepared to identify the key environmental features of the site and to outline how the LSP design and associated management actions address the potential environmental impacts.

## 2 Key Guidance Documents

### 2.1 *Environmental Protection Act 1986*

The EP Act is the pre-eminent environmental legislation in Western Australia. Development projects are regulated under Part IV of the Act. The EP Act also supports a number of subordinate Environmental Protection Policies and regulations which provide guidance on environmental management.

Assessment opportunities under the EP Act occur at the rezoning stage (region scheme and/or town planning scheme) under Section 48A of the EP Act and the subdivision/ development stage under Section 38 of the EP Act.

The PRS and TPS amendments were referred to the EPA under s. 48A of the EP Act. The EPA determined that assessment of these amendments was not required (Section 1.2.3 and 1.2.4).

### 2.2 *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992*

The site is located within the Swan Coastal Plain Catchment of the Peel Inlet - Harvey Estuary, which has a history of poor water quality. The objective of the '*Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992*' (Peel-Harvey EPP) (EPA, 1992)) is to reduce the input of nutrients, particularly phosphorus, into the Peel Inlet – Harvey Estuary through a number of means, which include appropriate land management by landowners in the policy area.

The Policy requires any future development within the policy area be designed to meet the water quality objectives. This may require the preparation of a nutrient budget or appropriate management plans for proposed land uses.

Existing drainage patterns, land use and nutrient export should be examined as the basis for evaluating the impacts of changing land use, and possible management techniques for nutrient control and engineering solutions for stormwater disposal derived from this evaluation.

### 2.3 **EPA Guidance Statement No. 33 – Environmental Guidance for Land Development**

EPA 'Guidance Statement No. 33: Environmental Guidance for Planning and Development' (EPA, 2008a) outlines the environmental protection process and provides the EPA's advice on a range of environmental factors in order to assist in the protection, conservation and enhancement of the environment during the land planning and development process.

### 2.4 **Peel Region Scheme Floodplain Management Policy**

The PRS establishes zoning and reservations to guide land uses and development at a regional level and is the key land use planning document for the region. Associated with the PRS are a range of policies that address key issues for the region including the Floodplain Management Policy (WAPC, 2015).

The PRS Floodplain Management Policy (WAPC, 2015) is designed to formalise the consideration of floodplain management requirements by responsible authorities when preparing Town Planning Schemes, scheme amendments, and when considering subdivision and development applications for land within floodplains and adjacent to the Peel Inlet and Harvey Estuary.

The policy applies to Nambeelup Brook and land parcels:

- within the 1 in 100 year annual exceedance probability (AEP) floodplains.
- adjacent to the floodplains, up to 0.5m above the 1 in 100 year AEP flood level.

- adjacent to the Peel Inlet – Harvey Estuary and below 2.7m AHD.

It has been identified that a small portion of the site falls within the Nambeelup Brook floodway. Development within floodway areas is not supported, but development within the flood fringe can occur subject to meeting minimum floor levels.

## 2.5 State Planning Policy 2.1: Peel – Harvey Coastal Plain Catchment

‘State Planning Policy 2.1: The Peel-Harvey Coastal Plain Catchment’ (SPP 2.1) was prepared to ensure that land use changes within the Peel-Harvey Estuarine System likely to cause environmental damage are brought under planning control and prevented. The objectives of this policy are to:

- Improve the social, economic, ecological, aesthetic, and recreational potential of the Peel - Harvey coastal plain catchment.
- Ensure that changes to land use within the catchment to the Peel - Harvey estuarine system are controlled so as to avoid and minimise environmental damage.
- Balance environmental protection with the economic viability of the primary industry sector.
- Increase high water use vegetation cover within the Peel - Harvey coastal plain catchment.
- Reflect the environmental objectives in the Peel-Harvey EPP.
- Prevent land uses likely to result in excessive nutrient export into the drainage system.

The policy highlights that proposed changes to land zonings should take into account land capability and suitability with regards to the net effect that such changes are likely to have on the nutrient load discharging from that catchment into the Peel-Harvey system. Subdivision proposals should also make provision for a drainage system which maximises the consumption and retention of drainage on site. Industrial development where processes would create liquid effluent must include provision for connection to a reticulated sewerage system (WAPC, 2003).

## 2.6 State Planning Policy 4.1: State Industrial Buffer Policy

In 2017, the WAPC released the draft State Planning Policy 4.1 – Industrial Interface (SPP 4.1) (WAPC, 2017). This policy applies state-wide to planning decision-making and proposals which seek to provide for new industrial areas and uses and essential infrastructure. The objectives of the policy are to:

- Protect existing and proposed industry, and infrastructure facilities from the encroachment of incompatible land uses that would adversely affect efficient operations
- Avoid land use conflict between existing and proposed industry/infrastructure facilities and sensitive land uses
- Promote compatible land uses in areas impacted by existing and proposed industry and infrastructure facilities.

SPP 4.1 continues to discuss that industrial areas, particularly strategic areas, should contain a core area in which intensive industry is able to be located and that the core area to be surrounded by a buffer area, to reduce impact off site to surrounding areas. Both core and buffer areas should be appropriately zoned.

Proposals that comply with recommended distances in EPA (2005) ‘Guidance Statement No. 3 – Separation Distances between Industrial and Sensitive Land Uses’ are also deemed to comply with the objectives of SPP 4.1 (WAPC, 2017).



## **2.7 Water Quality Improvement Plan for the Rivers and Estuary of the Peel - Harvey System – Phosphorus Management**

The Water Quality Improvement Plan for the Rivers and Estuary of the Peel – Harvey System – Phosphorus Management (WQIP) was released by the EPA in November 2008 (EPA, 2008b). The objective of the WQIP is to limit the level of phosphorus reaching the Peel - Harvey waterways to 75 tonnes per year (currently 145t/a). There are thirteen actions stated in the WQIP. Actions 1, 2, 5, 6 and 7 relate to agricultural land and hence are not relevant to industrial development. All requirements, and mechanisms by which this proposal can and will address the issues in the WQIP are discussed in Section 4.0.

## **2.8 Murray Drainage and Water Management Plan**

The Department of Water (DoW) released the draft Murray Drainage and Water Management Plan (Murray DWMP) in 2010 which provides guidance on how water quantity and quality can be managed to minimise any adverse impacts on the environment, and how to ensure sustainable development (DoW, 2010).

The Murray DWMP contains information regarding principles and strategies to manage catchments, minimise changes in hydrology, maintain or improve water quality, manage and restore waterways and wetlands and protect water resources. The report also provides guidance on best practice methods for stormwater, monitoring, groundwater management, wetland and waterway management, water re-use and efficiency, and wastewater management.

## **2.9 Swan Bioplan – Peel Regionally Significant Natural Areas**

The EPA has endorsed the use of the 'Swan Bioplan – Peel Regionally Significant Natural Areas' to guide strategic land use and conservation planning in the Peel sector of the Swan Coastal Plain (EPA, 2010).

Development proposals will be considered on their merits, however those impacting on regionally significant natural areas will be subject to higher scrutiny.

The portion of the site which is identified as a Regionally Significant Natural Area is discussed in Section 3.5.4.

## **2.10 Environment Protection and Biodiversity Conservation Act 1999**

In September 2016, Minister for Environment and Energy amended the list of Threatened Ecological Communities (TECs) under section 184 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to include the 'Banksia Woodlands of the Swan Coastal Plain' (Banksia Woodland TEC) ecological community in the endangered category.

The Banksia Woodland TEC typically has a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. There are key diagnostic characteristics, condition and minimum patch size thresholds which can be applied to remnant banksia woodland areas to determine whether they constitute the Banksia Woodland TEC (DotEE, 2016).

In addition, the EPBC Act also provides protection for listed conservation significant fauna including black cockatoos. Referral guidelines have been produced to assess if proposed developments are likely to have a significant impact on these species.

Should the development appear likely to have a significant impact on a matter listed under the EPBC Act, including those discussed above, a referral will be submitted to the Federal Department of the Environment and Energy.

This is further discussed in Sections 4.1 and 4.2 of this report.

## **2.11 Shire of Murray Local Planning Policy – Biodiversity Protection**

The Shire of Murray Local Planning Policy (LPP) addressing Biodiversity Protection (SoM, 2018) was prepared to support the Local Biodiversity Strategy (see Section 2.12) which was endorsed by the Shire in 2013.

This policy provides a means of recognising and applying the protection targets set out in the Local Biodiversity Strategy to planning proposals and sets out the ecological assessment information to be submitted to support a proposal which is likely to impact on biodiversity values.

The objectives of this policy are:

1. To protect, maintain and enhance the viability of habitats, ecological communities, flora and fauna, and biodiversity;
2. To ensure that any land use or development in close proximity to or containing a natural area is compatible with the long-term maintenance and conservation of that natural area, and will not have detrimental impacts on biodiversity; and
3. To assist in achieving the Specific Biodiversity Feature Targets and Precinct Protection Targets established in the Shire of Murray Local Biodiversity Strategy 2013.

In general the LPP includes the requirements for ecological site investigations and identifies reporting requirements.

The LPP notes that where there is an inconsistency between this LPP and a requirement under a more specific planning framework document for a particular site, the more specific requirement prevails to the extent of any inconsistency.

## **2.12 Shire of Murray Local Biodiversity Strategy**

The Shire of Murray Local Biodiversity Strategy (LBS) (Ironbark Environmental, 2013) was developed to provide a framework to protect the remaining natural areas and biodiversity values within the Shire.

The Strategy establishes the Shire's natural area protection and retention objectives.

The Strategy focuses on Local Natural Areas, which are areas of bushland and wetland outside of lands managed by the Department of Biodiversity, Conservation and Attractions (DBCA). They include local reserves, private lands and bushland managed by other State Government agencies. They are the areas of bushland over which the Shire has some level of influence as development is planned and designed (Ironbark Environmental, 2013).

## 3 Existing Environment

### 3.1 Surrounding Land Use

The site is zoned 'Industrial' under the PRS and is currently actively farmed. Murrayfield Airport is located on Lots 11 and 12 to the north of Lakes Road. A kennel and cattery precinct adjoins the airfield to the west. Lot 530, west of the project site and west of Paterson Road, though zoned Industrial, is currently used for rural activities. The remaining portion of Lot 224 to the south is rural and used for grazing. Lot 1 to the east is a disused abattoir (RPS, 2010a).

The site is less than one kilometre from the Forrest Highway and approximately seven kilometres from the Perth to Mandurah rail line (Figure 1).

### 3.2 Topography, Landforms and Soils

#### 3.2.1 Topography

The site is generally low lying and gently slopes south towards Nambeelup Brook, which meanders through the southern boundary of the site. The site elevation ranges from approximately 6m Australian Height Datum (AHD) at Nambeelup Brook rising to 15.7m AHD near the centre of the lot (Figure 3).

#### 3.2.2 Landforms and Soils

The environmental geology mapping provided in Figure 3 indicates that the site contains four natural soil types consisting of:

- Bassendean Sand: white and grey quartz sand (Qpb).
- Guildford Formation: sandy clays to clayey sands, includes other alluvium and colluviums (QBP/Qpa).
- Swamp deposits: swamp, estuarine and lagoonal (Qhw).
- Alluvium: silt, sand, clay and gravel and often contains high proportion of organic matter (Qha).

The site consists predominantly of Bassendean Sand and Bassendean Sand over Guildford Formation units. Swamp deposits are associated with the wetlands within the site, while alluvium deposits are associated with Nambeelup Brook.

Site investigation of Lot 221 (Bioscience, 2008b) confirmed the presence of Bassendean Sands over Guildford Formation throughout the majority of the lot. The sands are mostly medium textured, poorly sorted, unrounded white quartz. The clays are grey or orange and were rarely mottled. The depth of the Bassendean Sand ranged from 1m in the lower lying areas to above 10m in elevated areas.

Bioscience (2008a) reported soil in the wetlands as peaty sand to about 0.4m depth over white sand. Several discrete areas of indurated lateritic cap rock near the surface are present, mainly in the middle of the westernmost paddock. This cap rock is also present in some areas along the bed of Nambeelup Brook within the study area.

### 3.3 Acid Sulfate Soils

WAPC mapping identified the site as having a moderate to low risk of Acid Sulfate Soils (ASS) occurring within 3m of the natural soil surface with patches of high to moderate risk of ASS occurring within 3m of the natural soil surface associated with wetlands and surface water features (Figure 4).

The findings of the preliminary ASS assessment of Lot 221 (Bioscience, 2008c) were consistent with the WAPC ASS risk mapping for the Peel Region. The preliminary assessment concluded that there is a low risk of ASS in

the sandy soils, even at depths below the water-table. However, ASS is likely to exist in some of the wetland soils.

### **3.4 Hydrology**

#### **3.4.1 Groundwater**

Groundwater is present within the superficial aquifer at the site. The regional groundwater flow direction is south westerly towards Nambeelup Brook and the Peel Inlet – Harvey Estuary system (JDA, 2016).

Groundwater level and quality monitoring has occurred intermittently at Lot 221 and surrounds to provide information to support the NIA DSP and the scheme amendment. There are ten groundwater monitoring bores on site (Appendix 3). DoW modelled Average Annual Maximum Groundwater Levels (AAMaxGL) for the NIA DSP has estimated depth to AAMaxGL (m) ranges from 15m (on the south east corner of the site) to 6m in the south-west corner of the site.

The depth to the AAMaxGL across the site varies from >0.5m associated with the wetlands and Nambeelup Brook to above 1.5m in the centre of the site.

The NIA DSP DWMS (JDA, 2016) has identified the median Total Phosphorus (TP) levels from groundwater monitoring sites across the NIA. The median TP levels recorded in six monitoring bores were higher than the ANZECC Lowland River target (0.065 mg/L), with four of these being higher than WQIP Long term Target (>0.100 mg/L). The median Total Nitrogen (TN) (mg/L) recorded in six of the ten monitoring bores were higher than the ANZECC Lowland River target (1.2mg/L) (JDA, 2016) (Appendix 3).

Drainage and nutrient impacts and management are further discussed in Section 4.4.

#### **3.4.2 Wetlands**

The Department of Biodiversity Conservation and Attractions (DBCA) geomorphic wetlands database identifies a range of wetland types across the site (Figure 5). The database shows palusplain, dampland and sumpland wetland areas covering approximately half of the site. Based on the degraded nature of the site, the DBCA management category for most of these wetlands is Multiple Use.

There are two Resource Enhancement Wetlands (REWs) mapped as occurring on the site (UFI 4834 and 14438). Two Conservation Category Wetlands (CCWs) also occur on site (UFI 4835 and UFI 14424).

#### **3.4.3 Nambeelup Brook (Floodplain)**

Nambeelup Brook is an ephemeral waterway and intersects the site along the southern boundary for approximately 350m (Figure 6). Nambeelup Brook has been used for stock watering allowing unrestricted access down to and across the brook.

Flow within Nambeelup Brook generally occurs during the winter rainfall period up until October. Flow each year is dependent on winter rainfall and therefore highly variable, with recorded total flows ranging from 3GL (2006 data) to 44GL (1991 data). The average total flow is around 25GL per year.

Water quality within Nambeelup Brook has been measured by the (now) Department of Water and Environmental Regulation (DWER) since 1979. Results are summarised as follows:

- Median salinity measurements of 300mg/l (1998 - 2010) indicate the stream has fresh water quality.
- The median pH was 7, indicating neutral conditions.
- The median TN concentration was 2.6 mg/L, which is elevated in comparison to ANZECC (2000) guidelines for lowland rivers (1.2 mg/L), but is indicative of water quality associated with agricultural land use within the catchment.

- The median TP concentration was 0.59 mg/L, which is elevated in comparison to ANZECC (2000) guidelines for lowland rivers (0.065 mg/L). This is also indicative of water quality from a predominantly agricultural catchment.
- Site specific testing (RPS, 2010b) found nutrient results to be similar to those recorded by DoW. Nitrogen levels ranged between 1.8mg/l and 3.5mg/l, while phosphorus levels ranged between 0.12mg/l and 0.46mg/l.

The flood levels for Nambeelup Brook are presented in the Murray DWMP (DoW, 2010). The flood modelling for Nambeelup Brook identifies the floodplain only (1 in 100 year average recurrence interval [ARI] flood event), which constitutes both the floodway and flood fringe areas.

Within the site, the extent of the 100 year ARI flood plain levels for Nambeelup Brook range from approximately 7.6mAH (where Nambeelup Brook exits the site, in the south western corner) to 8.25mAH (where Nambeelup Brook enters the site, in the south eastern corner).

### 3.4.4 Surface Water and Drainage

Given much of Nambeelup is low lying, an extensive network of agricultural drains has been installed to lower the water table and improve stock grazing and cropping opportunities.

The site contains part of this network of drains, which have been installed to reduce areas of standing water. This drainage network ultimately drains to Nambeelup Brook which discharges to the Serpentine River and the Peel Inlet – Harvey Estuary. Although the drainage network would have had an impact on local hydrology for over twenty years, extensive areas of palusplain wetlands and sumplands still occur across the site, generally in very degraded condition.

Associated with the network of surface drains are surface water monitoring locations across the site (Appendix 3). The median TP recorded at the monitoring site were higher than the ANZECC Lowland River Target (0.065mg/L) and the WQIP median winter TP value (0.1 mg/L). The median TN recorded at the monitoring sites were also higher than the ANZECC Lowland River Target (1.20mg/L) (JDA, 2016).

## 3.5 Vegetation and Flora

### 3.5.1 General

The site lies within the Bassendean – Central and South vegetation complex. This complex is described as a woodland of *Eucalyptus marginata* (Jarrah) – *Casuarina fraserana* (Sheoak) and *Banksia* species, to a low woodland of *Melaleuca* species and sedgelands on the moister sites (Heddl et al., 1980).

The remaining extent of this vegetation complex is outlined on Table 3-1.

**Table 3-1 Bassendean Central and South Vegetation Complex Statistics**

Area	Shire of Murray <sup>1</sup>	Swan Coastal Plain <sup>1</sup>
Original Extent	13,703 ha	87,476 ha
Remaining Extent	3,352 ha (24%)	23,533 ha (27%)
Area with Protection	ND	1,624 ha (1.9%)

<sup>1</sup> Source: Govt of WA, 2018

ND = No Data

The site is predominantly cleared (85%), with pockets of remnant vegetation across the site.

### 3.5.2 Vegetation Type and Condition

Bioscience (2008) completed a Vegetation and Flora Survey report for Lot 221 in 2008, and identified four floristic community types on site, including:

- Type 21a – Central *Banksia attenuata*/*Eucalyptus marginata* woodlands;
- Type 23a – Central *Banksia attenuata*/*B. menziesii* woodlands;
- Type 4 – *Melaleuca preissiana* damplands; and
- Type 12 – *Melaleuca teretifolia* and/or *Astartea fascicularis* shrublands.

All four community types are well reserved within National Parks and Nature Reserves and their conservation value is considered as ‘low risk’ (Gibson et al., 1994). Vegetation condition rating varied from ‘Very Good’ to ‘Completely Degraded’ according to the Bush Forever scale (Government of Western Australia, 2000).

An additional flora and vegetation study was conducted by Focused Vision Consulting in 2020 (FVC, 2020). Updated vegetation unit and condition mapping identified 10 native vegetation units and 5 pasture units and cleared areas (Table 3-2). Vegetation condition onsite ranged from ‘Good’ to ‘Completely Degraded’ (Table 3-3). Over 95% of the study area was in ‘Degraded’ or lower condition.

Vegetation unit and condition mapping is shown on Figure 7 and Figure 8.

**Table 3-2 Vegetation Units (FVC, 2020)**

Floristic Community	Vegetation Unit and Description	Area (ha)	% of Study Area
Woodland	<b>AfBm</b> <i>Allocasuarina fraseriana</i> , <i>Banksia attenuata</i> and <i>Banksia menziesii</i> Low Woodland over introduced weeds and grasses	2.02	1.00
Woodland	<b>BmAfKg</b> <i>Banksia ilicifolia</i> , <i>Banksia menziesii</i> and <i>Allocasuarina fraseriana</i> with occasional <i>Eucalyptus marginata</i> Low Woodland over <i>Kunzea glabrescens</i> Tall Open Shrubland over <i>Hibbertia hypericoides</i> Low Open Shrubland	7.27	3.59
Woodland	<b>KgBm</b> <i>Kunzea glabrescens</i> , <i>Banksia attenuata</i> and <i>Banksia menziesii</i> Low Woodland over introduced weeds and grasses	10.72	5.30
Shrubland	<b>KgAs</b> <i>Kunzea glabrescens</i> and <i>Acacia</i> sp. Tall Shrubland	0.27	0.13
Shrubland	<b>KgS</b> <i>Kunzea glabrescens</i> Tall Open Shrubland over introduced weeds and grasses	13.03	6.44
Riparian/Wetland	<b>AsS</b> <i>Astartea ?scoparia</i> Tall Shrubland	0.34	0.17
Riparian/Wetland	<b>CcEr</b> <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> Woodland over introduced weeds and grasses	1.04	0.51



Floristic Community	Vegetation Unit and Description	Area (ha)	% of Study Area
Riparian/Wetland	<b>MpAS</b> <i>Melaleuca raphiophylla</i> and <i>Astartea</i> sp. Tall Shrubland over <i>Lepidosperma</i> sp. Very Open Tall sedges	1.76	0.87
Riparian/Wetland	<b>MpMIAf</b> <i>Melaleuca preissiana</i> Tall Sparse Shrubland over <i>Astartea leptophylla</i> and <i>Melaleuca lateritia</i> Open Shrubland	6.79	3.36
Riparian/Wetland	<b>MrS</b> <i>Melaleuca raphiophylla</i> Tall Shrubland over introduced weeds and grasses	2.11	1.04
Pasture	<b>Cc(P)</b> Isolated <i>Corymbia calophylla</i> over cleared pasture	37.91	18.74
Pasture	<b>Cc,Er,Af(P)</b> Isolated <i>Corymbia calophylla</i> , <i>Eucalyptus rudis</i> , <i>Allocasuarina fraseriana</i> over cleared pasture	3.18	1.57
Pasture	<b>Em,Af(P)</b> Isolated <i>Eucalyptus marginata</i> , <i>Allocasuarina fraseriana</i> over cleared pasture	8.44	4.17
Pasture	<b>Mp(P)</b> Isolated <i>Melaleuca preissiana</i> over cleared pasture	77.92	38.52
Pasture	<b>Xsp(P)</b> Isolated <i>Xanthorrhoea</i> sp. over cleared pasture	8.15	4.03
Cleared	<b>Cleared</b>	21.36	10.56
<b>TOTAL</b>		<b>202.30</b>	

**Table 3-3 Vegetation Condition (FVC, 2020)**

Vegetation Condition	Area (ha)	% of Study Area
Good	4.3	2.13
Good – Degraded	5.46	2.70
Degraded	34.00	16.80
Degraded – Completely Degraded	137.18	67.81
Completely Degraded	21.36	10.56
Total	202.30	

The key conclusion of the study included (FVC, 2020):

- 22% (45 ha) of the study area supports remnant vegetation which generally ranged in condition from ‘Good’ to ‘Degraded’.



- The remaining 77% (156 ha) of the study area has been subject to clearing and is largely void of remnant vegetation. This included 5 pasture units, primary comprising isolated tree or shrub species over cleared pasture.
- No Threatened or Priority flora listed under the EP Act or the EPBC Act were found onsite or considered likely to occur.
- 29 flora species and one weed species were recorded during the field assessment.
- Selected areas of one vegetation unit (BmAfKg) are likely representative of the Banksia woodlands TEC. This is further discussed in Section 3.5.3.

### 3.5.3 Banksia Woodlands of the Swan Coastal Plan

The key diagnostic characteristics of vegetation required to meet the definition of the Banksia Woodlands of the Swan Coastal Plain TEC are defined within the Banksia TEC Conservation Advice (TSSC, 2016) and include:

- Vegetation is located within the Swan Coastal Plain bioregion.
- Soil types and topography are consistent with where the Banksia Woodlands TEC may occur.
- Vegetation structure is a low woodland or forest.
- The canopy of most commonly dominated or co-dominated by *Banksia attenuata* and/or *Banksia menziesii*. Other banksia species which can dominate in some examples include *Banksia prionotes* or *Banksia ilicifolia*.
- The condition and size of the patch must meet the following thresholds:
  - Pristine condition – all vegetation.
  - Excellent condition – 0.5ha or greater patch size.
  - Very Good condition – 1ha or greater patch size.
  - Good condition – 2ha or greater patch size.

Note: a patch is defined as a discrete and mostly continuous area of the Banksia Woodland TEC. This can include small scale (<30m wide) gaps in vegetation.

Based on the flora and vegetation assessment undertaken by Focused Vision Consulting (2020), vegetation unit BmAfKg was found to be characteristic of the Banksia Woodland TEC (Table 3-4, Figure 7).

**Table 3-4 Banksia Woodland TEC Diagnostics (FVC, 2020)**

Key Character	Vegetation Unit (Releve R03)
a). Swan Coastal Plain or Jarrah Forest location	+
b). Soils and landform either deep Bassendean, Spearwood or occasionally Quindalup sands, sandy colluvium, Aeolian sands of the Ridge Hill Shelf or Whicher Scarp	+
c). Distinctive upper sclerophyllous layer dominated by <i>Banksia attenuata</i> , <i>Banksia menziesii</i> , <i>Banksia ilicifolia</i> or <i>Banksia prionotes</i>	+
d). With (although can be without) an emergent tree layer of <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> or <i>Eucalyptus gomphocephala</i>	+
e). With (although can be without) other trees including <i>Eucalyptus tottiana</i> , <i>Nuytsia floribunda</i> , <i>Allocasuarina fraseriana</i> , <i>Callitris arenaria</i> , <i>Callitris pyramidalis</i> or <i>Xylomelum occidentale</i>	+

Key Character	Vegetation Unit (Releve R03)
f). Understorey/mid-ground sclerophyllous shrub layer including mostly Asteraceae, Dilleniaceae, Droseraceae, Ericaceae, Fabaceae, Haemodoraceae, Iridaceae, Myrtaceae, Orchidaceae, Proteaceae, Restionaceae	+
g). Herbaceous ground layer including mostly Apiaceae, Asteraceae, Cyperaceae, Haemodoraceae, Poaceae, Restionaceae, Stylidiaceae	+
<b>Conclusion (Representative of the TEC?)</b>	<b>Likely</b>

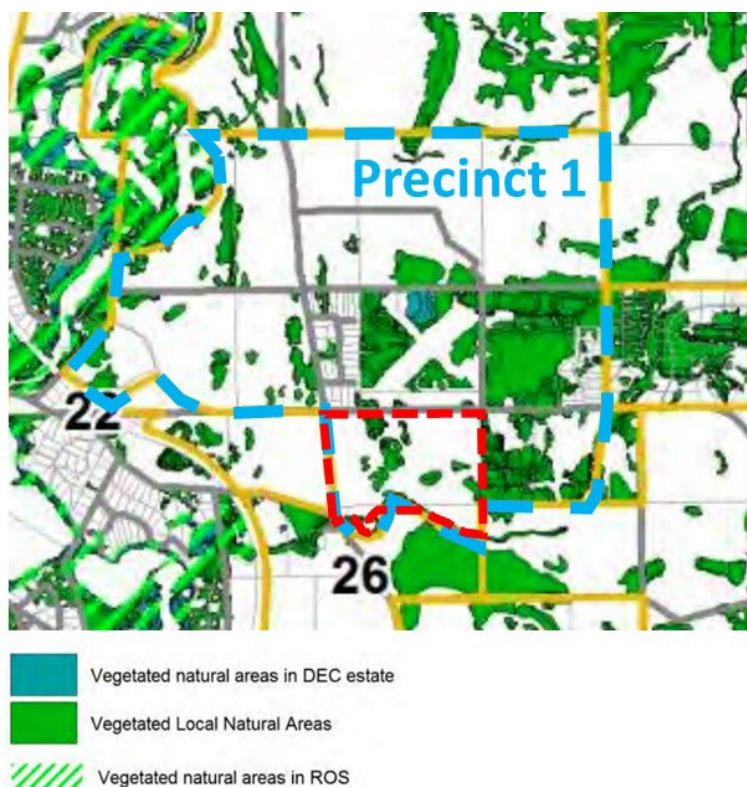
This vegetation unit occurs in two locations within the site, once being in an area of ‘Degraded’ condition, and the other in ‘Good’ condition (Figure 8). Vegetation in degraded condition does not meet the definition of the TEC. The area of this vegetation that is in ‘Good’ condition extends over 3.92 ha and therefore exceeds the TEC size threshold. The location of this area is shown on Figure 10.

### 3.5.4 Regionally Significant Natural Areas

Vegetation associated with CCW UFI 4835 and vegetation present along portions of Nambeelup Brook has been identified within the Swan Bioplan reporting as a Regionally Significant Natural Area (Figure 9). The EPA has identified that this information provides guidance in planning to firstly avoid and then minimise the impacts of development proposals and planning schemes on natural areas (EPA, 2010).

### 3.5.5 Local Natural Areas

The Shire of Murray Local Biodiversity Strategy identifies that the site is within Precinct 1 and contains a number of Local Natural Areas (LNAs) associated with remnant vegetation onsite (see Plate 3-1).



**Plate 3-1 Shire of Murray Local Natural Area mapping**

Source: Ironbark Environmental, 2013

The LNA statistics and protection targets within the overall extent of Precinct 1 include:

- Total natural area extent – 496.6 ha
- Total LNA extent – 485.8 ha
- Proposed protection target – 346.9 ha
- Percentage protection of all remaining natural areas – 72%
- Percentage precinct area covered by proposed protected natural areas (DBCA reserves and LNAs) – 12%

### 3.6 Fauna and Habitat

Ecologia (2007) undertook a Level 1 vertebrate fauna survey over a number of lots including Lot 221, in accordance with the EPA's 'Guidance Statement No. 56 – Terrestrial Fauna Surveys' (EPA, 2004). A summary of the outcomes of the fauna survey are provided below:

- Two (of thirty-four<sup>1</sup>) reptile species, zero (of eight) amphibian species, one (of eighteen) native mammal species and zero (of eight) non-native mammal species were recorded.
- Ten mammal, nine bird and four reptile species of conservation significance have the potential to occur in the wider study area.
- No species of conservation significance were recorded from Lot 221.
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) listed as Vulnerable under the EPBC Act and Endangered under the WA *Wildlife Conservation Act 1950* (WC Act). These species may opportunistically use the site for feeding when in the area.
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) listed as Endangered under the EPBC Act and Endangered the WC Act. These species may opportunistically use the site for feeding when in the area.
- The Forest Red-tailed Black Cockatoo (EPBC Act: Vulnerable; WC Act: Vulnerable) may feed on seeding Allocasuarina trees and perch in dead eucalypts, and have been observed in the area.
- The Southern Brown Bandicoot (*Isodon obesulus fusciventer*) (WA status: Priority 3) commonly occurs in coastal scrub and heath and hence may occur in the dense understorey vegetation associated with the drainage line in the southern portion of the site.
- Western Quoll (EPBC Act: Vulnerable; WC Act: Vulnerable) may occur in the general area. The Western Quoll will inhabit remnant sclerophyll forest, drier woodlands and mallee shrublands and therefore could possibly utilise portions of Lot 221.
- The Carpet Python (WC Act: Schedule 4) may occur; it is considered widespread but generally uncommon (Ecologia, 2007).

Several frog species i.e. *Litoria adelaidensis*, *Crinia glauerti*, *C. insignifera* and *C. georgiana* have also been identified in Wetland (UFI 4835) located in the north western section of Lot 221 (GHD, 2010).

Further to the survey undertaken in 2007, a search of the NatureMap database (DBCA, 2007) and the Protected Matters Search Tool (for species protected under the EPBC Act) from a central point on the site + 1 km buffer found conservation significant fauna species that may occur in the vicinity of the site. Species or species habitat known to occur within the area have been identified since the 2007 survey and are included in Table 3-5. Given the mobile nature of these species and the general presence of suitable habitat (i.e.

<sup>1</sup> The number in brackets refers to the potential number of species that occurs in the area as identified in previous fauna surveys.

wetlands and woodlands) in this region, development of the site is not anticipated to significantly impact these species if they were found to be present onsite.

**Table 3-5 Fauna database search results and species habitat requirements of additional species not identified in the 2007 survey**

Species	Conservation Code	Habitat
<i>Calidris ferruginea</i> (Curlew Sandpiper)	CE (Cth)	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. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Suitable habitat may be present onsite.
<i>Leipoa ocellata</i> (Malleefowl)	V (Cth) (WA)	Occurs in (scrubland and woodland dominated by mallee and wattle species). Suitable habitat may be present onsite.

Notes:

CE (Cth) – Critically Endangered under the EPBC Act

V (Cth) (WA) – Vulnerable under the EPBC Act and WC Act

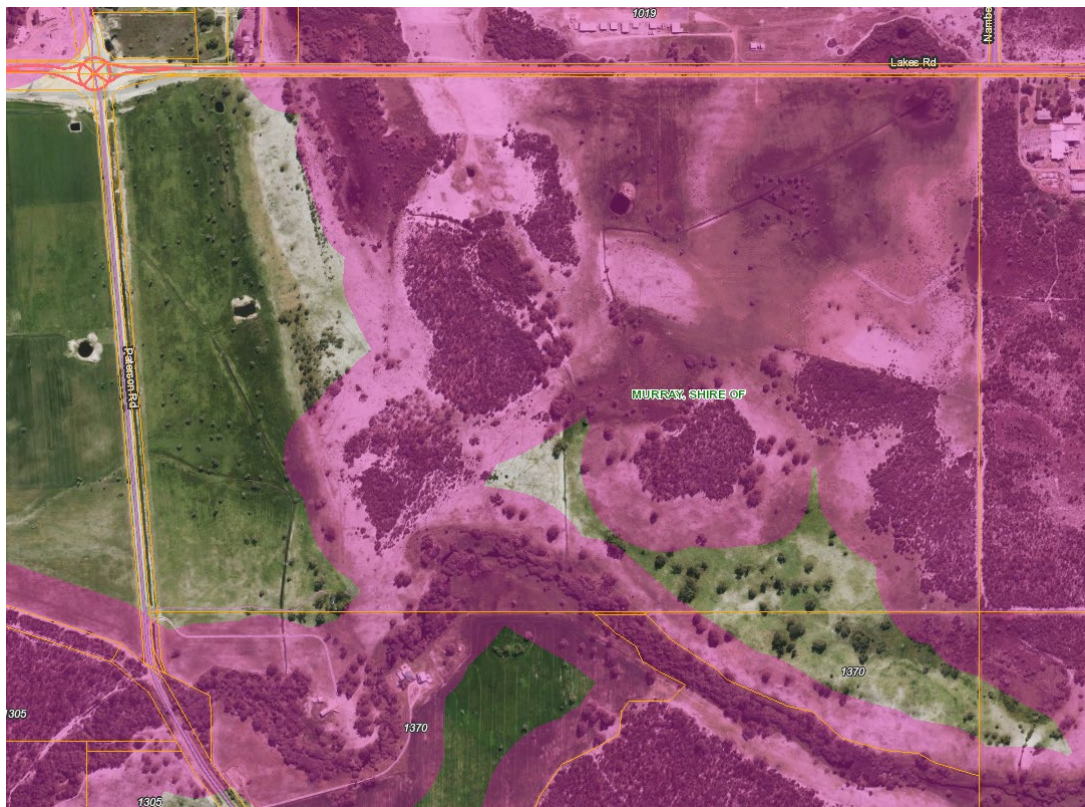
### 3.7 Bush Fire Risk

A significant portion of the site has been identified as bushfire prone areas in the Department of Fire and Emergency Services Map of Bushfire Prone Areas 2019 (Landgate, 2021). Refer to Plate 3-2.

In response to this a Bushfire Management Plan has been prepared for the site by Bushfire Safety Consulting and recently updated as part of the LSP tasks. The key conclusions of BMP include (Bushfire Safety Consulting, 2022):

- Areas proposed for industrial lots and road development sites proposed are generally sited on previously cleared and degraded native vegetation and grazed agricultural paddocks. The development impact is concentrated in this degraded area, with the more intact areas of undisturbed native vegetation contained in the POS Conservation Reserves where the vegetation is protected in perpetuity.
- There are no landscape or revegetation plans proposed for the site or adjacent land. Existing vegetation will be retained and has been assessed in its current condition
- All proposed future industrial units arising from the LSP will be exposed to BAL-29 or lower and will fall within the acceptable level of risk.
- A minimum of two vehicular access options is achieved, and fire hydrant requirements for fire-fighting are met.





**Plate 3-2 BushFire Prone Areas**

Source: (Landgate, 2021)

### 3.8 Cultural Heritage

An Aboriginal Site Survey of the Nambeelup Joint Venture landholding (including Lots 221, 223, 243, 246, 247 and 248 Lakes Road) was conducted in July 2006 (Yates Heritage Consultants, 2006).

The key conclusions and recommendations from the report were:

- Two Registered Aboriginal Sites are located within the designated survey area. They were DIA 4111 Tortoise Swamp and DIA 17982 Nambeelup Brook. Three scar trees and one artefact scatter were identified as a result of this survey. Of the sites identified, only Nambeelup Brook occurs within the study area.
- The Mythological significance of Nambeelup Brook is associated with Waugal Myth which covers much of the waterways in the region.
- It has been advised that the Waugal Myth should be viewed by modern day planners and developers in terms of an environmental conservation policy that sets out an ecologically sustainable way of treating fresh water sources. The Elders have requested a 50m buffer either side of the centreline of the Brook.

The Aboriginal heritage enquiry system identifies Nambeelup Brook as both a Registered Site (ID: 17982) and as Stored Data/Not a Site (ID: 37629) (DPLH, 2023).

The *Aboriginal Cultural Heritage Act 2021* comes into effect in Western Australia on 1<sup>st</sup> July 2023. Future development of the site will address the requirements of this legislation.

## 4 Impacts and Management

### 4.1 Vegetation and Flora

Remnant vegetation is present within portions of the site. The vegetation types within the site generally include Banksia / Eucalyptus upland areas and Melaleuca / Astartea wetland areas. The total area that has been allocated to 'Open Space' within Lot 221 is approximately 39.69 ha, which includes both wetland and dryland remnant vegetation areas (Figure 10). The vegetation associated with Nambeelup Brook, which is to the south of the LSP area boundary (but still within Lot 221) will also be preserved (Figure 10).

The NIA DSP Open Space Areas have captured the regionally significant natural areas (Swan Bioplan areas, CCWs, and REWs). All vegetation within CCW and REW areas is proposed to be retained under the LSP in accordance with the NIA DSP, which includes the majority of the areas of best condition vegetation identified during the flora and vegetation survey (Figure 7, Figure 8, Figure 10).

In addition, 3.92 ha representing the entire extent of the good condition area of vegetation unit BmAfKg, is proposed for retention in the LSP (Figure 10). This area may be considered to represent Banksia Woodland TEC vegetation (Focused Vision Consulting, 2020). The isolated patch is not connected to any other areas of Banksia woodland and therefore, is not part of any more broadly occurring regional patch (Focused Vision Consulting, 2020). The second area of Banksia Woodland not identified for retention is a portion of 'Degraded' condition vegetation unit BmAfKg, which does not qualify for as the TEC based on its condition (Focused Vision Consulting, 2020).

Vegetation associated with wetland UFI 4835 and vegetation present along portions of Nambeelup Brook has been identified within the Swan Bioplan as a Regionally Significant Natural Area (Figure 9). This vegetation will be fully retained under the proposed LSP design (Figure 10).

Overall approximately 4.1 ha (96%) of 'Good' condition vegetation present onsite is identified to be retained within POS areas. In addition, it is noted that approximately 20.6 ha (45%) of the intact vegetation present onsite (i.e. excluding vegetation units with a (P) description indicating they are predominately pasture areas) which varies in condition from Good to Degraded condition is to be retained in POS areas. The vegetation retention also addresses the following SoM targets as outlined within the local biodiversity strategy:

- Protection of all vegetated portions of CCW and REW wetlands in Category A precincts
- Protection of at least 50% of Priority Two Vegetation complexes (i.e. Bassendean – Central and South) in Category A precincts (based on the good condition vegetation retention extent)
- Protection of significant fauna habitat in ecologically viable natural areas
- Protection of riparian vegetation associated with natural watercourses

This consolidation of the retained vegetated areas proposed under the LSP design increases the ecological viability of the retained area (Figure 10). To further ensure the future viability of retained vegetation areas the following management strategies are proposed:

- Delineation of open space areas containing retained vegetation with a road separation to the industrial and commercial lots.
- Design of the retained vegetation areas in as regular a shape as possible, minimising the area to edge ratio.
- Set controlled groundwater levels at the AAMaxGL beside wetland ecological buffers to prevent water levels rising in wetlands.
- Preparation of a Public Open Space (POS) Management Plan at subdivision stage which will provide details of proposed management actions including vegetation management, weed control, access

control (during construction and post-construction), dieback control and management, fire management, and interface management.

## 4.2 Fauna and Habitat

Key species of conservation significance which have been identified as potentially utilising habitat present at the site include Carnaby's Black Cockatoo, Baudin's Black Cockatoo, the Southern Brown Bandicoot, the Western Quoll and the Carpet Python.

The two species of Black Cockatoos typically utilise areas of Banksia, Allocasuarina and Eucalyptus woodland. The central POS area has been expanded beyond the wetland and associated buffer zone extent to include an area of upland vegetation which contains Banksia and Allocasuarina species. This area will therefore continue to provide Black Cockatoo habitat in perpetuity.

The Southern Brown Bandicoot is commonly found associated with wetland areas. These habitat zones within the site will be retained post-development.

No Western Quoll individuals were observed on site although a skull likely to have been from this species was found. Specialist fauna consultants Ecologia (2007) have recommended that relocation of any Western Quoll or Bandicoots be undertaken prior to clearing. As such a fauna relocation specialist will be employed to undertake this work as needed at construction stage.

Carpet pythons are noted to potentially utilise denser areas of woodland and wetland margins, although no individuals were observed during the fauna survey (Ecologia, 2007). Representative habitat areas will be retained onsite post-development which will continue to provide these habitat opportunities.

## 4.3 Wetlands

There are two CCWs and two REWs that occur partially on the site (Figure 5). Extensive drainage networks were installed throughout the eastern and north-eastern Peel region over the last century to improve the productive capacity of agricultural lands. As a result of the extensive draining and grazing pressure many of the wetlands have been highly modified and degraded. This section describes the proposed management of these wetlands.

### 4.3.1 Conservation Category Wetland UFI 4835

UFI 4835 is classified as a CCW sumpland. Currently there are three constructed drainage lines into and out of UFI 4835 (RPS, 2010b). The vegetation condition of the wetland was assessed as 'Good' to 'Completely Degraded' (FVC, 2020) in accordance with the Bush Forever scale (Government of Western Australia 2000).

As outlined in EPA Guidance Statement No. 33 (EPA, 2008) and NIA DSP (WAPC, 2016) the wetland will be retained with a 50m buffer provided to protect the wetland functions.

The wetland will be connected to Nambeelup Brook via a POS corridor (Figure 10). This will provide an ecological linkage between these two areas, while also allowing for an overland flood/drainage flow path in the case of high rainfall events.

Proposed wetland and buffer zone management will be detailed in a POS Management Plan which is proposed to be prepared in consultation with the Shire of Murray at subdivision stage. The management plan is generally proposed to include:

- Detailed description of the wetland, buffer zone and retained upland area features.
- Vegetation management.
- Weed management.
- Access management.



- Implementation actions and responsibilities.

#### 4.3.2 Conservation Category Wetland UFI 14424

UFI 14426 occurs on the eastern most boundary of Lot 221 and only partially encroaches into the site. The majority of this wetland occurs on the adjacent Lot 1. The portion of UFI 14424 in Lot 221 has been severed by the boundary fence and vegetation condition is 'Degraded-Good' to 'Completely Degraded' as a result of grazing and the presence of an agricultural drain taking water from the wetland.

A reduced buffer width has been proposed to this wetland given its degraded state within Lot 221 (Figure 10). In response to a reduction of the buffer in this location, additional dryland vegetation has been included in the POS area adjacent to wetland UFI 14438.

This wetland area will be included in the POS Management Plan discussed above.

#### 4.3.3 Resource Enhancement Category Wetlands

The two areas of REW and associated buffer (in accordance with the NIA DSP; WAPC, 2016) are proposed for retention under the LSP. These wetlands contain vegetation that ranges in condition from 'Degraded' to 'Completely Degraded'. These areas are within the 'Open Space Corridor' shown on the DSP (refer to Appendix 1).

The location of the wetlands in relation to the proposed 'Open Space Corridor' is shown on Figure 10.

#### 4.3.4 Nambeelup Brook

Nambeelup Brook is located within the southern portion of the site and traverses the study area for a distance of approximately 350m. The brook is used for stock watering and shows extensive signs of degradation through cattle trampling and grazing, with little native understorey remaining. It is also evident that the lack of any significant vegetation along the banks of Nambeelup Brook allows for sediment and cattle waste to flow directly into the brook transported by rainfall run-off.

As part of the proposed development, stock will be removed from the site thereby removing a significant pressure on Nambeelup Brook. A minimum 30m buffer zone from the edge of the brook is proposed to be provided to the northern side of Nambeelup Brook waterbody in the LSP. Selected infill planting with endemic riparian species will be undertaken within the buffer zone to assist to improve both the habitat value of the brook and the sediment and nutrient removal ability of the banks of the brook. The use of deep-rooted perennial vegetation will also reduce erosion effects by binding soil and reducing stream flow velocity during heavy rainfall events.

A Foreshore Management Plan will be prepared at subdivision stage to detail, amongst other items, surface stabilisation, proposed infill planting works, plant species, target densities, weed control and access management including fencing and pathways for the Nambeelup Brook foreshore/buffer area. The aim of the foreshore works will be to establish a self-perpetuating ecosystem, including management of potential edge effects and drainage intervention.

### 4.4 Drainage and Nutrient Management

The low lying nature of the region and high groundwater levels has resulted in the construction of an extensive network of agricultural drains to facilitate shedding of surface water and reduce groundwater levels in some areas to improve year round agricultural use. The drainage network has been in place for many decades and has been maintained post agricultural use to continue the water shedding function.

Currently the drainage network results in flow of untreated surface water runoff to Nambeelup Brook which is connected to the Serpentine River and the Peel Inlet – Harvey Estuary. Nambeelup Brook is also used as a stock water point so stock also traverses through the brook. This use can cause associated environmental

impacts through creek bed erosion, vegetation damage and the subsequent impact of additional nutrient inputs from cattle manure.

#### **4.4.1 Better Urban Water Management Reporting**

Water management to address the site conditions is discussed in both the District Water Management Strategy (DWMS) and the Local Water Management Strategy (LWMS).

The NIA DWMS (JDA, 2016) was prepared to support the DSP and has been endorsed by the Department of Water. The DWMS demonstrated that the land is capable of supporting industrial development and identifies broad water sensitive design and best practice water management outcomes.

The Local Water Management Strategy (LWMS) has been prepared to support the LSP documentation (JDA, 2022). The key drainage and nutrient management actions outlined in this report are summarised below.

#### **4.4.2 District Scale Drainage Design**

The NIA DSP (JDA, 2016) presents the key drainage system strategies. The district scale recommendations included:

- Arterial network to be profiled and landscaped as living streams, or vegetated overland drainage swales where within major road reserves. Where of significant width they may be profiled with a base flow channel. Vegetation is to be focussed along the 1yr ARI critical and baseflow inundation areas.
- For retained natural channels (in POS/Drainage reserves), where possible restore vegetation and profile to open swales/living streams to convey flows. Works may include re-grading to prevent water pooling as approved by the Shire/DWER.

#### **4.4.3 Local Scale Stormwater Design**

The local stormwater management system will consist of ephemeral water retention areas to capture and detain stormwater runoff from contributing catchments prior to discharge to surrounding drains (JDA, 2022).

Stormwater management has been designed based on management of the 'small', minor and major events. The minor drainage system is defined as a system of drains, pipes, culverts, kerbs, gutters etc, which have the capacity to convey stormwater runoff generated by 'frequent' rainfall events up to the 10% AEP for industrial areas. The major drainage system is defined as the arrangement of roads, drainage reserves and detention areas planned to provide safe passage of stormwater runoff from 'extreme' rainfall events up to the 1% AEP (JDA, 2022).

#### **4.4.4 Local Scale Design Criteria**

##### **4.4.4.1 Manage catchments to maintain or improve water resources**

The following design criteria are proposed to minimise changes to hydrology, maintain or improve water quality and manage/protect wetlands (JDA, 2022):

- Post-development surface water outflows in the critical 1% AEP event are, where practical, detained consistent with pre-development peak flows.
- Lot soakwells sized for the first 15 mm of rainfall.
- Subsoil drainage set at Controlled Groundwater Level (CGL) to control rise in groundwater levels; controlled groundwater levels to consider wetland hydrology, site water balance, water quality and potential for ASS. It is noted that Setting appropriate CGLs in areas such as Nambeelup is complex, with the need to consider freely draining outlet requirements, downstream level constraints, and any wetlands. A draft CGL was generally set below AAMaxGL in industrial areas further from wetlands where hydraulic grade to the outlet could be achieved and set at AAMaxGL beside wetland buffers.

- Implement non-structural measures to reduce nutrient export from the site via the following strategies:
  - Local native plants to make up a minimum 50% of the planted areas and streetscape treatments. Any non-local species will be selected for drought tolerance and low fertiliser requirements. Landscape maintenance fertiliser restrictions for road reserves may also be considered.
  - Drainage areas have separate bio-retention areas, with native plants selected for nutrient stripping, consistent with Monash (2014).
  - Maintenance practices such as street sweeping to reduce sediment build-up, particularly during the development and construction phase.
  - In addition, re-zoning of land from grazing/open pasture to commercial/industrial results in a substantial reduction in nutrient input.
- Implement best management practice water quality treatment trains for stormwater runoff and any subsoil discharge.
- Manage infiltration device size to deliver desired recharge rates for groundwater aquifers.
- Ensure development is outside the Nambeelup Brook floodplain/foreshore reserves or any classified wetlands.

#### **4.4.4.2 Manage flooding and inundation risk**

The NIA DSP proposed industrial areas are outside of the Nambeelup Brook floodplain, which is within open space adjacent to the southern boundary of the site. The LSP design avoids development within the floodplain.

The following design criteria are proposed to manage flooding and inundation risks to human life and property (JDA, 2022):

- Finished levels of buildings to provide minimum 0.3 m clearance above 1% AEP flood level of arterial drains and local drainage systems including basins and roads.
- Finished levels of buildings to provide minimum 0.5 m clearance above 1% AEP flood level of Nambeelup Brook.
- Subsoil drainage/drains set at CGLs to control rise in groundwater levels. Subsoils in all road reserves.
- Lot soakage devices sized to manage the first 15 mm of rainfall ('small' event).
- Meet DWMS arterial drain requirements for receiving flows from upstream and discharging to downstream
- Restrict peak outflow from the development area for the 10% AEP (10 year ARI) and 1% AEP (100 year ARI).
- Manage surface water flows from major events to protect infrastructure and assets from flooding and inundation.

#### **4.4.4.3 Ensure the efficient use and re-use of water resources**

The following design criteria are proposed to minimise water use within the development and achieve highest value use of fit-for-purpose water, consideration all available forms of water for their potential as a resource (JDA, 2022):

- Implementation of hydro zoning and minimum 50% native plantings to minimise water use in open areas and streetscapes.
- Consider alternative fit for purpose water sources where appropriate and cost-effective.

- Buildings are to comply with water efficiency standards introduced into the building code.

#### 4.4.5 Nutrient Load Target and Modelling Results

The proposed Nutrient Input Target is an 80% reduction in Total Nitrogen (TN) and Total Phosphorus (TP). This equates to 2.5 kg/ha/year TP and 17.3 kg/ha/year TN. This is achievable through the proposed Study Area land use change from rural grazing to commercial/industrial (JDA, 2022).

UNDO modelling of three potential development scenarios confirmed in all case that the above targets could be achieved. Additional information is provided in the LWMS (JDA, 2022).

#### 4.5 Acid Sulfate Soils

WAPC mapping indicates the site contains areas mapped as generally having a moderate-low risk of ASS. The preliminary onsite review also indicated a low risk of ASS (Section 3.3).

In accordance with DWER guidelines a Preliminary Site Assessment will be undertaken to assess the presence and extent of ASS prior to subdivision. Depending upon the results of the preliminary assessment, an ASS Assessment and Dewatering Management Plan will be prepared if required. This plan will be approved for implementation by the DWER prior to any ground disturbing works being undertaken.

#### 4.6 Contamination

A Preliminary Site Investigation (PSI) for Lot 221 was undertaken by Bioscience (2008a) according to the methodology detailed in the Contaminated Sites Management Series (2003). This involved interviews with the previous land owners, inspection of salient facilities on the property, and general observations made during other site investigations. The PSI concluded that there was no evidence to indicate contamination on the site from past site activities (Bioscience, 2008c).

Inspection of the portion of Lot 224 included in the site rezoning plan, did not indicate any visual evidence of contamination. This area has historically been used for grazing with no infrastructure or work areas located in this portion of the lot. The risk of potential contamination in this area therefore appears low.

It is noted that the former Abattoir facility located on Lot 1 included unlined waste disposal ponds. Testing of groundwater quality within the eastern side of Lot 221 (bore LP4) has not indicated any significant increase in TN and TP concentrations<sup>2</sup> of groundwater on comparison with other bores the vicinity.

---

<sup>2</sup> Based on data available and presented in the NIA DWMS.

## 5 IMPLEMENTATION STRATEGY

### 5.1 Overview

This EAR has been prepared with reference to the NIA DSP and regulatory authority comments provided following the scheme amendment referrals. The EAR identifies the key environmental features of the site and discusses design and management action proposed to address potential environmental impacts.

The key environmental considerations for the site relate to vegetation, wetland, nutrient, and drainage impacts and management. The findings and conclusions from this assessment are presented below.

#### 5.1.1 Vegetation

Vegetation identified for retention under the LSP design includes all vegetation within CCW and REW areas, upland vegetation located adjacent to UFI 4835, and 3.92 ha containing the entire extent of vegetation in 'Good' condition located within vegetation unit BmAfKg which represent the Banksia Woodland TEC.

To ensure the future viability of retained vegetated and revegetated areas, the management strategies which will be implemented will address delineation of retained vegetation, management of stormwater flow into areas of retained vegetation, and preparation of a POS Management Plan.

#### 5.1.2 Wetlands

The two CCWs will be retained and rehabilitated to improve their health and function.

A portion of Nambeelup Brook also occurs on-site. The brook and an associated buffer will be retained with open space to assist to protect the brook.

A POS Management Plan that will detail planting works, weed control, fencing and possible access control is proposed to be prepared at subdivision stage in consultation with the Shire of Murray.

A Foreshore Management Plan to detail, amongst other items, surface stabilisation, proposed infill planting works, plant species, target densities, weed control and access management including fencing and pathways for the Nambeelup Brook foreshore/buffer area will be prepared at subdivision stage in consultation with the Shire of Murray.

#### 5.1.3 Drainage Design and Nutrient Retention

Existing untreated drainage into Nambeelup Brook will cease, the site will be destocked, and artificial drainage channels will be replaced by a managed drainage system.

The local stormwater management system will consist of ephemeral water retention areas to capture and detain stormwater runoff from contributing catchments prior to discharge to surrounding drains. Structural and non-structural controls will be implemented to reduce nutrient exports (JDA, 2022).

An Urban Water Management Plan(s) will be prepared at subdivision stage, in line with DWER guidance (DoW, 2008).

### 5.2 Future Environmental Management Items

The following additional environmental investigations and reporting requirements will be addressed at the subdivision stage of the project:

- A POS Management Plan will be prepared at the subdivision stage to address the management of open space areas containing native vegetation.
- A Foreshore Management Plan will be prepared at subdivision stage to address management of the Nambeelup Brook foreshore zone.



- An ASS assessment will be undertaken prior to subdivision and an ASS management plan will be prepared if potential ASS or actual ASS is found to be present at the site and at risk from disturbance from the proposed site works. This plan would be prepared in accordance with the DWER ASS guidelines and approved by the DWER prior to implementation.
- Urban Water Management Plan(s) will provide further detail design on catchments and basin/detention management and water conservation strategies and recommendations.

## 6 References

- ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. ANZECC and ARMCANZ, Canberra.
- Bioscience (2008a). Vegetation and Flora Survey Nambeelup Industrial Estate Lot 221 Nambeelup. For Clough Property (Nambeelup) Pty Ltd and Westprime Assets Pty Ltd, Perth.
- Bioscience (2008b). Environmental Report: Lot 221 Nambeelup – Rezoning from Rural to Industrial Clough Nambeelup Pty Ltd/Westprime Asset Pty Ltd Joint Venture. For Clough Nambeelup/Westprime Asset Joint Venture, Perth.
- Bioscience (2008c). Soil Investigation Report: Lot 221, Nambeelup. For Clough Property Pty Ltd.
- Bushfire Safety Consulting (2018). Peel Region Scheme Amendment for Lots 211 Lakes Road and part Lot 224 Paterson Road, Nambeelup. Report Version 2.0. Report prepared for Coterra Environment.
- Bushfire Safety Consulting (2022). Lot 221 Lakes Road and part Lot 224 Paterson Road, Nambeelup Local Structure Plan – Bushfire Management Plan. Version 2.0. Report prepared for CLE Town Planning and Design.
- Del Marco, A., Taylor, R., Clarke, K., Savage, K., Cullity, J. and Miles, C. (2004). Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region. Western Australian Local Government Association and Perth Biodiversity Project, Perth
- Department of Biodiversity, Conservation and Attractions (DBCA) (2007). NatureMap: Mapping Western Australia's Biodiversity. Department of Biodiversity, Conservation and Attractions. [online] available at <https://naturemap.dbca.wa.gov.au>
- Department of Environment and Energy (DotEE) (2016). Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s 266B) Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community. Government of Australia, Canberra.
- Department of Fire and Emergency Services (DFES) (2018). Map of Bushfire Prone Areas 2018. Government of Western Australia, Perth.
- Department of Minerals and Energy (1986). Serpentine sheet (Jordan JE 1986b Serpentine Sheet part of Sheets 2033 II and 2133 III. Environmental Geology Series. Geological Survey of Western Australia, Perth, Western Australia.)
- Department of Planning, Lands and Heritage (DPLH) (2023) Aboriginal Heritage Inquiry System online. Accessed 26 July 2023. <https://espatial.dplh.wa.gov.au/AHIS/index.html?viewer=AHIS>
- Department of Water (DoW) (2008). Urban Water Management Plans: Guidelines for preparing plans and complying with subdivision conditions. DoW, Perth.
- Department of Water (DoW) (2010). Murray Drainage and Water Management Plan. DoW, Perth.
- Ecologia (2007). Clough Nambeelup Pty Ltd and Westprime Asset Pty Ltd Lot 221 Fauna Survey. Prepared for Clough Nambeelup Pty Ltd and Westprime Asset Pty Ltd, Perth.
- Environmental Protection Authority (EPA) 1992. Environmental Protection (Peel Inlet–Harvey Estuary) Policy 1992. Government of Western Australia, Perth.
- Environmental Protection Authority (EPA) (2004). Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. EPA Guidance Statement No. 56. EPA, Perth.
- Environmental Protection Authority (EPA) (2005). Guidance Statement for the separation distances between industrial and sensitive land uses. Final Guidance No. 3. Environmental Protection Authority, Perth.





- Environmental Protection Authority (EPA) (2006). Guidance Statement for Level of Assessment for proposals affecting areas within the System 6 regions and Swan Coastal Plain portion of the System 1 region. Final Guidance No. 10. Environmental Protection Authority, Perth.
- Environmental Protection Authority (2008a). EPA Guidance Statement No. 33: Environmental Guidance for Planning and Development. Government of Western Australia, Perth.
- Environmental Protection Authority (EPA) (2008b). Water Quality Improvement Plan for the Rivers and Estuary of the Peel – Harvey System – Phosphorus Management. EPA and Australian Government, Perth.
- Environmental Protection Authority (EPA) (2010). Swan Bioplan – Peel Regionally Significant Natural Areas. Environmental Protection Bulletin No. 12. EPA, Perth.
- Environmental Protection Authority (EPA) (2016). Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment. EPA, Perth.
- Environmental Protection Authority (EPA) (2019). Peel Region Scheme Amendment 046-41. Advice to the Western Australian Planning Commission, 20 March 2019. EPA, Perth.
- Environmental Protection Authority (EPA) (2020). Shire of Murray Local Planning Scheme Amendment 311 (and accompanying advice). EPA, Perth.
- Focused Vision Consulting (2020). Flora and Vegetation Survey – Nambeelup. Prepared for Coterra. Rev0, October 2020.
- Gibson, N., Keighery, B.J, Keighery, G.J, Burbidge, A.H and Lyons, M.N (1994). A Floristic Survey of the Southern Swan Coastal Plain. Unpublished Report for the Australian Heritage Commission prepared by Department of Conservation and Land Management and the Conservation Council of WA (INC).
- GHD (2010). Ecological water requirements for selected wetlands in the Murray drainage and water management plan area: Murray Drainage and Water Management Plan and Associated Studies. Prepared for the Department of Water, Perth.
- Government of Western Australia (2000). Bush Forever, Volume 2. Government of Western Australia, Perth.
- Hedde, E.M. Loneragan, O.W, Havel, J.J (1980). Vegetation Complexes of the Darling System Western Australia, In. Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Perth.
- Ironbark Environmental (2013) Shire of Murray Local Biodiversity Strategy. Report prepared for the Shire of Murray.
- JDA (2016). Nambeelup Industrial Area DSP: District Water Management Strategy. Report prepared for the Department of Planning.
- JDA (2022). Lot 1221 Lakes Road and Part Lot 1400 Paterson Road, Nambeelup – Local Water Management Strategy. April 2022. Report prepared for Nambeelup JV (Westprime Asset Pty Ltd and Peel Estates (WA) Pty Ltd).
- Monash University (2014). Vegetation Guidelines for Stormwater Bio-filters in the south-west of Western Australia. November 2014
- RPS (2010a). Environmental Assessment Report: Proposed PRS Rezoning Amendment for Lot 221 Lakes Road, Nambeelup. Rev 1, August 2009. Report prepared for Twin Ocean Nambeelup Pty Ltd and Westprime Asset Pty Ltd.
- RPS (2010b). District Water Management Strategy: Lot 221 Lakes Road Nambeelup. Prepared for Twin Ocean Property. C09248, Rev0, May 2010.
- Shire of Murray (2018) Local Planning Policy – Biodiversity Protection. Shire of Murray, Pinjarra.

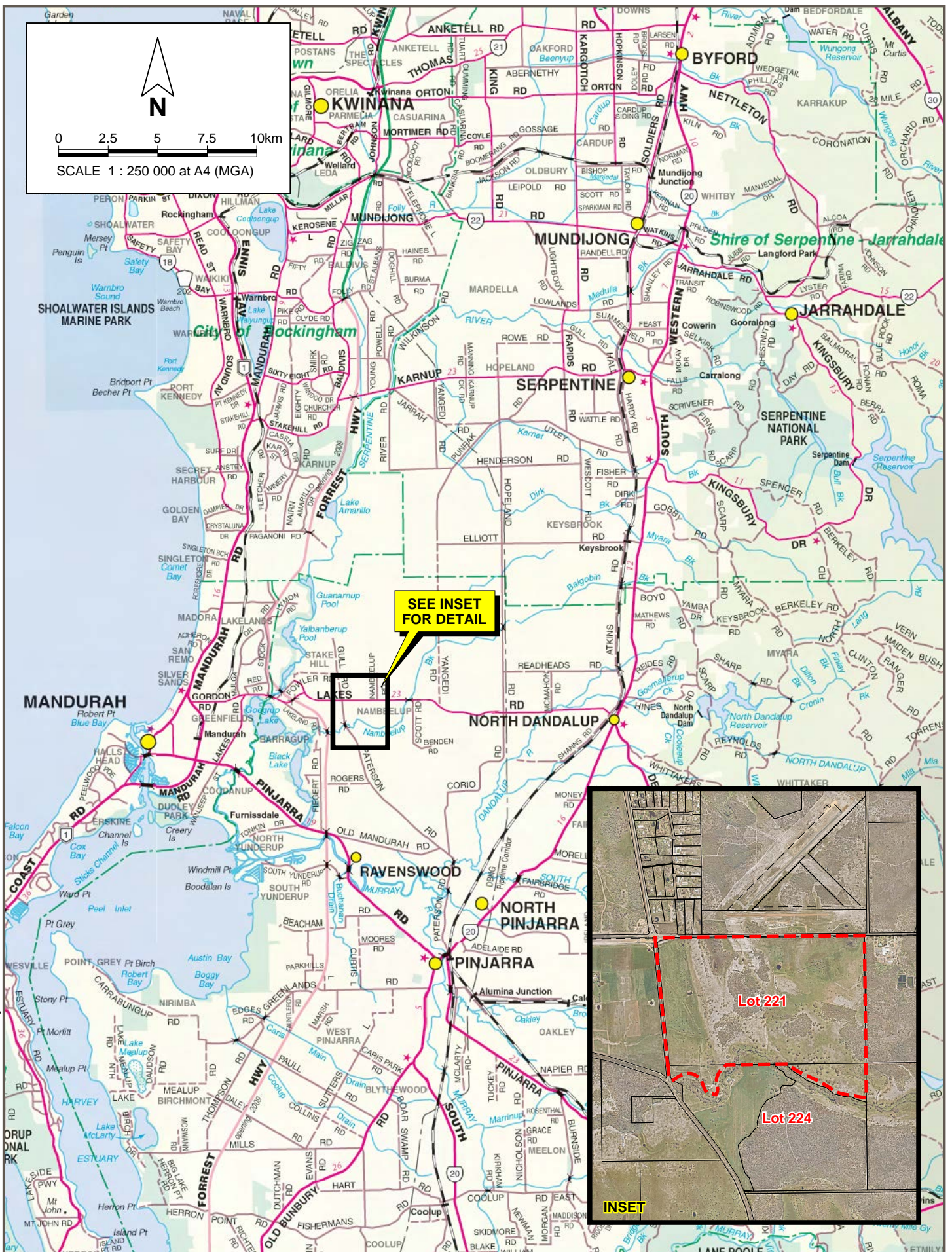


- Threatened Species Scientific Committee (TSSC) (2016). Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain Ecological Community. Canberra: Department of the Environment and Energy. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/131-conservation-advice.pdf>. Accessed 1 September 2020.
- Western Australian Planning Commission (WAPC) (2003). Statement of Planning Policy 2.1: The Peel–Harvey Coastal Plain Catchment. State of Western Australia, Perth.
- Western Australian Planning Commission (WAPC) (2008). Better Urban Water Management. WAPC, Perth.
- Western Australian Planning Commission (WAPC) (2015). Peel Region Scheme: Floodplain Management Policy. Western Australian Planning Commission, Perth.
- Western Australian Planning Commission (WAPC) (2016). Nambeelup Industrial Area District Structure Plan. Western Australian Planning Commission, Perth.
- Western Australian Planning Commission (WAPC) (2017). Draft State Planning Policy 4.1 – Industrial Interface. Government of Western Australia, Perth.
- Western Australian Planning Commission (WAPC) (2019). Peel Region Scheme Amendment 046/41 – Nambeelup Industrial Zone: Lot 221 Lakes Road and Parts of Lot 400 Paterson Road, Nambeelup – Amendment Report (April 2019). Western Australian Planning Commission, Perth.
- Yates Heritage Consultants (2006). Report on an Aboriginal Site Survey of the Proposed Nambeelup Joint Venture, Shire of Murray. Prepared for Clough Property Group, Perth.

## Figures

---





**COTERRA**  
ENVIRONMENT

Nambeelup JV  
ENVIRONMENTAL ASSESSMENT REPORT  
LOT 221 LAKES ROAD AND PART LOT 224 PATERSON ROAD, NAMBEELUP

Drawn: K. Watts

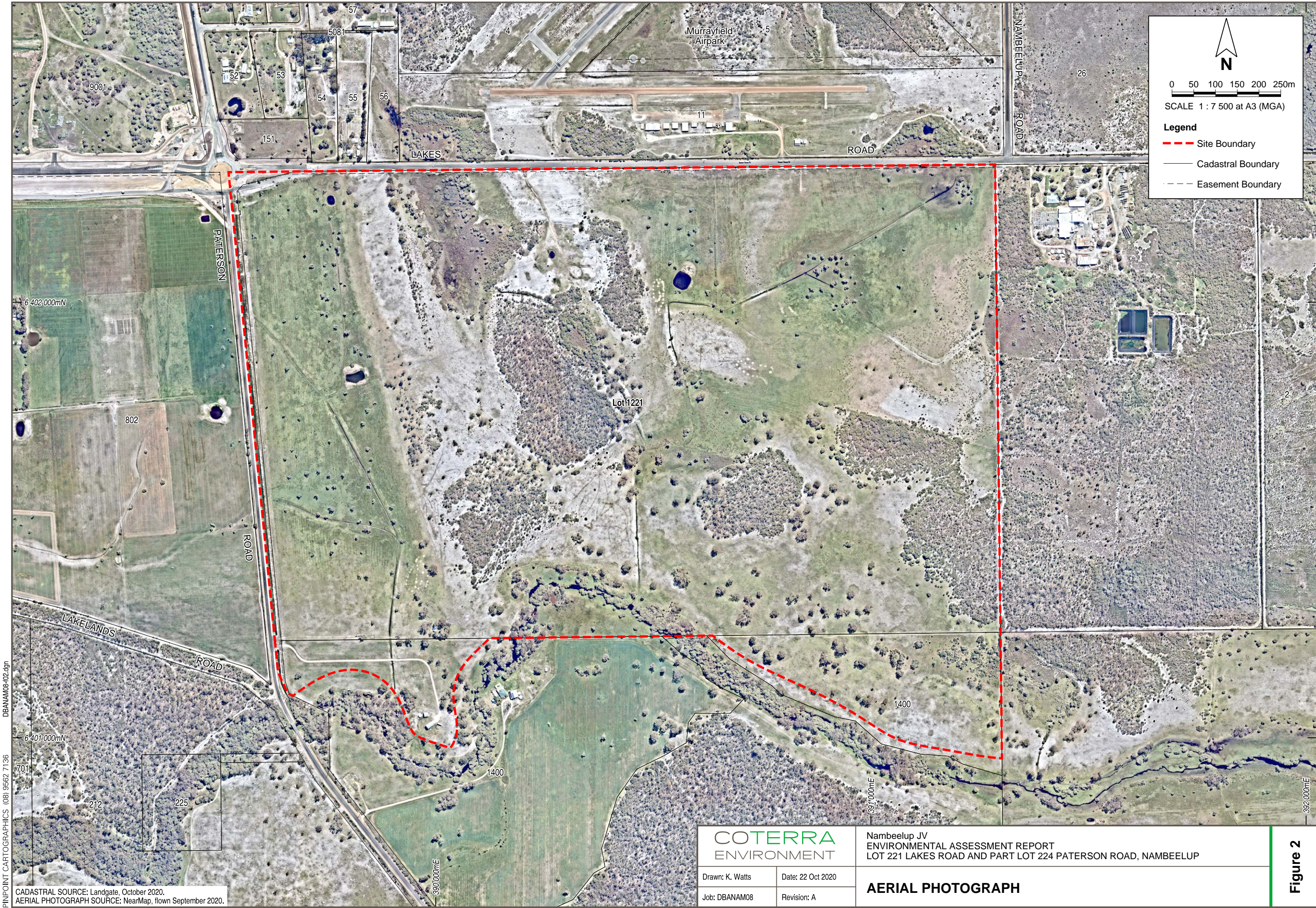
Date: 22 Oct 2020

Job: DBANAM08

Revision: A

## SITE LOCATION





DBANAM08-102.dgn  
PINPOINT CARTOGRAPHICS (08) 9562 7136

CADASTRAL SOURCE: Landgate, October 2020.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2020.

COTERRA  
ENVIRONMENT

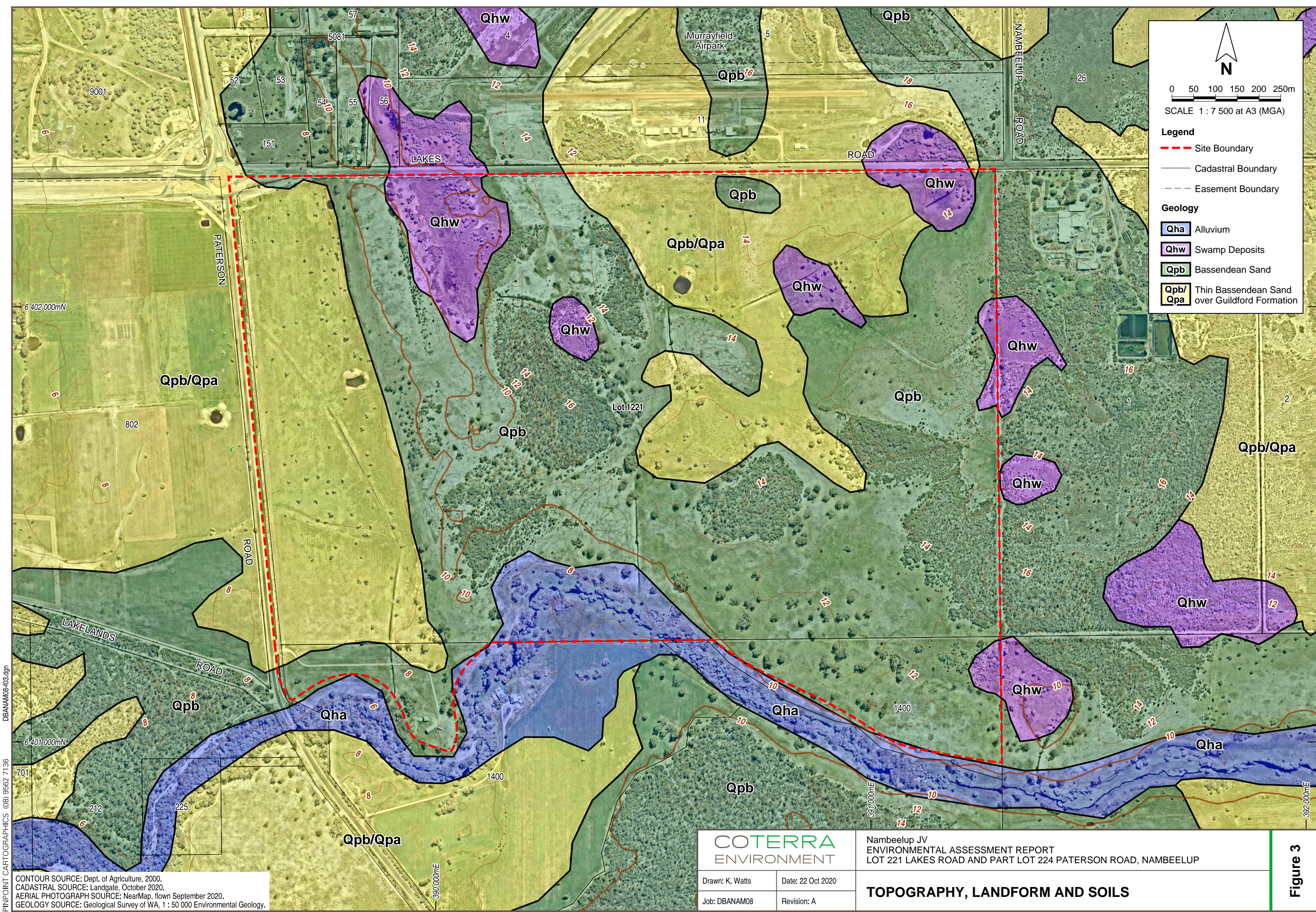
Nambeelup JV  
ENVIRONMENTAL ASSESSMENT REPORT  
LOT 221 LAKES ROAD AND PART LOT 224 PATERSON ROAD, NAMBEELUP

Drawn: K. Watts	Date: 22 Oct 2020
Job: DBANAM08	Revision: A

AERIAL PHOTOGRAPH

Figure 2



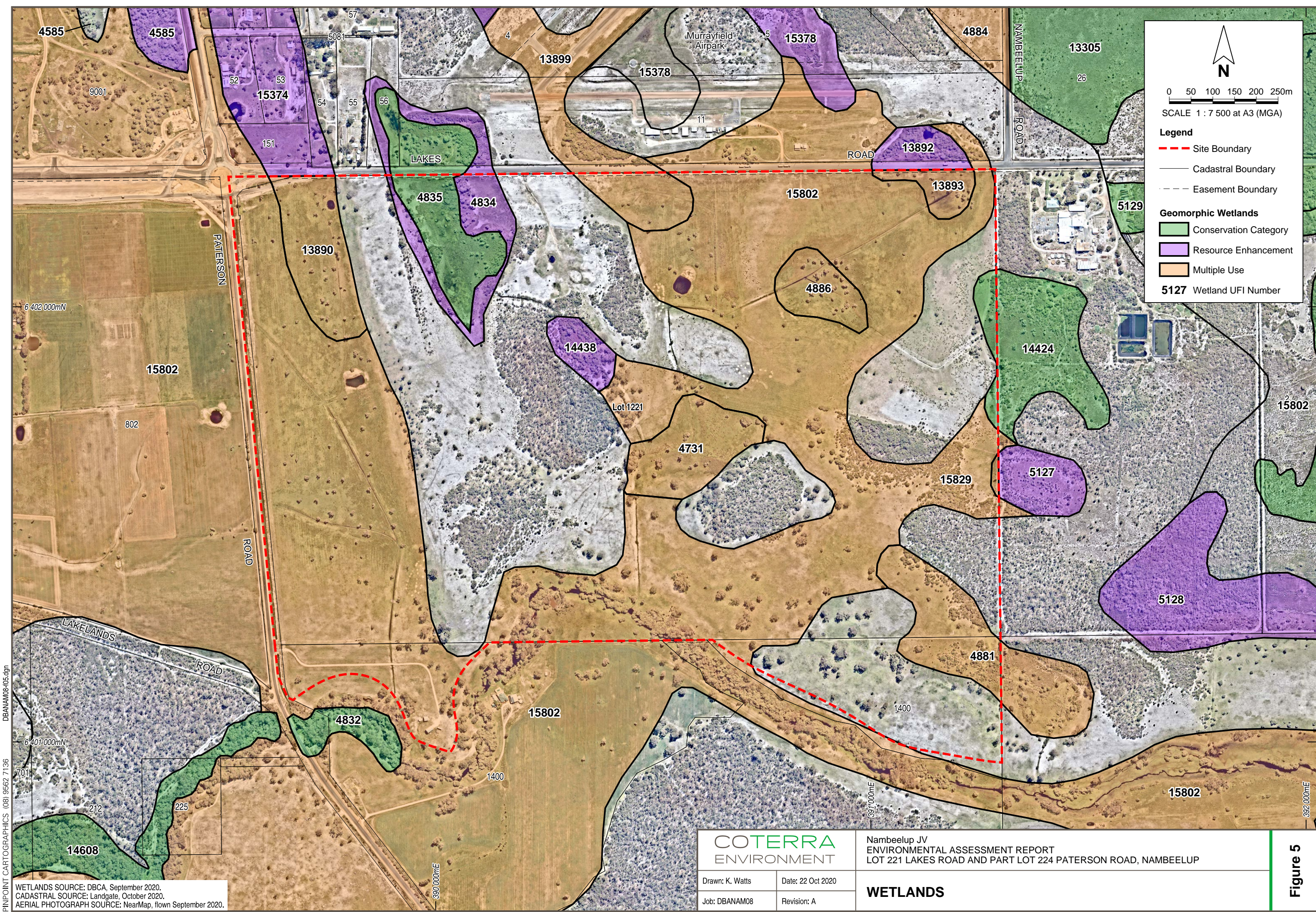


CONTOUR SOURCE: Dept. of Agriculture, 2000.  
CADASTRAL SOURCE: Landgate, October 2020.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2020.  
GEOLOGY SOURCE: Geological Survey of WA, 1 : 50 000 Environmental Geology.









N

050100150200250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

Site Boundary

Cadastral Boundary

Easement Boundary

Geomorphic Wetlands

Conservation Category

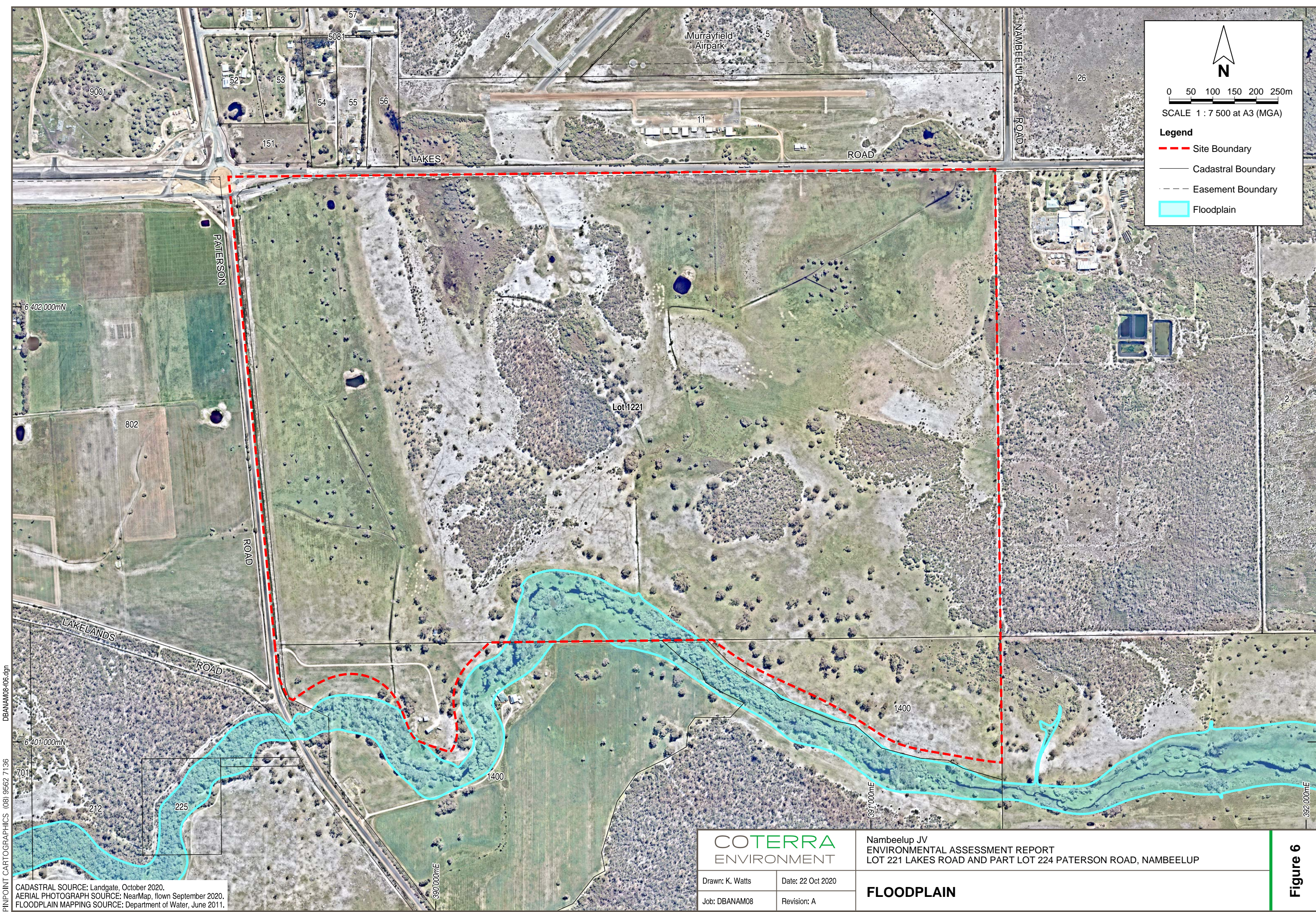
Resource Enhancement

Multiple Use

5127 Wetland UFI Number

COTERRA ENVIRONMENT		Nambeelup JV ENVIRONMENTAL ASSESSMENT REPORT LOT 221 LAKES ROAD AND PART LOT 224 PATERSON ROAD, NAMBEELUP	
Drawn: K. Watts		Date: 22 Oct 2020	
Job: DBANAM08		Revision: A	





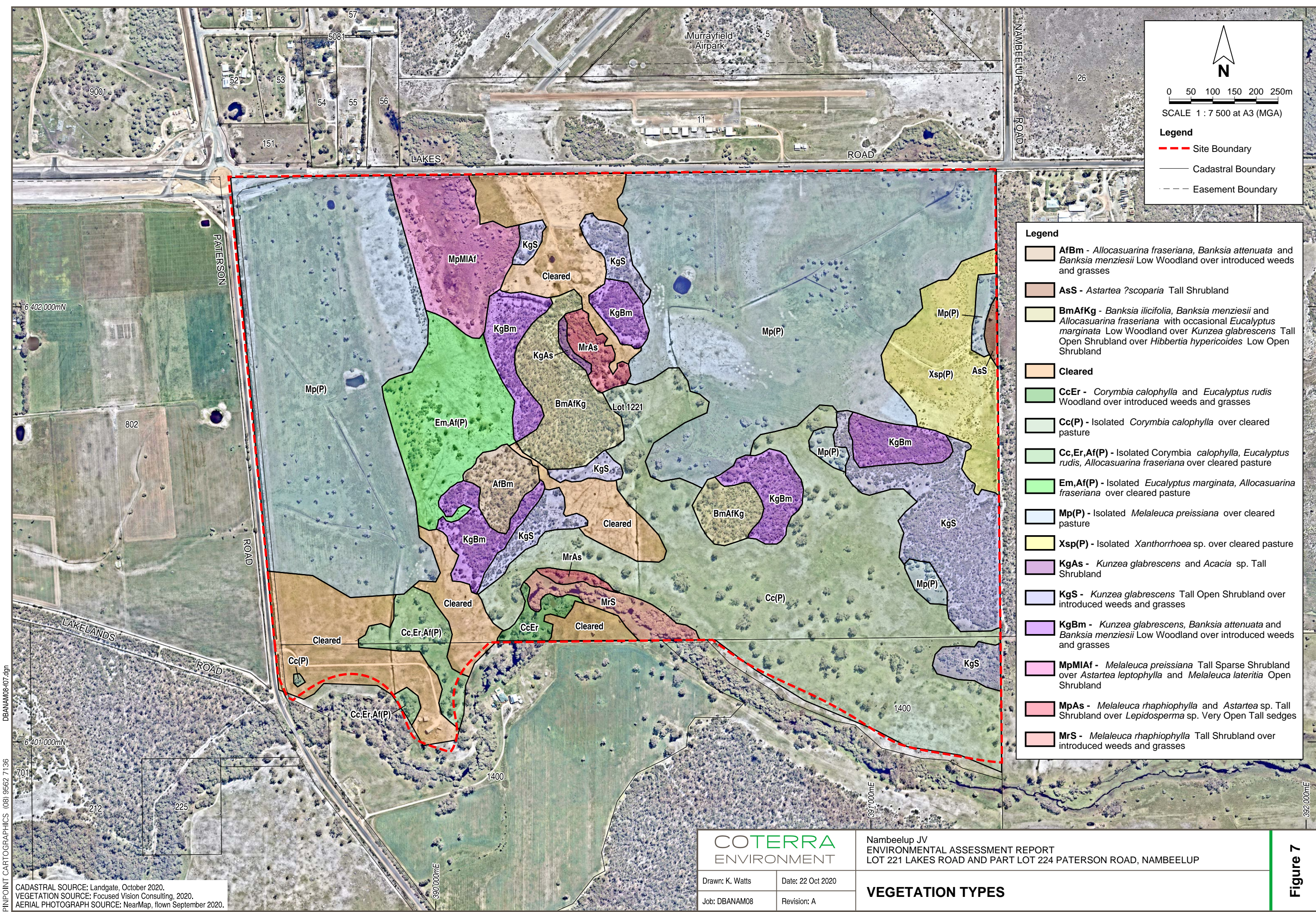
DBANAM08-106.dgn  
PINPOINT CARTOGRAPHICS (08) 9562 7136

CADASTRAL SOURCE: Landgate, October 2020.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2020.  
FLOODPLAIN MAPPING SOURCE: Department of Water, June 2011.

COTERRA ENVIRONMENT		Nambeelup JV ENVIRONMENTAL ASSESSMENT REPORT LOT 221 LAKES ROAD AND PART LOT 224 PATERSON ROAD, NAMBEELUP	
Drawn: K. Watts	Date: 22 Oct 2020	FLOODPLAIN	
Job: DBANAM08	Revision: A		

Figure 6





N

050100150200250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

Site Boundary

Cadastral Boundary

Easement Boundary

Legend

**AfBm** - *Allocasuarina fraseriana*, *Banksia attenuata* and *Banksia menziesii* Low Woodland over introduced weeds and grasses

**AsS** - *Astartea ?scoparia* Tall Shrubland

**BmAfKg** - *Banksia ilicifolia*, *Banksia menziesii* and *Allocasuarina fraseriana* with occasional *Eucalyptus marginata* Low Woodland over *Kunzea glabrescens* Tall Open Shrubland over *Hibbertia hypericoides* Low Open Shrubland

**Cleared**

**CcEr** - *Corymbia calophylla* and *Eucalyptus rudis* Woodland over introduced weeds and grasses

**Cc(P)** - Isolated *Corymbia calophylla* over cleared pasture

**Cc,Er,Af(P)** - Isolated *Corymbia calophylla*, *Eucalyptus rudis*, *Allocasuarina fraseriana* over cleared pasture

**Em,Af(P)** - Isolated *Eucalyptus marginata*, *Allocasuarina fraseriana* over cleared pasture

**Mp(P)** - Isolated *Melaleuca preissiana* over cleared pasture

**Xsp(P)** - Isolated *Xanthorrhoea* sp. over cleared pasture

**KgAs** - *Kunzea glabrescens* and *Acacia* sp. Tall Shrubland

**KgS** - *Kunzea glabrescens* Tall Open Shrubland over introduced weeds and grasses

**KgBm** - *Kunzea glabrescens*, *Banksia attenuata* and *Banksia menziesii* Low Woodland over introduced weeds and grasses

**MpMIAf** - *Melaleuca preissiana* Tall Sparse Shrubland over *Astartea leptophylla* and *Melaleuca lateritia* Open Shrubland

**MpAs** - *Melaleuca raphiophylla* and *Astartea* sp. Tall Shrubland over *Lepidosperma* sp. Very Open Tall sedges

**MrS** - *Melaleuca raphiophylla* Tall Shrubland over introduced weeds and grasses

DBANAM08-107.dgn  
PINPOINT CARTOGRAPHICS (08) 9562 7136

CADASTRAL SOURCE: Landgate, October 2020.  
VEGETATION SOURCE: Focused Vision Consulting, 2020.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2020.

COTERRA

ENVIRONMENT

Drawn: K. Watts

Date: 22 Oct 2020

Job: DBANAM08

Revision: A

Nambeelup JV

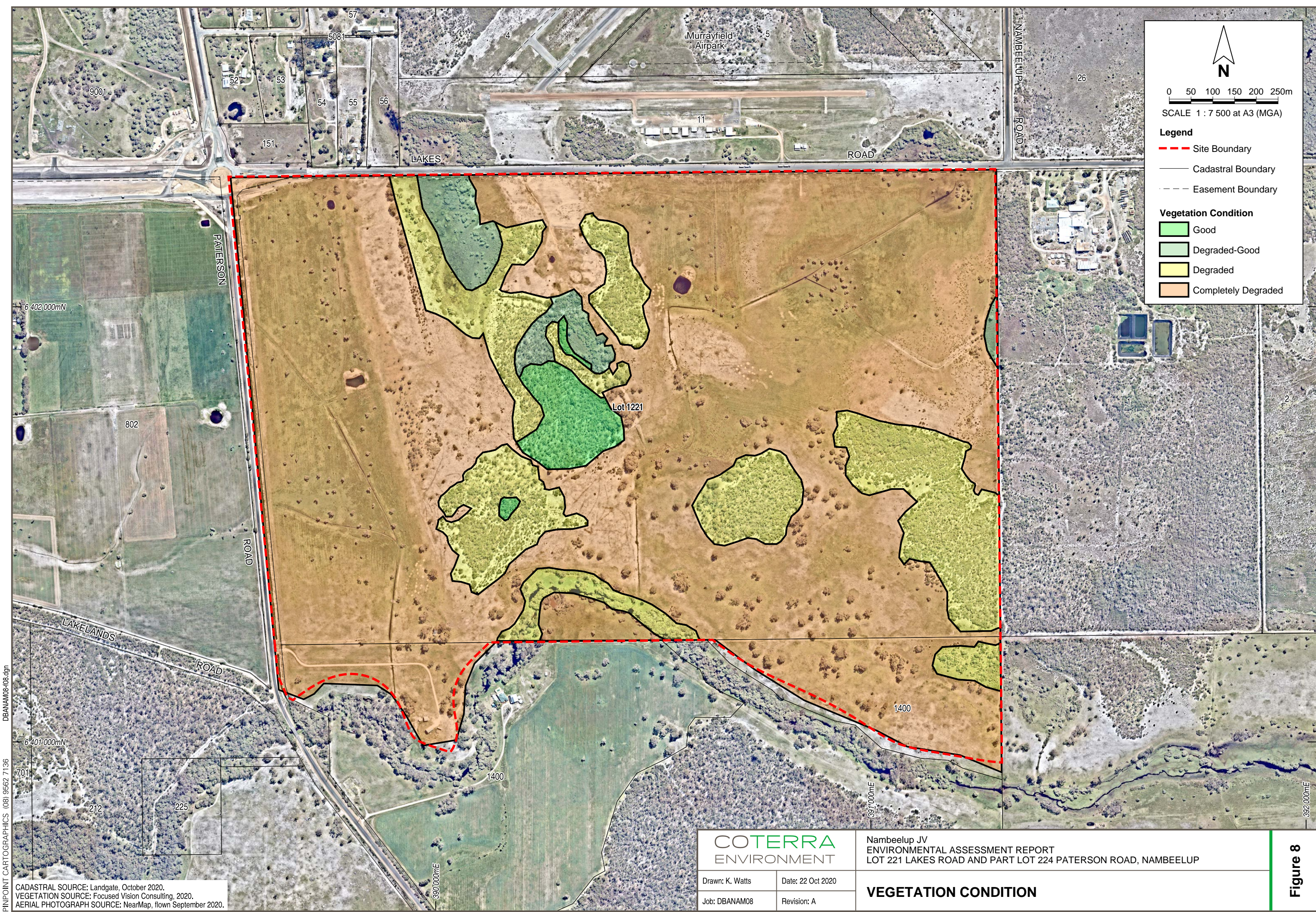
ENVIRONMENTAL ASSESSMENT REPORT

LOT 221 LAKES ROAD AND PART LOT 224 PATERSON ROAD, NAMBEELUP

VEGETATION TYPES

Figure 7





N

0 50 100 150 200 250m

SCALE 1 : 7 500 at A3 (MGA)

Legend

Site Boundary

Cadastral Boundary

Easement Boundary

Vegetation Condition

Good

Degraded-Good

Degraded

Completely Degraded

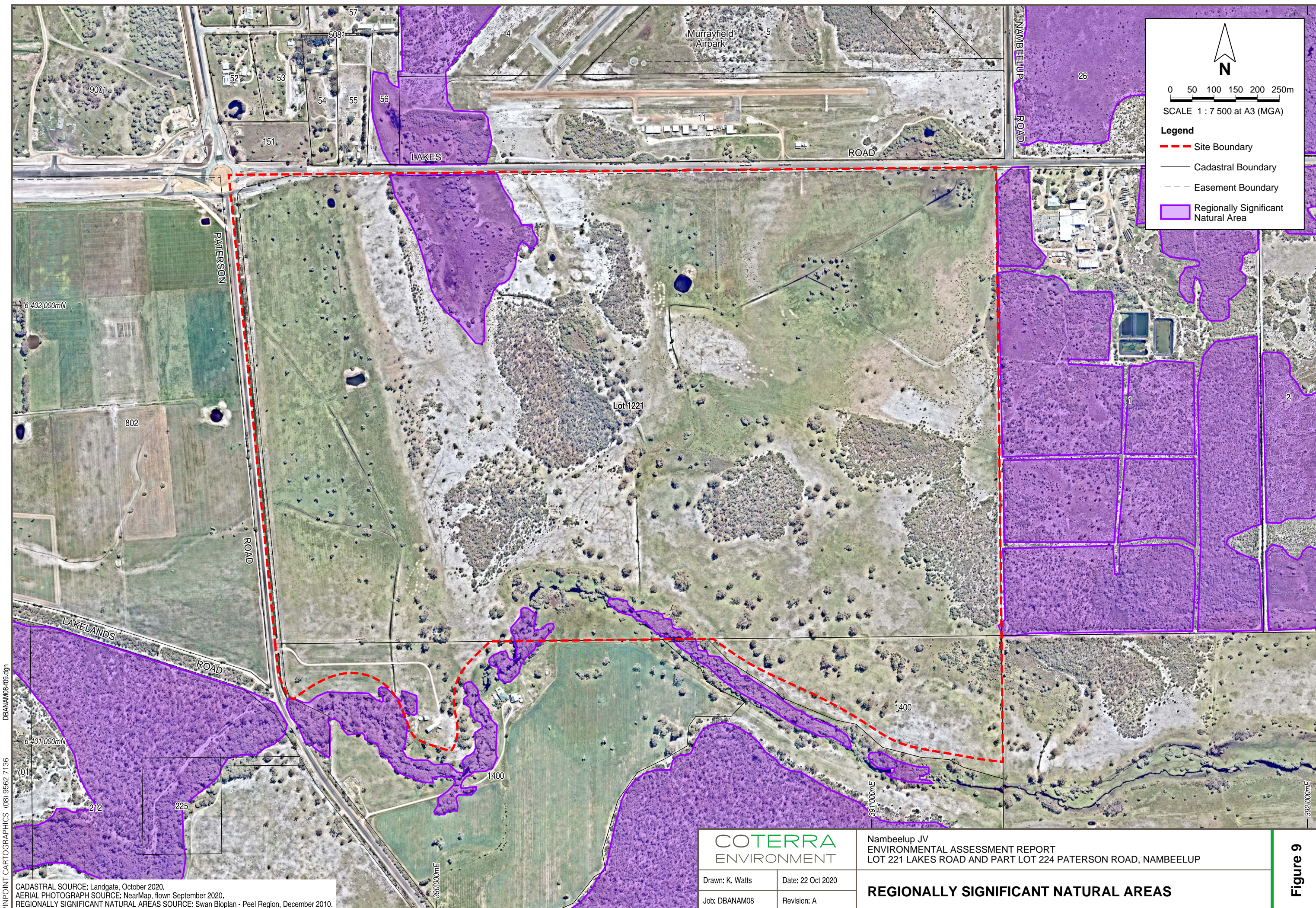
DBANAM08-108.dgn  
PINPOINT CARTOGRAPHICS (08) 9562 7136

CADASTRAL SOURCE: Landgate, October 2020.  
VEGETATION SOURCE: Focused Vision Consulting, 2020.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2020.

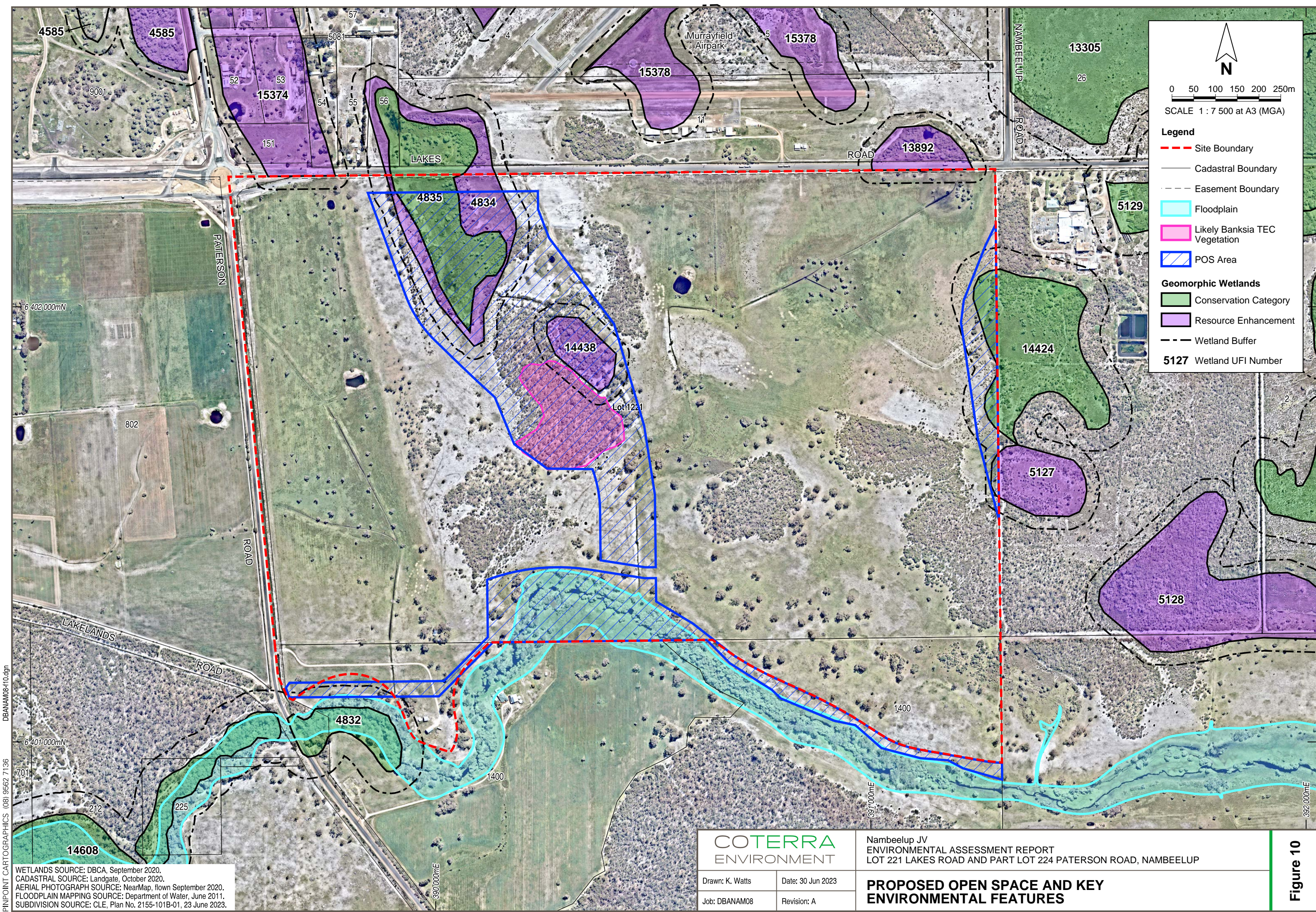
COTERRA ENVIRONMENT		Nambeelup JV ENVIRONMENTAL ASSESSMENT REPORT LOT 221 LAKES ROAD AND PART LOT 224 PATERSON ROAD, NAMBEELUP	
Drawn: K. Watts		Date: 22 Oct 2020	
Job: DBANAM08		Revision: A	
		VEGETATION CONDITION	

Figure 8









DBANAM08-110.dgn  
6 402 000mN  
6 401 000mN  
701  
212  
225  
330 000mE  
331 000mE  
332 000mE

WETLANDS SOURCE: DBCA, September 2020.  
CADASTRAL SOURCE: Landgate, October 2020.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown September 2020.  
FLOODPLAIN MAPPING SOURCE: Department of Water, June 2011.  
SUBDIVISION SOURCE: CLE, Plan No. 2155-101B-01, 23 June 2023.

COTERRA ENVIRONMENT		Nambeelup JV ENVIRONMENTAL ASSESSMENT REPORT LOT 221 LAKES ROAD AND PART LOT 224 PATERSON ROAD, NAMBEELUP	
Drawn: K. Watts	Date: 30 Jun 2023	PROPOSED OPEN SPACE AND KEY ENVIRONMENTAL FEATURES	
Job: DBANAM08	Revision: A		

Figure 10





## **Appendix 1      Nambeelup Industrial Area District Structure Plan**

---

# Nambeelup Industrial Area

## DISTRICT STRUCTURE PLAN

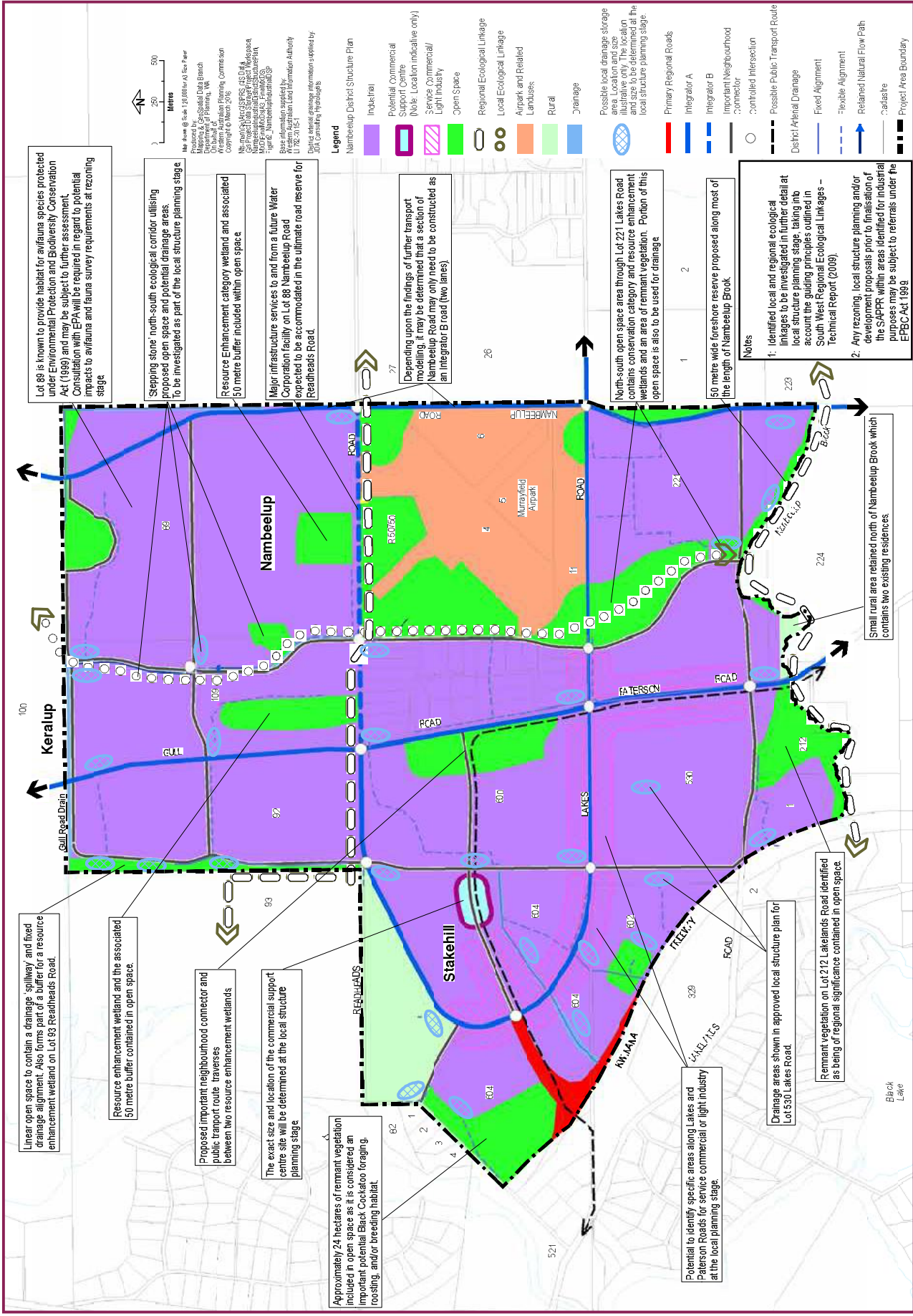
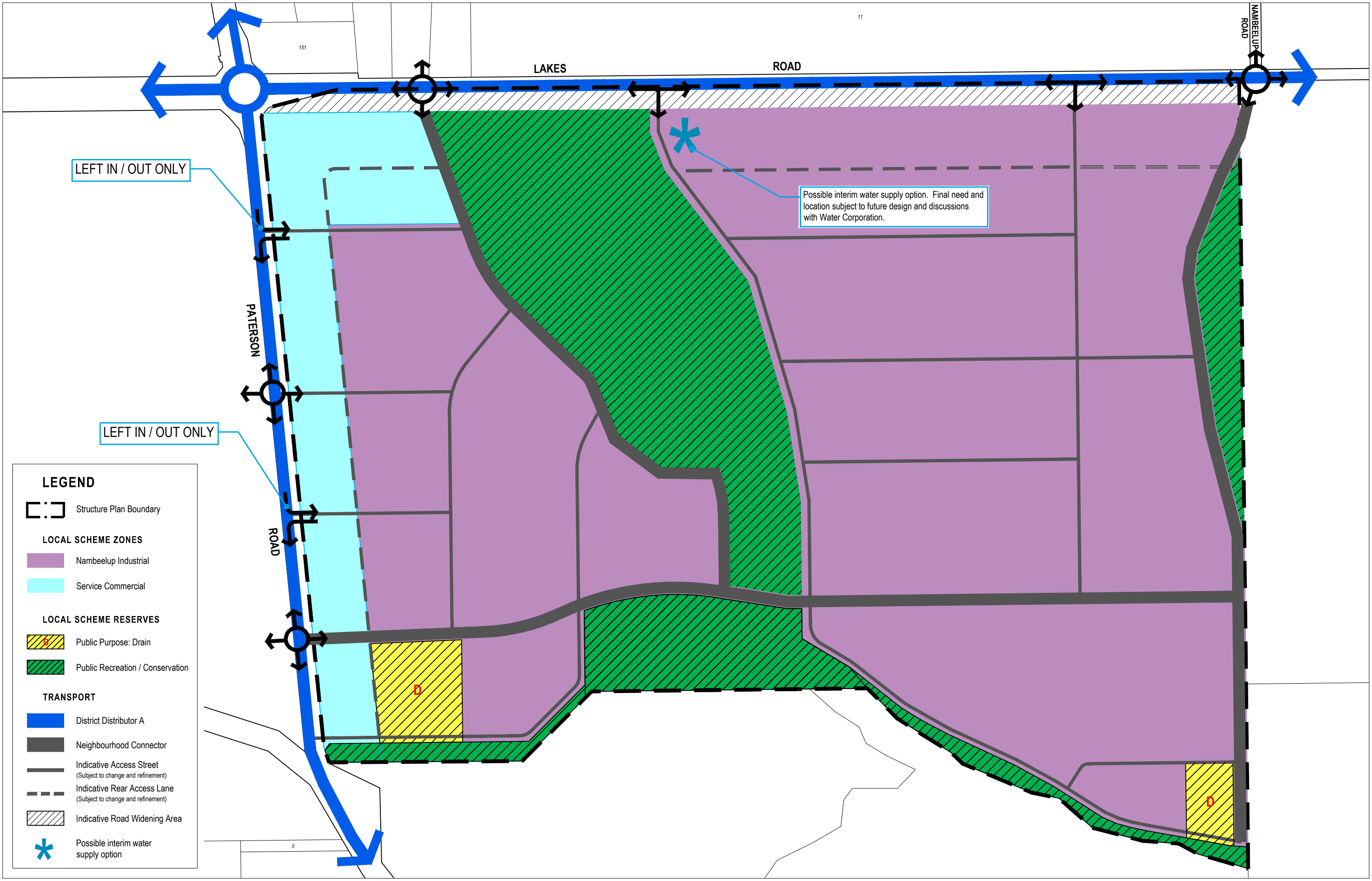


Figure 2: Nambeelup Industrial District Structure Plan



## **Appendix 2      Local Structure Plan**

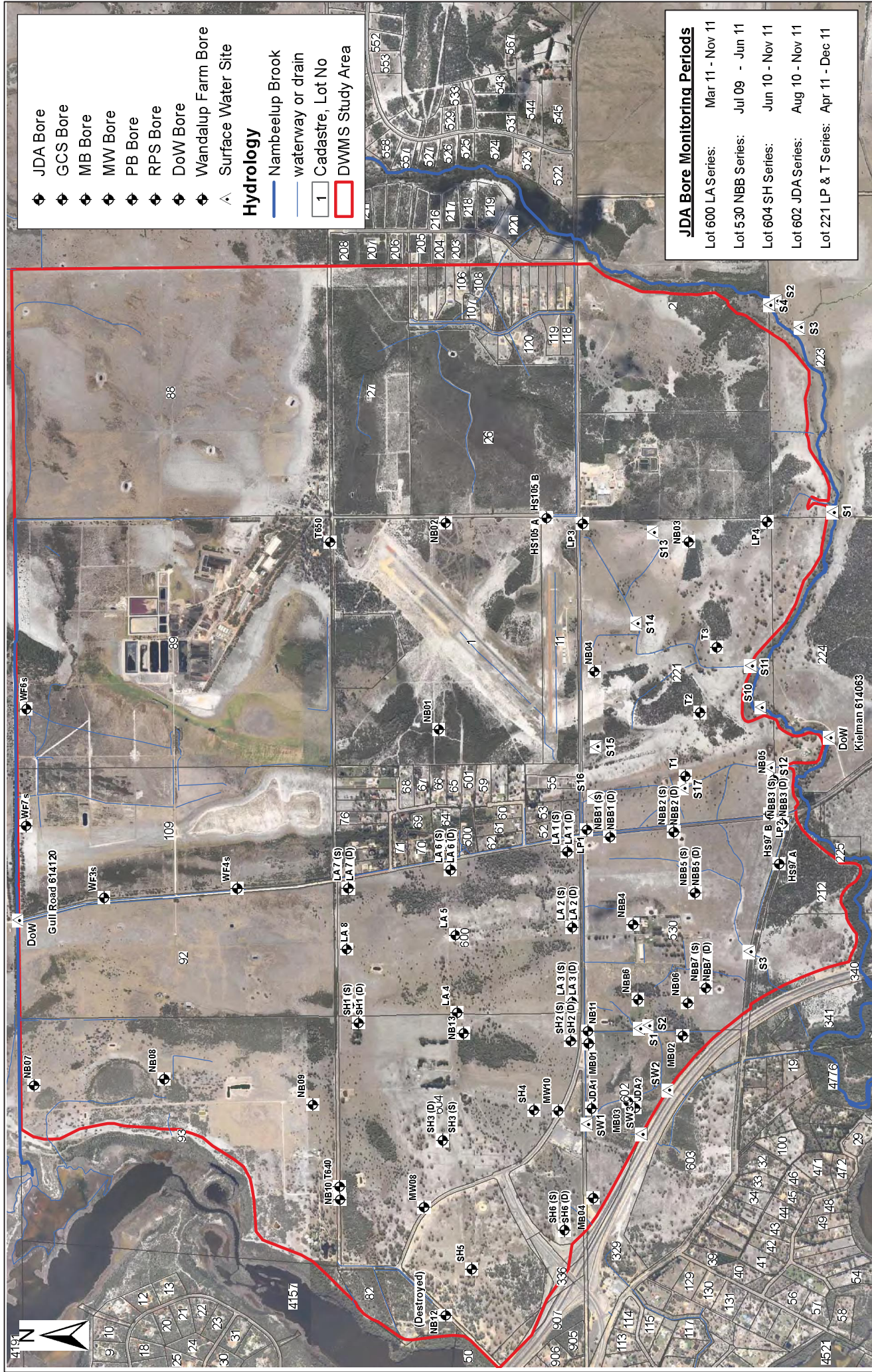
---



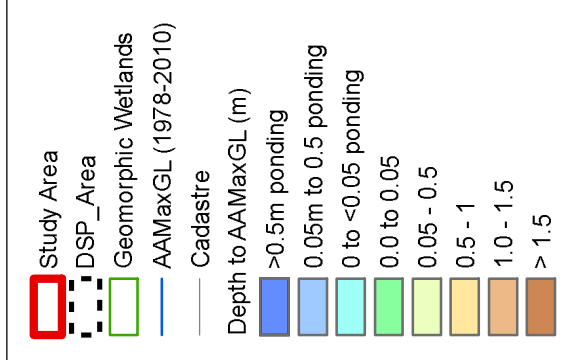
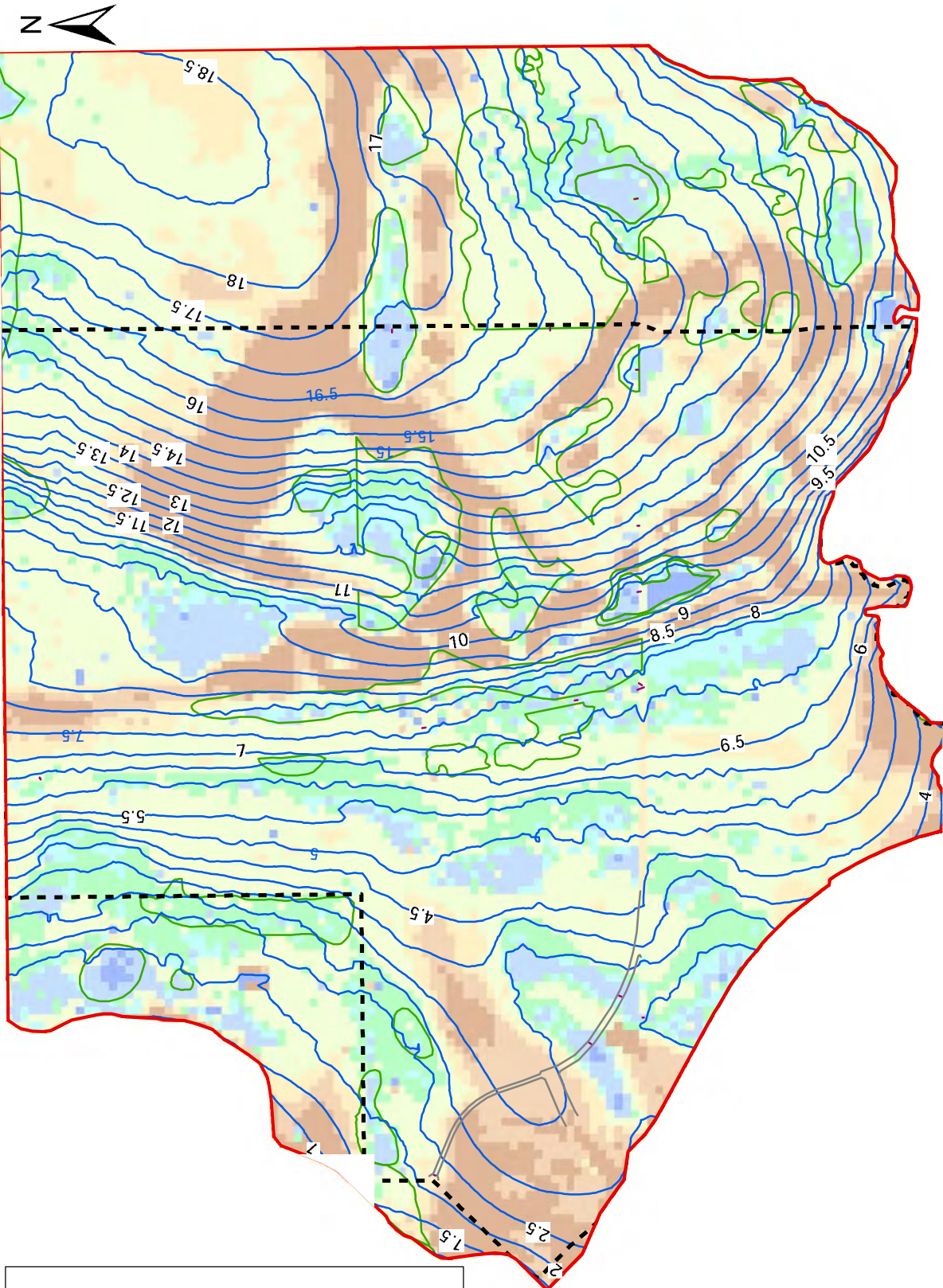
## **Appendix 3      Groundwater and Surface Water Monitoring Sites and Data (JDA, 2016)**

---









Data Source: Marillier (2011) MIKE-She model output

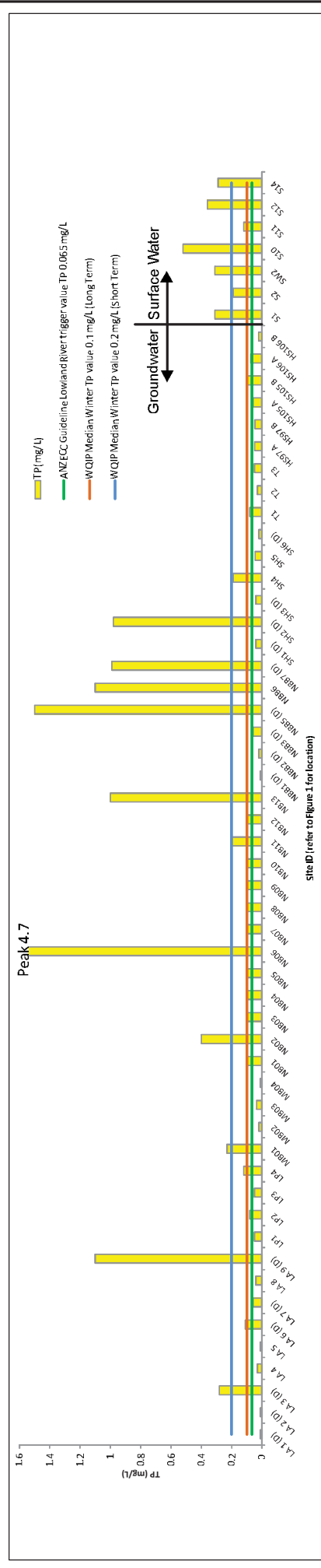
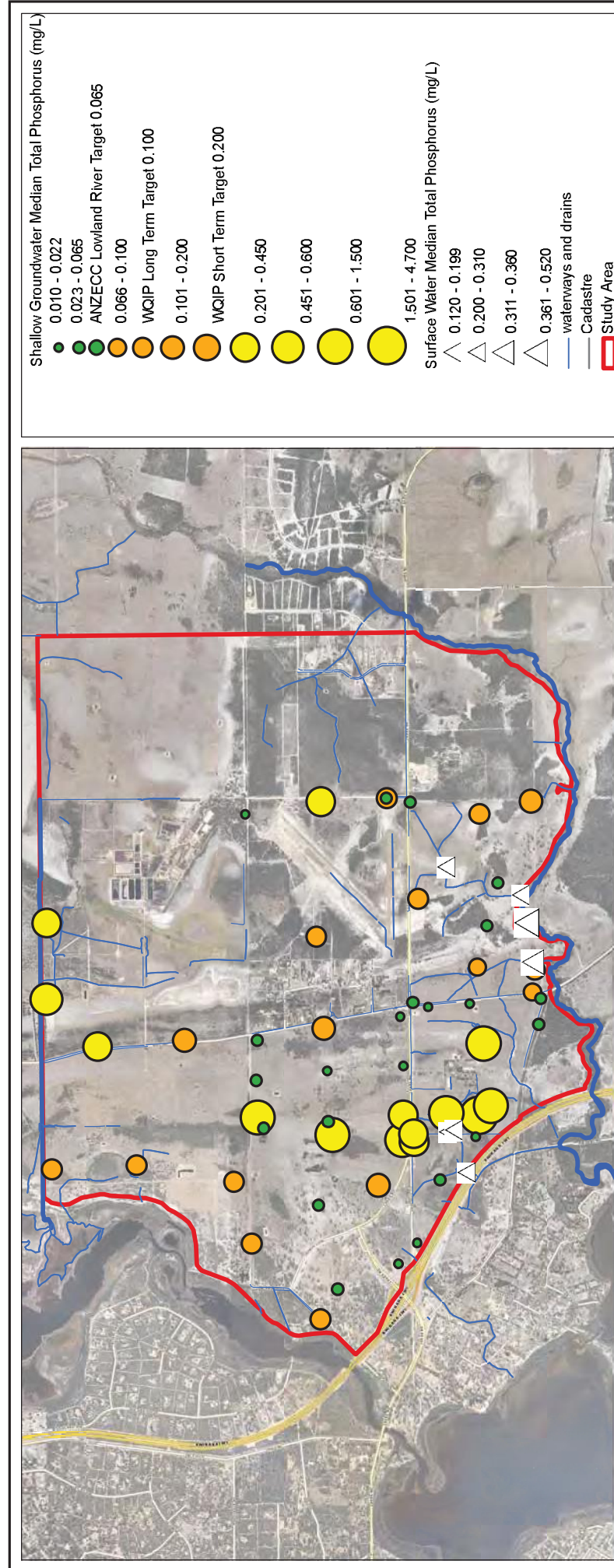
Job No. J6095

Scale: 1:30,000



Department of Planning  
 Nambeelup Industrial Area DSP: District Water Management Strategy  
 Figure 7: DoW modelled Average Annual Maximum  
 Groundwater Levels (AAMaxGL)

© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2016



Data Source: ANZECC (2000a) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, Oct 2000; EPA (2008) Water Quality Improvement Plan for the Rivers and Estuary of the Peel-Harvey System

Job No. J4758

Scale: 1:50,000

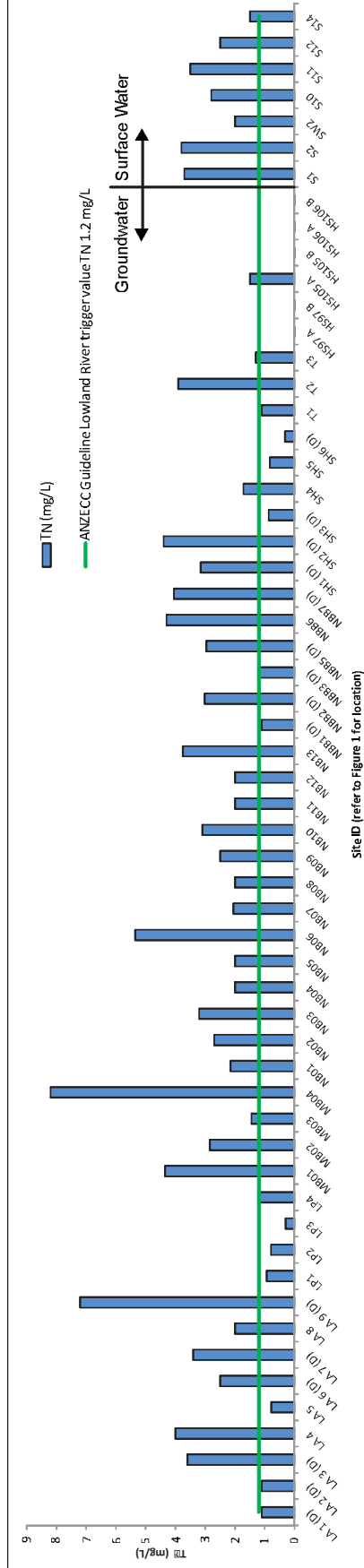
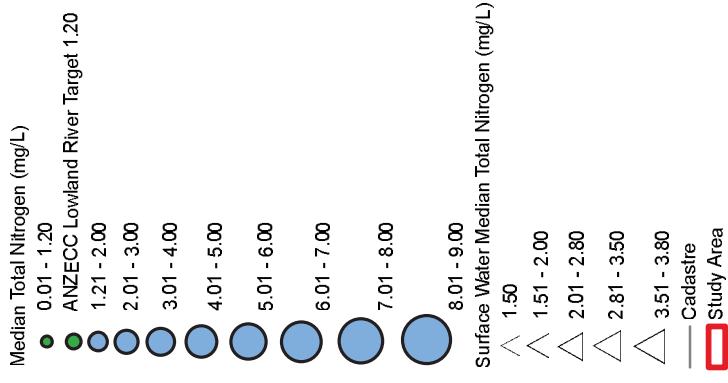
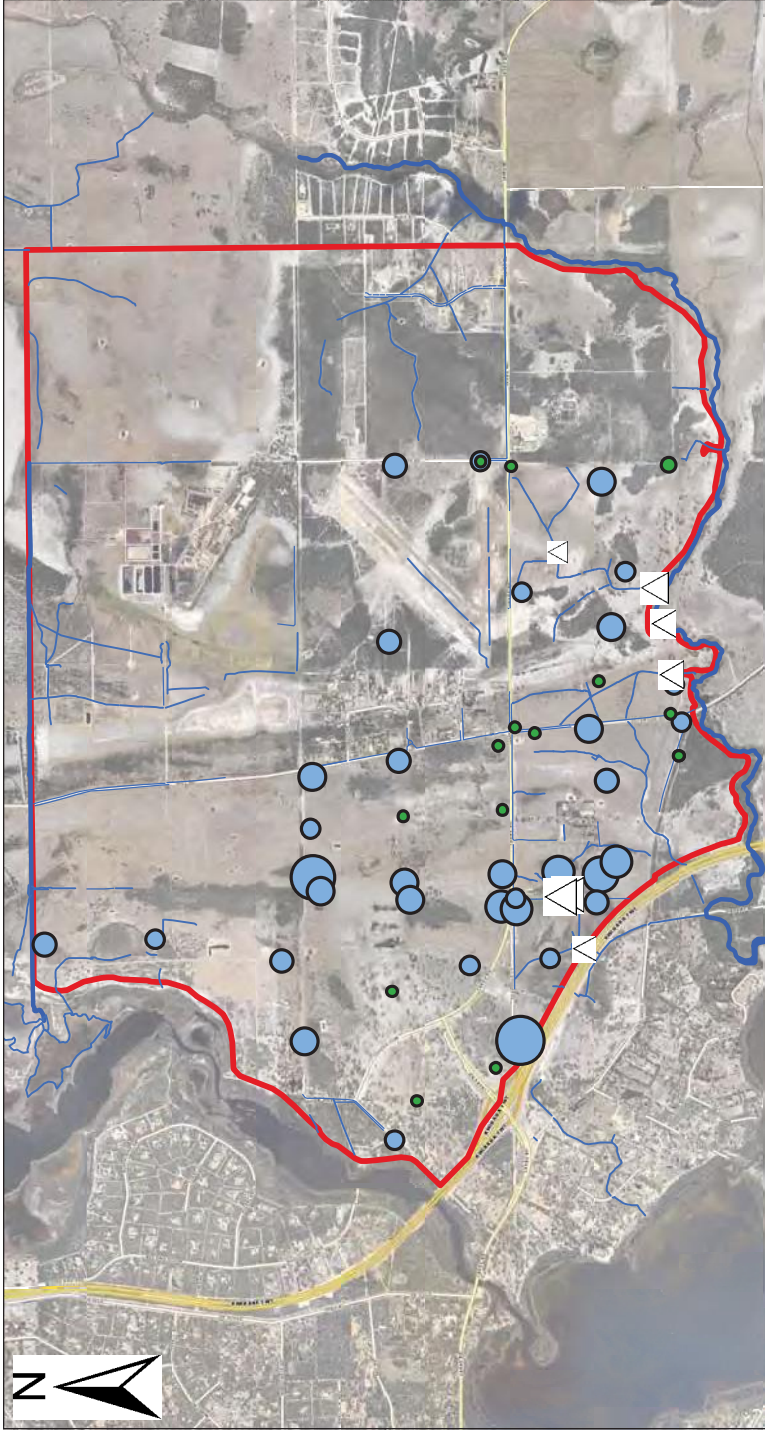
© COPYRIGHT JIM DAVIES & ASSOCIATES PTY. LTD. 2011



**JDA**  
Consultant Hydrologists

Department of Planning  
Nambelup Industrial Area DSP: District Water Management Strategy  
**Figure 8: Median Total Phosphorus**







# COTERRA ENVIRONMENT

Level 1, 98 Colin Street  
West Perth WA 6005

T (08) 9381 5513

[www.coterra.com.au](http://www.coterra.com.au)  
[info@coterra.com.au](mailto:info@coterra.com.au)

