Osprey Expansion

Environmental Referral Supporting Document

Tronox Management Pty Ltd

5 March 2025

→ **The Power of Commitment**

Project name	Osprey Expansion					
Document title	Osprey Expansion | Environmental Referral Supporting Document					
Project number	12649786					
File name	12649786-RPT-0_Tronox Osprey Project_Referral Supporting Information.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S2	A	M Ryan R Jarrold N Stjepanovic	M Brook	On file	T Sleigh	On file	3/12/24
S4	B	M Ryan R Jarrold N Stjepanovic	M Brook	On file	T Sleigh	On file	20/02/25
S4	0	M Ryan R Jarrold N Stjepanovic	M Brook		T Sleigh		05/03/25

Client Review: Tronox Pty Ltd		
Revision	Reviewer	Date
A	C Beckley T Munro	18/12/24
B	C Beckley T Munro	27/02/25
0		

GHD ABN 39 008 488 373
999 Hay Street,
Perth, WA 6000, Australia
T 08 6222 8222 | **F** 08 6222 8222 | **E** permail@ghd.com | **ghd.com**

[Compliance statement]

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1. Introduction

1.1 Proposal Description

Tronox is proposing to expand the existing Cooljarloo Mineral Sands Mine by developing a satellite pit named Osprey. The Osprey Expansion has a Disturbance Footprint of 61 hectares (ha), representing an increase in the existing project footprint by 1%. The Osprey satellite pit allows an additional 12 months mining, extending the life of the existing Cooljarloo Mine.

1.2 Background

Tronox Management Pty Ltd (Tronox) is the world's largest vertically integrated titanium dioxide (TiO_2) producer. Tronox operates a large mineral sands mining operation at Cooljarloo located approximately 20 kilometres (km) northwest of Cataby, and approximately 170 km north of Perth in Western Australia (WA) (Figure 1.1). The Cooljarloo Mineral Sands Project (hereafter the Cooljarloo Mine) first obtained approval under the *Environmental Protection Act 1986* (EP Act) in 1988. Since then, the Cooljarloo mine has been expanded four times with various amendments under Part IV of the EP Act outlined in Table 1.1.

Tronox are now proposing to amend the existing Part IV approval to include the addition of the Osprey orebody (the Proposal).

Table 1.1 Existing WA approvals

Proposal title	Approval	Date	Proposal description
Cooljarloo and Cooljarloo West Titanium Minerals Sands Project	Part IV Ministerial Statement 1158	22 Jan 2021	To conduct mineral sands mining at Cooljarloo and expand operations by developing the Cooljarloo West Titanium Minerals Project situated west of the existing Cooljarloo Mine. This includes: – Construction of a transportation channel – Construction of topsoil and overburden stockpiles – Dredge mining of Kestral, Harrier, Woolka North and Woolka South orebodies – Construction of tailings storage facility – Movement of the dredge and concentrator from Cooljarloo West back to the Cooljarloo Mine through the transportation channel.
Cooljarloo Mineral Sands Mine	Part V Licence L5319/1988/12	24 Nov 2023	Category 8: Mineral sands mining or processing: premises on which mineral sands ore is mined, screened, separated or otherwise processed
Mining Proposal - Cooljarloo Mineral Sands Operation – Revision 4 – J00485	ML70/1398	21 Dec 2023	Mining and processing operations at Cooljarloo were conducted in accordance with the Mineral Sands (Cooljarloo) Mining and Processing Agreement Act 1988 (the Cooljarloo Act) which was administered by the Department of Jobs, Tourism, Science and Innovation. The Cooljarloo Act came into effect in December 1998 and M268SA expired on 1 March 2020. Upon its expiry, the site was transitioned to a new Mining Lease, M70/1398, granted under the Mining Act 1978. This Mining Proposal was first submitted to assist with the transition from the Cooljarloo Act to ML70/1398. It consolidated all past and existing approvals and provides an overview of current disturbance relative to approved life of the existing mine disturbance

Proposal title	Approval	Date	Proposal description
Mine Closure Plan - Cooljarloo Mineral Sands Operation - Revision 4 – J00485	ML70/1398	20 Feb 2020	Current active Mine Closure Plan (MCP). A revised MCP (Revision 4) is currently being prepared by Tronox.

1.3 Purpose and scope

The Proposal is being referred to the Environmental Protection Authority (EPA) under Section 38 of the EP Act as the potential impacts may have a significant impact on the environment. The purpose of this document is to provide supporting information to enable the EPA to determine whether or not to assess the Proposal under Section 38G of the EP Act, and if so, the appropriate Level of Assessment.

This supporting document has been prepared in consideration of the following EPA guideline documents:

– Environmental Impact Assessment (Part IV Divisions 1 And 2) Administrative Procedures (EPA, 2021a)
– Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2021 (EPA, 2021b)
– Instructions: Referral of a Proposal Under Section 38 of the Environmental Protection Act (EPA, 2024a)

The intent of the supporting document is to provide an assessment of the potential impacts of the Proposal on identified environment factors.

The scope of the document includes:

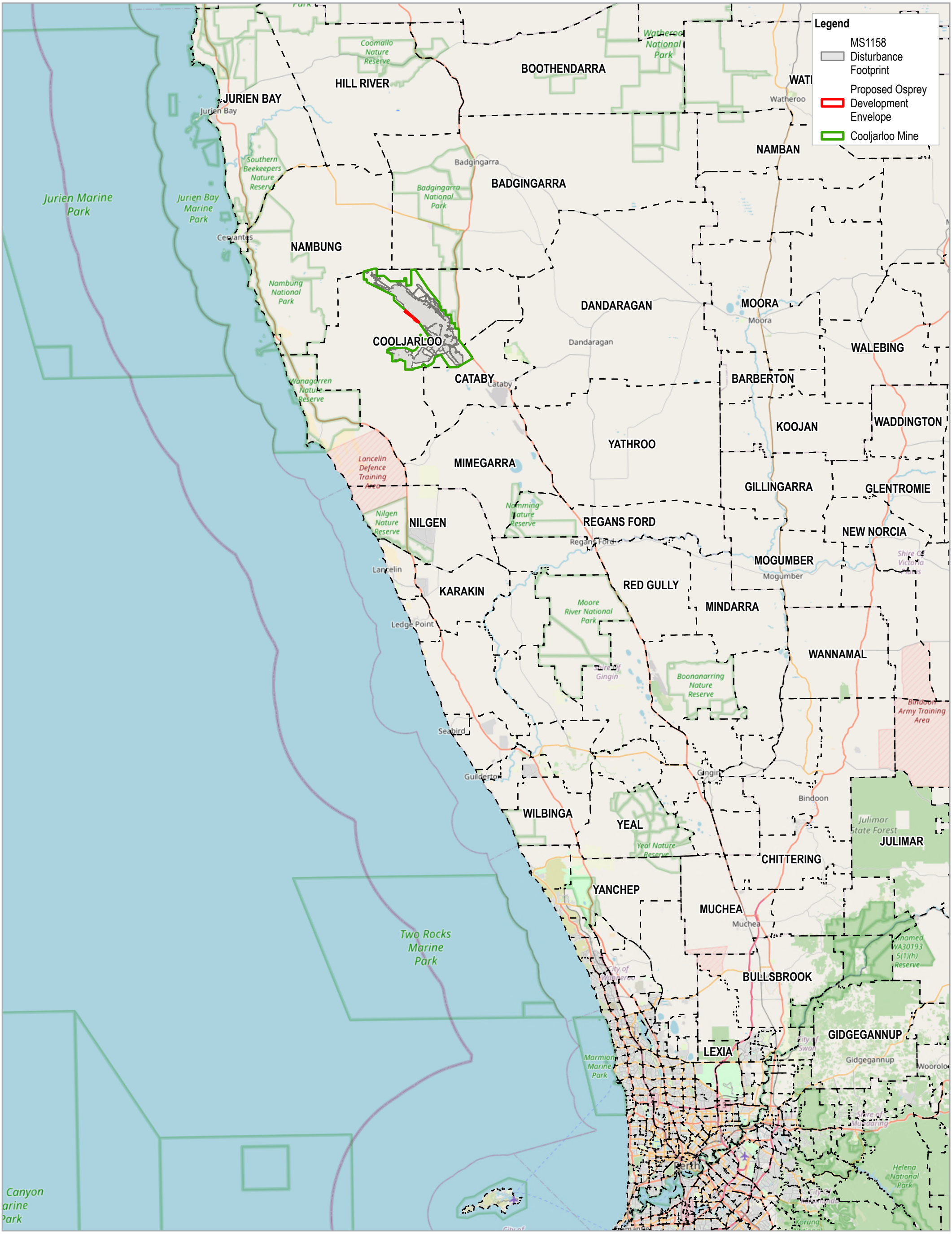
– Description of the operational components of the Proposal, and their extent, which have the potential to have a significant effect on the environment
– Description of the local and regional context within which the Proposal would be implemented, drawing upon proposal specific biological and other technical studies that have been completed
– Identification and description of the potential impacts resulting from the implementation of the Proposal
– Outline of the overarching mitigation strategies the Proponent would use to avoid, minimise, and manage potential adverse impacts.

1.4 Proponent details

Proponent details are provided in Table 1.2.

Table 1.2 Proponent details

Item	
Company	Tronox Management Pty Ltd
ACN/ABN	ACN: 009 343 364 ABN: 59 009 343 364
Address	Lot 22 Mason Road, Kwinana, WA 6167
Contact	Cindy Beckley Senior Environmental Approvals – MRD Email : Cindy.beckley@tronox.com



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Project Regional Location

Project No. **12649786**
Revision No. **2**
Date **01/03/2025**

FIGURE 1-1

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2. The Proposal

2.1 Overview

The Cooljarloo Mine has been operating for over 30 years and has a suite of existing approvals. Mining at Cooljarloo is undertaken using dry mining methods to access the upper to mid ore-bodies and dredge mining to access lower grade ore deeper in the profile. Both mining methods are described in Table 2.1.

Table 2.1 Current mining methods used at the Cooljarloo Mine

<table>
<tr><th>Dry Mining</th><th>Dredge Mining</th></tr>
<tr><td colspan="2">   </td></tr>
<tr><td colspan="2">The site is prepared by removing the overburden (5 to 20 m) to expose the ore body below the water table. Overburden material is either relocated to overburden dumps or used to fill mine voids elsewhere on the site. Overburden materials suitable for forming the upper soil profile during post-mining land forming will be preserved where practical.</td></tr>
<tr><td>Dewatering pumps are used to evacuate water from the active mining pit in areas below the water table. This water is generally utilised in the process or stored in water holding dams for later use.
Bulldozers push material into an in-pit hopper to screen the ore and remove oversize.
Water is then injected to create a slurry that is pumped to the trommel to remove the oversize.</td><td>Dual dredges are operated capable of mining to 25 m below the water surface. Ore is dredged then pumped via a floating pipeline to the wet concentrator situated behind the dredge in the pond.
Process water used at the concentrator is obtained from the dredge pond, nearby abstraction bores and decant water from the tailing dams. Water overflow from the various processes is recycled to the pond.
The ore slurry is screened through a trommel to remove oversize.</td></tr>
<tr><td colspan="2">The slurry ore is passed through a series of hydro-cyclones to separate the fine slimes fraction.</td></tr>
<tr><td colspan="2">The remaining ore is passed over the gravity spiral circuits which upgrade the ore to a heavy mineral concentrate (HMC).</td></tr>
<tr><td>Sand tails are deposited in nearby drying cells. Clay tails are deposited in external solar drying cells.</td><td>Sand tails are deposited in the dredge pond or nearby drying cells. Clay tails are deposited in external solar drying cells or remain in the dredge pond.</td></tr>
<tr><td colspan="2">HMC is pumped to a land-based stockpile where it is allowed to drain and is then transported by road for further processing at Tronox’s downstream processing plant at Chandala.</td></tr>
<tr><td colspan="2">Upon completion of ore extraction activities, mine voids are backfilled with tails and overburden to at least 1 m above the average pre-disturbance maximum groundwater level. The disturbed area is contoured to match surrounding landforms and drainage patterns.
Before use in landform reconstruction, materials are characterised to ensure they are suitable for their intended final position within the landform and soil profile.</td></tr>
<tr><td colspan="2">Rehabilitation transforms the new landform into land suitable for the post mining land use. This includes ripping soil profiles to relieve compaction from land forming activities, placing topsoil, initial site stabilisation through mulch, cover crops, or other means, and seeding with endemic species.</td></tr>
</table>

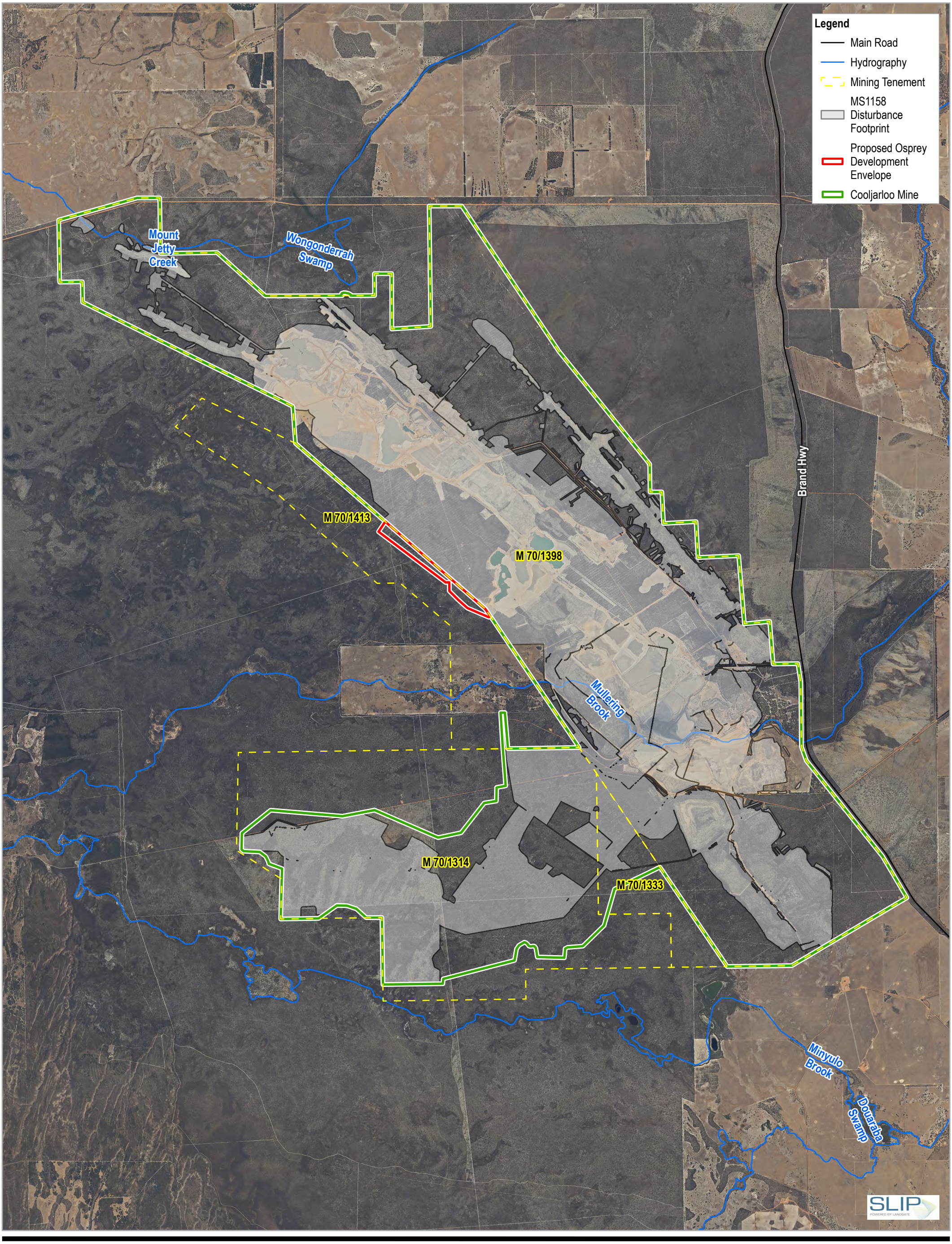
Exploration drilling identified an additional orebody (Osprey) on mining tenement M70/1413 adjacent to the western boundary of the existing Cooljarloo Mine (Figure 2.1). The Proposal Development Envelope (DE) including the Osprey orebody, associated infrastructure, and operational areas is expected to cover approximately 61 hectares (ha).

Tronox proposes to include the orebody into the Cooljarloo Mine Plan and dredge mine the ore as part of the existing operations. The floating feed preparation unit and primary concentrator from the existing Cooljarloo dredge mine will be used. The Heavy Mineral Concentrate (HMC) produced will be transported offsite to a Tronox downstream processing plant for further processing.

Key characteristics of the Proposal are presented in Table 2.2.

Table 2.2 Key Proposal characteristics

Proposed element	Location	Maximum extent, capacity, or range
Physical elements		
– Disturbance and vegetation clearing – Open pit below the water table – Topsoil stockpiles – Overburden stockpiles – Mine waste stockpiles	Figure 2.1	Up to 59.14 ha of vegetation clearing within a Development Envelope of 61 ha.
Rehabilitation		
Progressive rehabilitation will be undertaken throughout the life of mine where practicable. This will include back-filling of mine pits and revegetation with local flora. Rehabilitation will be undertaken to meet the following environmental objective: *"restoration of native vegetation communities that adequately represent the vegetation types that have been cleared"*.		
Proposal timeline		
– Active mining: 1 year – Operations phase: 1 year – Rehabilitation & decommissioning phase: 1-3 years		



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Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 50

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Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Osprey Development Envelope and the existing Cooljarloo Mine Development Envelope

Project No. **12649786**
Revision No. **3**
Date **01/03/2025**

FIGURE 2-1

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2.2 Rehabilitation

Rehabilitation of the Proposal will be undertaken as per existing rehabilitation measures (refer to Rehabilitation Management Plan (Appendix A)) employed for the existing Cooljarloo Mine, in accordance with Condition 9 of MS1158, and the current MCP in accordance with conditions of the Mining Lease (M70/1398).

2.3 Justification for the Proposal

The Proposal would result in community benefits for Australia and Western Australia by extending Tronox mining activities by approximately 1 year. Such benefits are realised through:

- Royalties and taxation payments
- Support of downstream processing industries, including processing HMC at the Tronox Chandala Processing plant into SR and further processing of SR into titanium pigments at the Tronox Kwinana pigment plant
- Employment and training opportunities
- Encouragement in the growth of ancillary industries in WA
- Sustaining demand for goods and services supporting the national, state and local economy
- Titanium dioxide produced from the mine is used to manufacture titanium which is listed as a critical mineral in Australia, and forms part of Australia's critical mineral strategy of and growing Australia's geostrategic and economic footprint. The Proposal also forms part of WA's Critical Mineral Strategy[1] whereby the supply of critical minerals enable global decarbonisation, underpins economic diversification and delivers meaningful outcomes for regional communities.
- The Proposal will provide contractual and full-time employment opportunities to local communities. Further employment opportunities would be created by flow-on effects to service industries and other sectors of the economy
- Optimisation of mineral resources and utilisation of existing infrastructure, such as mineral separation units, administration and camp facilities.

2.4 Proposal alternatives

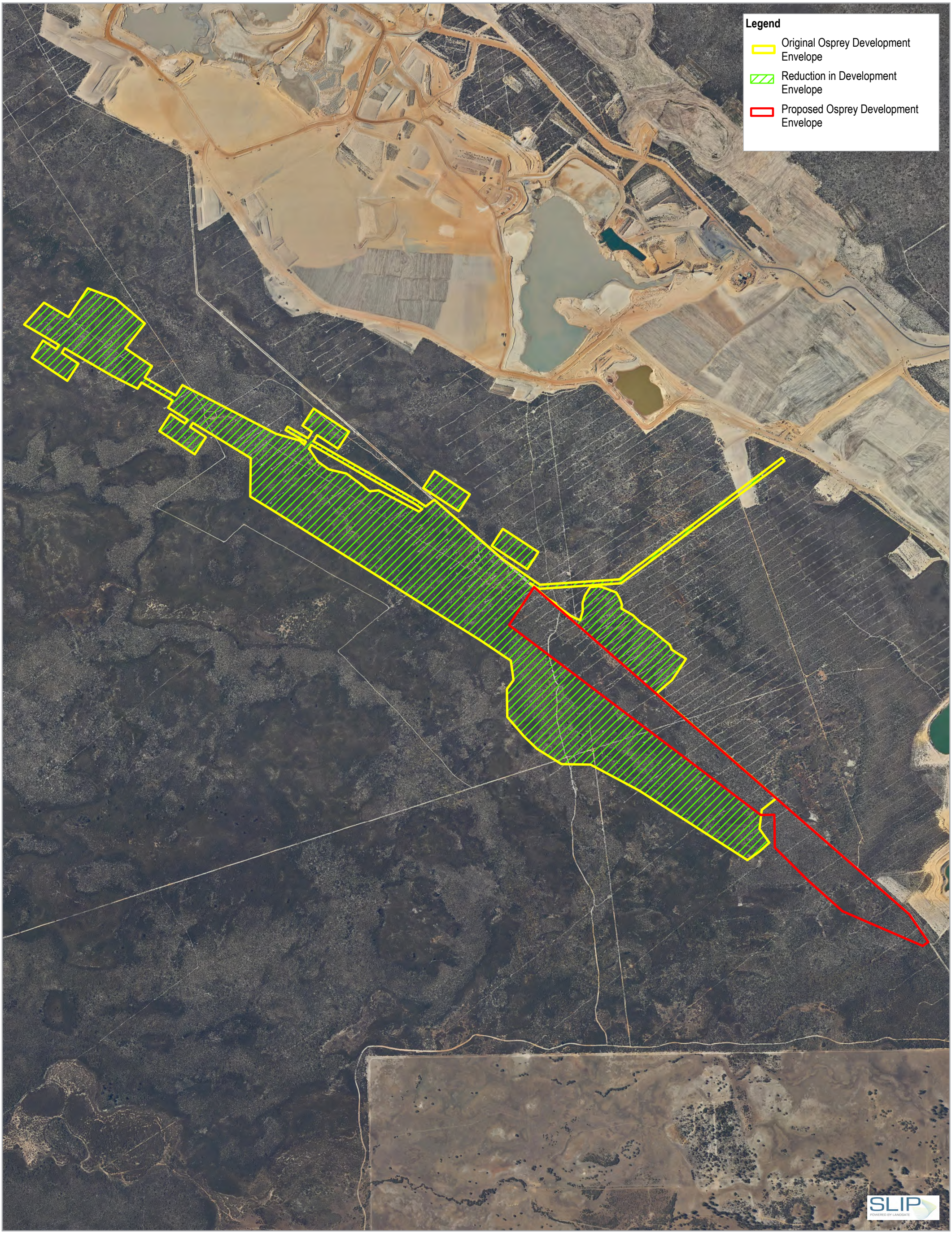
The original Proposal, first discussed with EPA Services in 2023, included both dry and dredge mining operations across a project area of approximately 256.6 ha (Refer Figure 2.2). Baseline environmental investigations were undertaken to support the development of the original project, including flora, vegetation, fauna and hydrogeological studies. The results from these studies identified a number of potentially significant impacts, including:

- Clearing conservation significant ecological communities, namely Banksia Woodlands of the Swan Coastal Plain PEC
- Clearing conservation significant flora species
- Clearing conservation significant fauna habitat, namely Carnaby's Cockatoo foraging habitat
- Impacts to vegetation as a result of the dewatering program required to support dry mining.

Tronox conducted a review of the mine planning and greater site operations and designed a revised Proposal project footprint, the proposed DE, and amended the mining method for the Proposal to dredge mining only. The revised design resulted in the following reduction of potential environmental impacts:

- Reduction of vegetation clearing impacts of 193 ha
- Reduction of clearing impacts to the Banksia Woodlands of the SCP TEC/PEC of approximately 29 ha
- Reduction of impacts to priority flora species
- Reduction of clearing impacts to Carnaby's Cockatoo foraging habitat of 188 ha
- Removal of groundwater drawdown and indirect impacts to GDEs

[1] **Western Australia's Battery and Critical Minerals Strategy 2024 - 2030**



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Tronox Management Pty Ltd
Environmental Approval Support for Osprey Project

Proposal Alternatives

Project No. **12649786**
Revision No. **1**
Date **17/02/2025**

FIGURE 2-2

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3. Assessment of environmental impacts

3.1 Environmental principles and factors

3.1.1 Environmental principles

Section 4A of the EP Act establishes the objectives and principles of the Act in accordance with the EPA Statement of Environmental Principles, Factors and Objectives. These are:

– The precautionary principle
– The principle of intergenerational equity
– Principles relating to improved valuation, pricing, and incentive mechanisms
– The principle of the conservation of biological diversity and ecological integrity
– The principle of waste minimisation.

Table 3.1 lists these environmental protection principles, which were considered throughout the preparation of this document.

Table 3.1 Principles of the EP Act

Principle	Consideration
1. The precautionary principle Where there are threats of serious irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and an assessment of the risk-weighted consequences of various options.	Baseline studies have been undertaken to understand the environmental and social values of the proposed Development Envelope. The studies have enabled the minimisation of any potential impacts in the design as far as practicable.
2. The principle of intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	Measures have been taken to minimise impacts on the environment so that ecological functions are maintained for future generations.
3. The principle of the conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integration should be a fundamental consideration.	The design and operation of the Proposal have been informed by ecological assessments and conducted in and around the Development Envelope to ensure biological diversity and ecological integrity of the area are maintained. Ecological considerations have been made on a regional scale to consider connectivity.
4. Principles relating to improved valuation, pricing, and incentive mechanisms Environmental factors should be included in the valuation of assets and services. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services,	Environmental goals have been established, and waste minimisation goals are to be realised throughout the project.

Principle	Consideration
including the use of natural resources and assets and the ultimate disposal of any waste. Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, which benefit and/or minimise costs to develop their own solutions and responses to environmental problems.	
5. The principle of waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	The waste hierarchy will be implemented in the Proposal, namely: – Avoidance of waste sources at the source – Reuse and recycling of materials where possible – Waste removal from site. – Extract additional usefulness of existing assets onsite by extending the mining life.

3.1.2 Identification of key environmental factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a proposal. The EPA has fourteen environmental factors organised into five themes: Sea, Land, Water, Air and People. The EPA assesses the significance of a proposal's environmental factor, as well as making a holistic assessment of the acceptability of the proposal against the EP Act principles.

Table 3.2 presents the environmental factors relevant to the Proposal, including the EPA's objective for each factor. Environmental factors are classified as key environmental factors where they may be significantly impacted by the Proposal.

Table 3.2 EPA environmental factors and their relevance to the Proposal

Theme	Factor	Objective	Relevance to Proposal	Key Environmental Factor?	Relevant section in this document
Sea	Benthic Communities and Habitats	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	N/A	No	
	Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	N/A	No	
	Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	N/A	No	
	Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	N/A	No	
Land	Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	The Proposal will require the clearing of native vegetation.	**Yes**	Section 4
	Landforms	To maintain the variety and integrity of significant physical landforms so that	No significant impact expected.	No	Summarised in Section 8 - Other

Theme	Factor	Objective	Relevance to Proposal	Key Environmental Factor?	Relevant section in this document
		environmental values are protected.			environmental factors
	Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	The Proposal is not expected to result in significant impacts to subterranean fauna. For completeness a desktop assessment has been undertaken	No	Summarised in Section 8 - Other environmental factors
	Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	The Proposal is not expected to result in significant impacts to terrestrial environmental quality.	No	Summarised in Section 8 - Other environmental factors
	Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	The Proposal will require clearing of fauna habitat.	**Yes**	Section 5
Water	Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The Proposal may affect surface water features.	**Yes**	Section 6
Air	Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	The Proposal is not expected to result in significant impacts to Air quality	No	Summarised in Section 8 - Other environmental factors
	Greenhouse Gas (GHG) Emissions	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change	The Proposal is unlikely to substantially increase greenhouse gas (GHG) emissions above the existing Cooljarloo Mine. However, as the Proposal is an expansion of an existing project it is included for completeness.	**Included for completeness**	Section 7
People	Social Surroundings	To protect social surroundings from significant harm.	Proposal is not expected to result in significant impacts to noise, visual amenity or Aboriginal heritage values.	No	Summarised in Section 8 - Other environmental factors
	Human Health	To protect human health from significant harm.	Proposal is not expected to result in significant impacts to Human health	No	Summarised in Section 8 - Other environmental factors

3.2 Studies and surveys

The table below (Table 3.3) outlines the studies and surveys that have been undertaken to inform the assessment of environmental impacts.

Table 3.3 Studies and surveys informing the assessment of environmental impacts

Study/Survey title	Date undertaken	Date published	Author	Appendix no.
Flora & Vegetation				
Cooljarloo West: *Phytophthora cinnamomi* occurrence assessment	2012	2012	Glevan Consulting	B1
Cooljarloo West: Wetlands, Watercourses & Groundwater Dependent Ecosystems Investigation	September 2012 – July 2013	October 2013	Syrinx Environmental	B2
Cooljarloo West Titanium Minerals Project: Flora and Vegetation Assessment	September – November 2012 and May 2013	January 2014	Woodman Environmental	B3
Conservation Significant Flora Risk Assessment	Desktop assessment	October 2015	Woodman Environmental	B4
Detailed Flora and Vegetation Assessment: Osprey Project	October 2022	February 2024	Umwelt	B5
Targeted Flora and Vegetation Assessment	October 2023 and December 2024	August 2024	Umwelt	B6
Fauna				
Cooljarloo West Proposal: Subterranean Fauna, Desktop Study and Methods Statement	Desktop assessment	April 2013	Bennelongia Environmental Consultants	B7
Cooljarloo West Proposal: Short Range Endemic Fauna, Pilot and Targeted Surveys. Final report	October – December 2012, March 2013	June 2013	Bennelongia Environmental Consultants	B8
Cooljarloo West Proposal: Pilot-Scale Stygofauna Survey	February 2013	June 2013	Bennelongia Environmental Consultants	B9
Tronox Annual Progress Report—2021. Fauna Investigations at Cooljarloo: North Mine, North Mine Rehabilitation and South Mine	2021	2022	Bamford Consulting Ecologist	B10
Level 1 Fauna and Targeted Black-Cockatoo Assessment of the Lone South and Osprey Survey Areas	November 2023, January 2024, November 2024	January 2025	Bamford Consulting Ecologists	B11
Heritage				
Aboriginal heritage survey for proposed Cooljarloo Mine expansion, near Cataby, Western Australia	March – April 2024	June 2024	Dortch & Cuthbert Heritage Futures	B12
Soils				
The Soil Landscapes of Cooljarloo Volume II		2004	Blandford	N/A
Hydrology				
Modelled groundwater drawdown – Cooljarloo Mine operations with planned Osprey expansion		February 2024	HGEO Pty Ltd	N/A

4. Flora and vegetation

The objective of the factor Flora and Vegetation is *'To protect flora and vegetation so that biological diversity and ecological integrity are maintained.'*

The EPA defines flora as native vascular plants, and vegetation as groupings of different flora patterned across the landscape that occur in response to environmental conditions.

4.1 Relevant policy and guidance

The following policy and guidance documents have been considered throughout this section:

– Environmental Factor Guideline Flora and Vegetation (EPA, 2016a)
– Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b)
– Conservation codes for Western Australia Flora and Fauna (DBCA, 2020).

4.2 Studies and surveys

Table 4.1 presents the relevant studies undertaken for the Proposal.

Table 4.1 Flora and vegetation studies and surveys

Survey	Date Published	Author
Flora and Vegetation Assessment (September to November 2012 and May 2013)	January 2014	Woodman Environmental
Conservation Significant Flora Risk Assessment	October 2015	Woodman Environmental
Detailed Flora and Vegetation Assessment: Osprey Project (October 2022)	February 2024	Umwelt
Targeted Flora and Vegetation Assessment (October 2023 and November 2024)	August 2024	Umwelt

4.2.1 Regional biogeography

The Interim Biogeographic Regionalisation of Australia (IBRA) bioregions are defined as large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. Their purpose is to capture the large-scale geophysical patterns that occur across the Australian continent (Thackway & Cresswell, 1995). These patterns influence fauna assemblages at the broad scale.

The DE is located within the Perth IBRA subregion (SWA2), near the junction with the Lesueur Sandplain subregion (GES02) (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023). The Perth subregion is a low lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah (*Eucalyptus marginata*) woodland. The outwash plains, once dominated by *Casuarina obesa-Corymbia calophylla* (Marri) woodlands and Melaleuca shrublands, are extensive only in the south (Department of Conservation and Land Management (DCLM), 2002a). The Lesueur Sandplain subregion comprises shrub-heaths rich in endemics on a mosaic of lateritic mesas, sandplains, coastal sands and limestones. Heath occurs on lateritised sandplains along the subregion's north-eastern margins (DCLM, 2002). The DE is also located within the Drummond Botanical Subdistrict of the Darling Botanical District Swan Coastal Plain Subregion (Beard, 2015).

4.2.2 Regional vegetation mapping

Broad-scale (1:250,000) Pre-European Vegetation Mapping (Department of Primary Industries and Regional Development (DPIRD), 2019) identified the entire DE to be mapped as vegetation association 1030: Low Woodland; *Banksia attenuata* and B. *menziesii*. Vegetation association 1030 has more than 30% remaining at the IBRA Bioregion, IBRA Subregion, and Local Government Authority (LGA) extents, which is above the threshold level (30%) at which the community is considered at risk of decline (EPA, 2000). Pre-European Vegetation Representation of vegetation association 1030 is presented in Table 4.2.

Vegetation association 1030, the Bassendean System, consists of a flat undulating plain with low ridges of bleached sand interspersed with swampy flats underlain by calcareous soils. On well drained soils Banksia woodlands are dominant, with trees ranging from 3 – 6 m in height. Beard (1979) noted that in the Banksia Low Woodlands there was considerable consistency in the overstorey, but less so in the understory. The swampy areas give rise to heaths of a mix of species including *Acacia lasiocarpa*, *Melaleuca acerosa*, *Banksia telmatiaea*, *Calytrix aurea*, *Calytrix flavescens*, *Verticordia densiflora* and *Verticordia drummondii*. Samphires and *Frankenia* spp. are found within salt pans, whereas deeper swamps typically consist of woodlands of *Melaleuca rhaphiophylla*, *Eucalyptus rudis* and *Banksia littoralis* over species such as *Hypocalymma angustifolium*, *Acacia rostellifera*, *Melaleuca thyoides* and *Casuarina obesa* (Beard, 1979).

Table 4.2 Pre-European vegetation representation (source: DBCA, 2019)

Pre-European vegetation association	Scale	Pre–European extent (ha)	Current extent (ha)	Percentage remaining	Percentage of current extent in DBCA managed land (proportion of pre-European extent)
Veg Assoc No. 1030	**Statewide** WA	139,013	88,950	64%	12%
	IBRA Bioregion Swan Coastal Plain	134,789	86,014	64%	11%
	IBRA Sub-region Perth	114,216	79,563	70%	11%
	Local Government Authority Shire of Dandaragan	121,005	80,779	67%	14%

4.2.3 Vegetation types

Vegetation mapping has been completed for the Project Footprint by Umwelt (2024a). This mapped portion contains 59.14 ha (96.9%) of native vegetation, which will require clearing for development. Four vegetation types were identified in the DE by the survey:

– D-A: Low woodland to isolated trees – 30.00 ha (49.2%)
– D-B: Low woodland to isolated trees – 3.38 ha (5.5%)
– W-C: Occasional low open woodland to isolated trees of mixed species – 20.56 ha (33.7%)
– W-E: Occasional low isolated trees – 5.20 ha (8.5%)

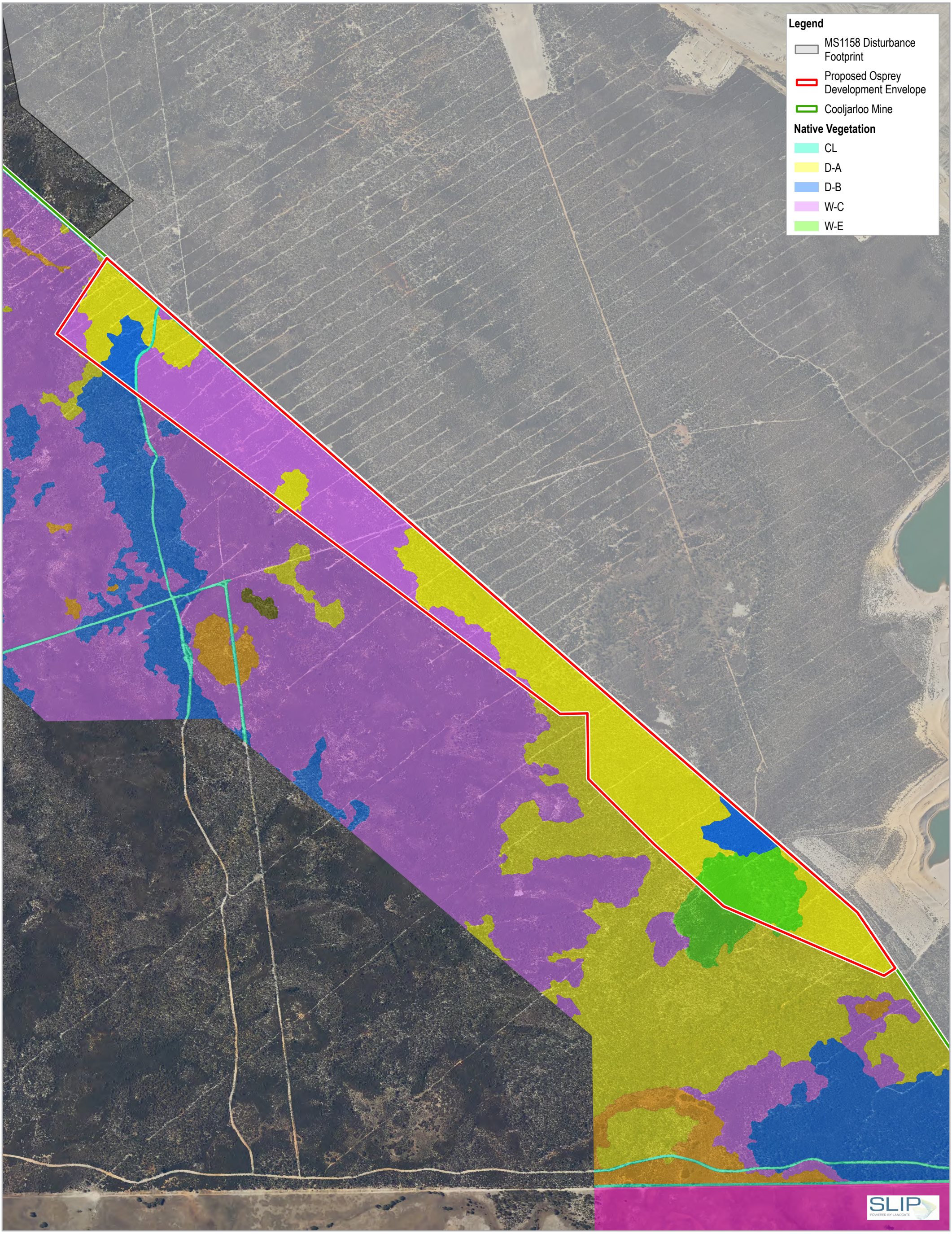
The remaining 1.86 ha (3.1%) was mapped as cleared land. Refer to Table 4.3 for vegetation type descriptions and Figure 4.1 for mapped native vegetation types within the DE.

Table 4.3 Summary of vegetation types within the Development Envelope

VT	Vegetation Description	Extent (ha) within the DE	Potential significance	Representative photo
D-A	**Description:** Low woodland to isolated trees of *Banksia attenuata* and *Banksia menziesii*, occasionally with *Eucalyptus todtiana* and *Nuytsia floribunda*, over mid isolated shrubs of *Xanthorrhoea preissii*, over low shrubland to sparse shrubland of mixed species dominated by *Bossiaea eriocarpa* and *Melaleuca clavifolia* and also *Hibbertia hypericoides* subsp. *hypericoides*, *Jacksonia nutans* and *Eremaea pauciflora* var. *pauciflora*, over low sparse sedgeland and bushland of mixed species including *Lepidosperma* cf. *pubisquameum*, *Alexgeorgea nitens* and *Mesomelaena pseudostygia*, over low sparse forbland of mixed species including *Dasypogon obliquifolius* and *Patersonia occidentalis* var. *occidentalis*, on grey or brown deep sands or sandy loam on plains or flats within undulating plains and slopes of low dunes. **Significant Taxa:** *Hypocalymma quadrangulare* (P3), *Poranthera asybosca* (P1).	30.00	**Local** Not considered significant in a local context. **Regional** Representative of 'Banksia Woodlands of the Swan Coastal Plain' EPBC TEC/DBCA PEC.	
D-B	**Description:** Low woodland to isolated trees of *Banksia attenuata* and *Banksia menziesii*, occasionally with *Eucalyptus todtiana* or *Banksia prionotes*, over mid open to sparse shrubland of mixed species dominated by *Allocasuarina humilis*, *Eremaea pauciflora* var. *pauciflora*, *Acacia pulchella* var. *glaberrima* and occasionally *Hakea trifurcata* and *Xanthorrhoea preissii*, over low open to sparse shrubland of mixed species dominated by *Hibbertia hypericoides* subsp. *hypericoides*, *Conospermum stoechadis* subsp. *stoechadis*, *Hibbertia striata*, *Stirlingia latifolia* and occasionally *Petrophile macrostachya*, over low sparse sedgeland and rushland of mixed species including *Lepidobolus preissianus* subsp. *preissianus* and *Mesomelaena pseudostygia*, on yellow-brown or grey deep sands or sandy loam on flats within undulating plains and slopes of low dunes. **Significant Taxa:** *Hypocalymma quadrangulare* (P3), *Poranthera asybosca* (P1), *Stylidium hymenocraspedum* (P3).	3.38	**Local** Not considered significant in a local context. **Regional** Representative of 'Banksia Woodlands of the Swan Coastal Plain' EPBC TEC/DBCA PEC.	

VT	Vegetation Description	Extent (ha) within the DE	Potential significance	Representative photo
W-C	**Description:** Occasional low open woodland to isolated trees of mixed species including *Nuytsia floribunda*, *Banksia menziesii*, *Banksia attenuata*, *Banksia prionotes* and *Melaleuca preissiana*, over mid closed to open heathland of mixed species dominated by *Banksia telmatiaea*, *Regelia ciliata*, *Hakea obliqua* subsp. *parviflora* and occasionally *Beaufortia squarrosa* and *Calytrix aurea*, over low heathland to sparse heathland of mixed species including *Melaleuca seriata*, *Verticordia densiflora* var. *densiflora*, *Isopogon panduratus* subsp. *palustris* (P3), *Acacia lasiocarpa* var. *lasiocarpa* and *Jacksonia hakeoides*, on grey, brown or yellow sandy loam or sand on seasonally damp to wet low-lying plains, flats, open depressions and swamps. **Significant Taxa:** *Anigozanthos viridis* subsp. *terraspectans* (T), *Babingtonia urbana* (P3), *Chordifex reseminans* (P2), *Conospermum scaposum* (P3), *Desmocladus nodatus* (P3), *Hypocalymma quadrangulare* (P3), *Isopogon panduratus* subsp. *palustris* (P3), *Lepyrodia curvescens* (P2), *Persoonia rudis* (P3), *Poranthera asybosca* (P1), *Schoenus griffinianus* (P4), *Verticordia lindleyi* subsp. *lindleyi* (P4).	20.56	**Local** Not considered significant in a local context. **Regional** Not considered significant in a regional context.	
W-E	**Description:** Occasional low isolated trees of *Melaleuca rhaphiophylla*, *Eucalyptus rudis* subsp. *rudis*, *Banksia littoralis* and/or *Banksia menziesii*, over tall sparse to isolated shrubs of mixed species including *Acacia saligna* subsp. Wheatbelt (B.R. Maslin 8602), *Exocarpos sparteus* and occasionally *Viminaria juncea*, *Melaleuca incana* subsp. *incana* and *Hakea varia*, over mid open to sparse heathland of *Banksia telmatiaea* and other species including *Kunzea micrantha* subsp. *petiolata*, *Regelia ciliata*, *Melaleuca teretifolia* and *Hakea trifurcata*, over low sparse shrubland of mixed species including *Xanthorrhoea preissii*, *Hypocalymma balbakiae*, *Melaleuca viminea* subsp. *viminea* and *Acacia lasiocarpa* var. *lasiocarpa*, on brown or grey clay loam or sandy loam on damp to wet flats or plains. **Significant Taxa:** *Isopogon panduratus* subsp. *palustris* (P3).	5.20	**Local** Not considered significant in a local context. **Regional** Not considered significant in a regional context.	

Source: Detailed Flora and Vegetation Assessment: Osprey Project (Umwelt, 2024a),Targeted Flora and Vegetation Assessment (Umwelt, 2024b).



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Environmental Approval Support for Osprey Expansion

Vegetation Types within the Development Envelope

Project No. **12649786**
Revision No. **4**
Date **01/03/2025**

FIGURE 4-1

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4.2.3.1 Vegetation condition

Vegetation mapping conducted by Umwelt (2024a) found 59.14 ha (96.9%) of the DE to be in 'Excellent' condition, while 1.86 ha (3.1%) was rated as 'Not Assessed' due to being cleared land.

4.2.4 Conservation significant ecological communities

Spatial data mapping (DBCA, 2022) identified five Threatened Ecological Communities (TECs) as potentially occurring within the DE. The field survey conducted by Umwelt (2024b) identified a total of three patches of the Banksia Woodland of the Swan Coastal Plain (SCP) Commonwealth endangered TEC / WA Priority Ecological Community (PEC), hereon referred to as the Banksia Woodlands of the SCP PEC. This ecological community comprises 33.37 ha (54.7%) of the DE. The Banksia Woodlands of the SCP PEC is listed as a Priority 3 Ecological Community in WA under the Department of Biodiversity, Conservation and Attractions (DBCA) classification (DBCA, 2023). Priority is not a listing category under the *Biodiversity Conservation Act 2016* (BC Act) and, therefore, does not have a specific statutory protection under the BC Act, rather a list maintained by the DBCA and published on the department's website. All surveyed patches of the Banksia Woodlands of the SCP PEC were determined to have a vegetation condition classification of Excellent (Umwelt, 2024b). Refer to Figure 4.2 for mapped Banksia Woodlands of the SCP PEC within the DE.

4.2.4.1 Banksia Woodlands of the Swan Coastal Plain PEC

The canopy of Banksia Woodlands of the SCP PEC is commonly dominated or co-dominated by Banksia *attenuata* and/or *B. menziesii*. Other Banksia species that can dominate in the community are *B. prionotes* or *B. ilicifolia*. It typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands; it is also common on sandy colluvium and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau and, in other less common scenarios (DBCA, 2023). The Priority Ecological Communities List (DBCA, 2023) states that *"the description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this Priority ecological community"*.

The Banksia Woodlands of the SCP PEC is restricted to the SCP IBRA bioregion and immediately adjacent areas, including the Dandaragan Plateau, from Jurien Bay in the north, to Dunsborough in the south, and northwest on the Whicher and Darling escarpments. The community typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands (Department of the Environment and Energy (DEE), 2016a).

A key diagnostic feature of this PEC is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The community is characterised by a high endemism and considerable localised variation in species composition across its range (DEE, 2016b).

Major threats to the Banksia Woodlands of the SCP include land clearing, phytophthora dieback, novel biota, introduced fauna and anthropogenic greenhouse gas emissions (DEE, 2016a). With many of the occurrences occurring within the greater Perth metropolitan area, the frequency of fires, impact of recreational users, weed invasion and incidence of illegal rubbish dumping are generally increased. These threats can all lead to degradation of vegetation and alteration of structure, species composition or loss of component taxa.

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Conservation Significant Ecological Communities mapped in the Development Envelope

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Date **01/03/2025**

FIGURE 4-2

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4.2.5 Flora diversity

A total of 348 discrete vascular flora taxa were recorded in the Survey Area by the 2022 survey, with 84 taxa identified within the DE (Umwelt, 2024a).

Extensive flora surveys have been undertaken throughout the region, providing good contextual information regarding flora taxa known of the region and their distribution. On a regional scale, a total of 624 taxa were recorded in a study of vegetation between the Moore River and Jurien (Griffin & Keighery, 1989); 2,847 flowering vascular plant taxa (including 1,964 native taxa) were subsequently recorded in 649 sites in the northern sandplain region between Geraldton and Perth (Griffin, 1994). Griffin and Keighery (1989) noted that it is likely that the flora in the northern sandplains region represents one fifth of the flora of WA.

A total of 1,156 discrete vascular flora taxa and 1 putative hybrid recorded within or immediately adjacent to the Study Area, representing 86 families and 318 genera (Woodman Environmental, 2014). The families with the highest number of taxa were Myrtaceae (134 taxa), Proteaceae (104 taxa), Fabaceae (98 taxa), Cyperaceae (67 taxa) and Asteraceae (64 taxa).

4.2.5.1 Introduced species

Umwelt (2024a) recorded 26 introduced (weed) taxa in the 2022 survey, including 11 within the DE. All introduced flora taxa were present in low numbers. No Declared Pests listed under the BAM Act or WoNS were recorded in the Survey Area.

A total of 93 introduced (weed) taxa within or immediately adjacent to the DE, two of which are Declared Pests (DP) listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), *Echium plantagineum* and *Moraea flaccida* (Woodman Environmental, 2014). *Echium plantagineum* (Paterson's Curse) produces large amounts of seed that can germinate at any time throughout the year; however, most germination occurs after substantial rains in autumn and winter. *Moraea flaccida* (One-leaf Cape Tulip) is a common weed of seasonally wet sites, pastures, woodlands, granite rocks and limestone heath throughout the Southwest of Western Australia. Density of introduced flora within the DE was generally low, contributing to the vegetation condition rating of Excellent. A previous 2012 study of DE identified 65 introduced taxa.

4.2.5.2 Threatened Flora

There were no flora species listed as Threatened under the BC Act identified in the DE during field surveys (Umwelt, 2024a; Umwelt, 2024b; Umwelt, 2024c).

4.2.5.3 Priority Flora

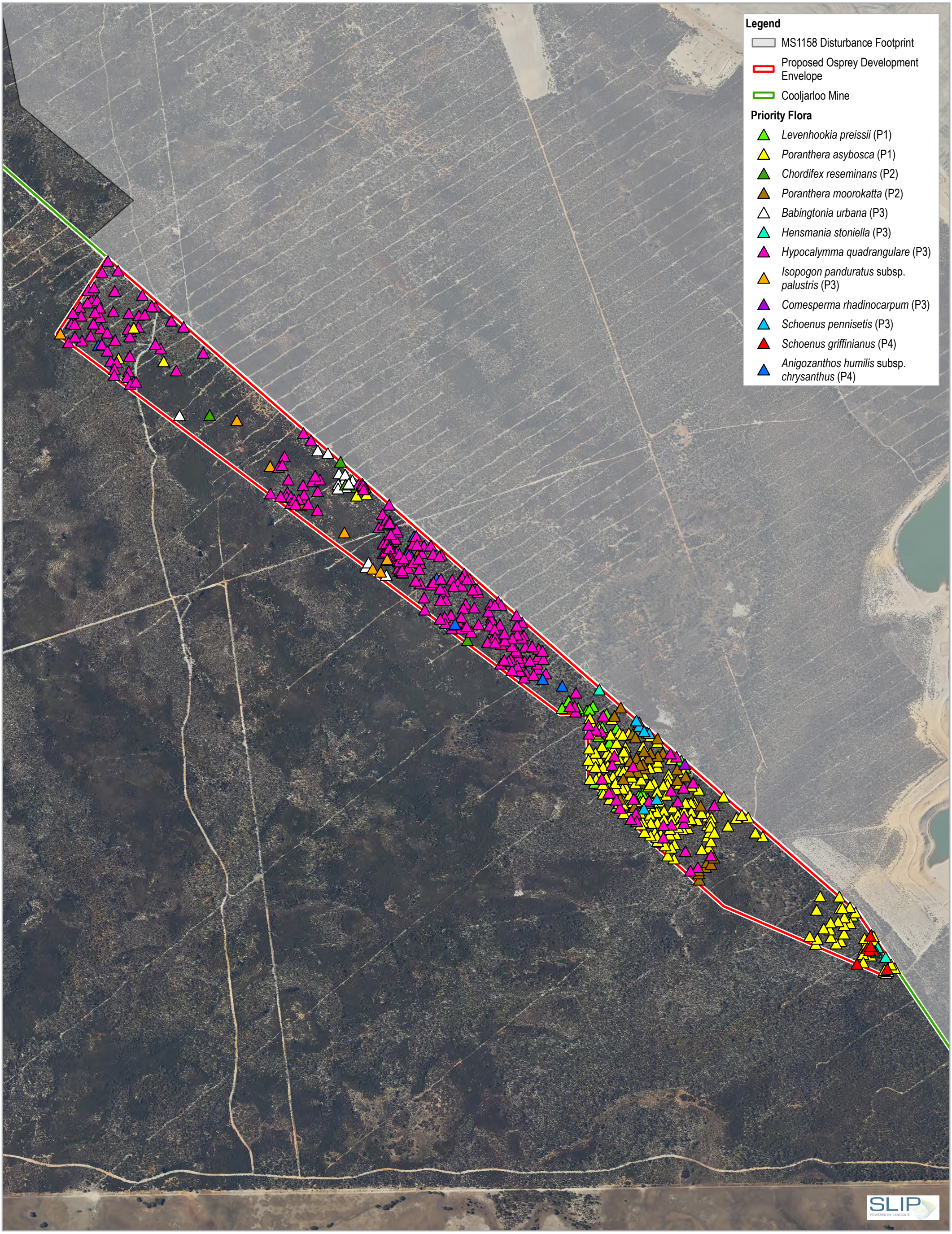
Twelve (12) Priority Flora species (Table 4.4) were recorded in the DE during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). Priority is not a listing category under the BC Act. The Priority Flora lists are maintained by the DBCA and are published on the department's website. Mapped locations of these priority species in the DE are presented in Figure 4.3.

Table 4.4 Priority Flora species recorded in the Development Envelope

Species	State listing status[1]	Number recorded
Levenhookia preissii	DBCA: P1	366
Poranthera asybosca	DBCA: P1	1588
Chordifex reseminans	DBCA: P2	10
Poranthera moorokatta	DBCA: P2	551
Babingtonia urbana	DBCA: P3	107
Comesperma rhadinocarpum	DBCA: P3	1
Hensmania stoniella	DBCA: P3	5
Hypocalymma quadrangulare	DBCA: P3	859
Isopogon panduratus subsp. *palustris*	DBCA: P3	45

Species	State listing status[1]	Number recorded
Schoenus pennisetis	DBCA: P3	196
Anigozanthos humilis subsp. *chrysanthus*	DBCA: P4	9
Schoenus griffinianus	DBCA: P4	22

[1] (DBCA, 2024a)



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Priority Flora recorded in the Development Envelope

Project No. **12649786**
Revision No. **5**
Date **01/03/2025**

FIGURE 4-3

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Data source: Landgate_Subscription_Imagery\WANow: . Created by: klabez

4.2.5.4 Significant flora descriptions

Descriptions of significant taxa recorded surveys in DE are provided in Table 4.5 (Umwelt, 2024b; Umwelt, 2024c).

Table 4.5 Significant flora recorded in the Project DE from field surveys

Species	State listing status	Description
Levenhookia preissii	DBCA: P1	*Levenhookia preissii* is an ephemeral herb with pink-red flowers, growing from 3 to 17 cm, occurring on winter-wet flats and wetlands with grey or brown sand (DBCA, 2024b). It has a geographical distribution of 230 km from Cervantes to Pinjarra; however, taxon is known from three disjunct areas, being the Cooljarloo area, Perth area and Pinjarra with approximately 17 populations recorded in DBCA databases (Umwelt, 2024b). *Levenhookia preissii* is ranked as a Priority 1 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Poranthera asybosca	DBCA: P1	*Poranthera asybosca* is a Small annual growing to 2 to 4.5 cm with reddish green stems, narrowly triangular stipules and pink to greenish calyx lobes present from September to October. This species generally occurs on white sand over laterite (DBCA, 2024b). It has a geographical distribution of approximately 100 km occurring from Beekeepers Nature Reserve to Wongonderrah; however, according to WA Herbarium, taxon is only known from two locations. Umwelt has made collections of the taxon from Arrowsmith to Cooljarloo, extending the known range to 150 km (Umwelt, 2024b). Approximately 2 populations are recorded in DBCA databases (or 110 locations including Umwelt records). *Poranthera asybosca* is ranked as a Priority 1 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Chordifex reseminans	DBCA: P2	*Chordifex reseminans* is a rhizomatous, erect, tufted, perennial rush growing to 0.9 m in height, occurring on flats and winter-wet depressions with white-grey sand over laterite, with flowers present from March to May (DBCA, 2024b). It has a geographical distribution of approximately 130 km occurring from Eneabba to Regans Ford, with approximately 29 populations recorded in DBCA databases (Umwelt, 2024b). *Chordifex reseminans* is ranked as a Priority 2 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Poranthera moorokatta	DBCA: P2	*Poranthera moorokatta* is a monoecious, erect herb growing to 5 cm in height with deeply dissected stipules and slender calyx lobes. This species generally occurs in open Banksia woodland on white silica sand in open spaces between shrubs, not in shaded areas or in areas of high litter cover (DBCA, 2024b). It has a geographical distribution of approximately 345 km occurring from Nambung National Park to Tutunup (near Busselton); however, taxon is known from three disjunct areas, being the Cooljarloo area, Gingin to Perth area and south of Capel, with approximately 15 populations recorded in DBCA databases (Umwelt, 2024b). *Poranthera moorokatta* is ranked as a Priority 2 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Babingtonia urbana	DBCA: P3	*Babingtonia urbana* is an erect slender shrub growing to 0.7 m in height with white or pale pink flowers present from January to March. This species generally occurs in low wet heath on winter-wet depressions, flats and swamps with brown or white clay loam, sometimes peaty (DBCA, 2024b). It has a geographical distribution of approximately 200 km occurring from Cooljarloo to west of Mundijong; however, taxon is known from three disjunct areas, being the Cooljarloo area, Perth area and near Moora with approximately 26 populations recorded in DBCA databases (Umwelt, 2024b). *Babingtonia urbana* is ranked as a Priority 3 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).

Species	State listing status	Description
Comesperma rhadinocarpum	DBCA: P3	*Comesperma rhadinocarpum* is a perennial herb to 0.5 m high with linear-elliptic leaves, and blue flowers on slender racemes. This species generally occurs on undulating plains, valley slopes and flats with grey, brown or yellow sandy loam or sand (DBCA, 2024b). It has a main distribution 550 km north-south from Port Gregory to Kenwick, with disjunct records at Koolyanobbing and Great Victoria Desert extending east-west distribution to 850 km, with approximately 18 populations recorded in DBCA databases (Umwelt, 2024b). *Comesperma rhadinocarpum* is ranked as a Priority 3 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Hensmania stoniella	DBCA: P3	*Hensmania stoniella* is a tufted, stilt-rooted perennial herb growing to 0.2 m in height with yellow-cream-white flowers present from September to November. This species generally occurs on white, grey or lateritic sand, often in winter-wet areas, sandplains, flats and slopes (DBCA, 2024b). It has a geographical distribution of approximately 200 km occurring from Arrowsmith East to Regans Ford with approximately 47 populations recorded in DBCA databases (Umwelt, 2024b). *Hensmania stoniella* is ranked as a Priority 3 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Hypocalymma quadrangulare	DBCA: P3	*Hypocalymma quadrangulare* is an erect, multi-stemmed shrub with square shaped stems growing to 0.2 m in height with yellow flowers present from July to October. This species generally occurs in Banksia woodlands on lower slopes with grey or yellow sand (DBCA, 2024b). It has a geographical distribution of approximately 100 km occurring from Badgingarra to Yeal. There are approximately 9 populations recorded in DBCA databases (excluding a cultivated record at the WA Herbarium) (Umwelt, 2024b). *Hypocalymma quadrangulare* is ranked as a Priority 3 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Isopogon panduratus subsp. *palustris*	DBCA: P3	*Isopogon panduratus* subsp. *palustris* is an erect, robust, multi-stemmed spreading shrub growing to 2 m in height with pale pink flowers from August to November. This taxon occurs on sand and sandy clay in winter-wet areas and low-lying flats (DBCA, 2024b). *Isopogon panduratus* subsp. *palustris* has a geographical range of approximately 33 km with records from Nambung to Cooljarloo with approximately 23 populations recorded in DBCA databases (Umwelt, 2024b). *Isopogon panduratus* subsp. *palustris* is ranked as a Priority 3 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Schoenus pennisetis	DBCA: P3	*Schoenus pennisetis* is a tufted annual, grass-like sedge growing to 15 cm with purple-black flowers generally occurring in winter-wet flats, wetlands and valley floors with grey, yellow or brown sandy loam (DBCA, 2024b). It has a geographical distribution of 675 km from near Mullewa to Wamballup Nature Reserve (northwest of Mount Barker) with approximately 44 populations recorded in DBCA databases (Umwelt, 2024b). *Schoenus pennisetis* is ranked as a Priority 3 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).
Anigozanthos humilis subsp. *chrysanthus*	DBCA: P4	*Anigozanthos humilis* subsp. *chrysanthus* is a small rhizomatous herb to 0.8 m with multiple stems each arising from a leaf joint and golden yellow catspaw flowers present from July to October. This species generally occurs in Banksia woodland and low wet heath on slopes, plains, winter-wet areas with white, grey or yellow sand (DBCA, 2024b). It has a geographical distribution of approximately 160 km occurring from Cooljarloo to Clackline, with approximately 65 populations recorded in DBCA databases (Umwelt, 2024b). *Anigozanthos humilis* subsp. *chrysanthus* is ranked as a Priority 4 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a).

Species	State listing status	Description
Schoenus griffinianus	DBCA: P4	*Schoenus griffinianus* is a small, tufted perennial sedge to 0.1 m high generally occurring on sandplains and flats with white-grey sand (DBCA, 2024b). It has a geographical distribution of approximately 560 km from Geraldton to Perth, with disjunct records at Wongan Hills and Lake Grace and 44 populations recorded in DBCA databases (Umwelt, 2024b). *Schoenus griffinianus* is ranked as a Priority 4 flora under the DBCA Threatened and Priority Flora List (DBCA, 2024a)

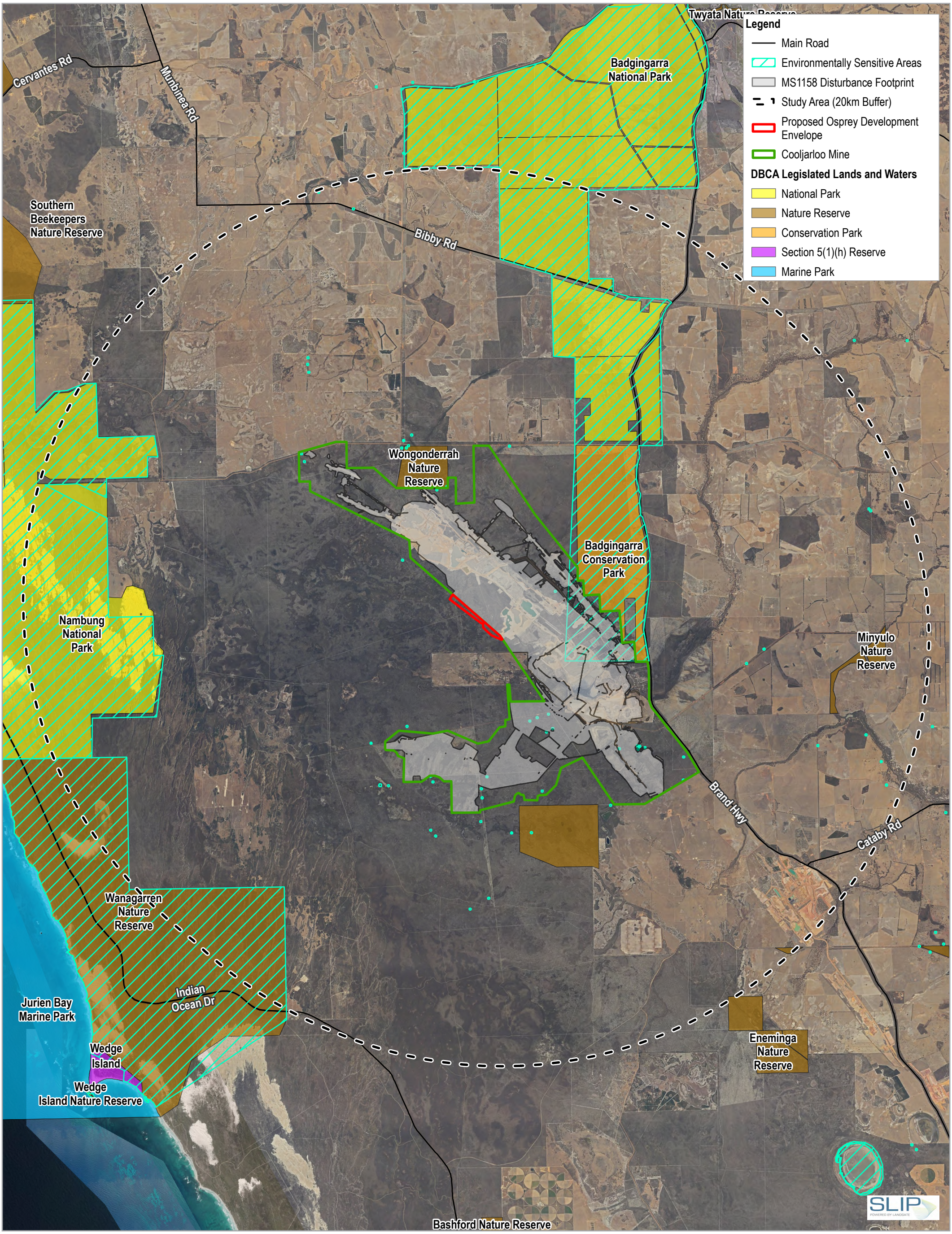
4.2.6 Conservation areas

4.2.6.1 Conservation Reserves

The DE does not intersect any Conservation Reserves (DBCA, 2024c). The nearest conservation reserve is Wongonderrah Nature Reserve approximately 5 km to the north. See Figure 4.4 for regional mapping of Reserves and Conservation Areas.

4.2.6.2 Environmentally Sensitive Areas

The DE does not intersect any Environmentally Sensitive Areas (ESAs), as defined under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (DWER, 2021a). The nearest Environmentally Sensitive Area is located approximately 3 km to the east and is associated with a Register of the National Estate. See Figure 4.4 for regional mapping of ESAs.



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Environmental Approval Support for Osprey Expansion

Reserves and Conservation Areas

Project No. **12649786**
Revision No. **3**
Date **01/03/2025**

FIGURE 4-4

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4.3 Potential impacts

Potential direct impacts to flora and vegetation values from the Proposal include:

– Clearing of 59.14 ha of native vegetation including:
  - 59.14 ha of vegetation in Excellent condition
  - 33.37 ha of Banksia woodlands of the SCP PEC
– Clearing of priority flora species including:
  - 366 individuals of *Levenhookia preissii* (DBCA: P1)
  - 1588 individuals of *Poranthera asybosca* (DBCA: P1)
  - 10 individuals of *Chordifex reseminans* (DBCA: P2)
  - 551 individuals of *Poranthera moorokatta* (DBCA: P2)
  - 107 individuals of *Babingtonia urbana* (DBCA: P3)
  - 1 individual of *Comesperma rhadinocarpum* (DBCA: P3)
  - 5 individuals of *Hensmania stoniella* (DBCA: P3)
  - 859 individuals of *Hypocalymma quadrangulare* (DBCA: P3)
  - 45 individuals of *Isopogon panduratus* subsp. *palustris* (DBCA: P3)
  - 196 individuals of *Schoenus pennisetis* (DBCA: P3)
  - 9 individuals of *Anigozanthos humilis* subsp. *chrysanthus* (DBCA: P4)
  - 22 individuals of *Schoenus griffinianus* (DBCA: P4).

The Proposal also has the potential to result in the following indirect impacts to vegetation and flora values:

– Fragmentation of native vegetation and flora habitat
– Introduction and/or spread of weeds
– Introduction and/or spread of *Phytophthora* dieback
– Alteration to hydrology
– Generation of dust.

4.3.1 Loss of vegetation and flora

4.3.1.1 Vegetation complexes and types

The Proposal will result in the direct clearing of up to 59.14 ha of native vegetation. Clearing of vegetation will result in changes to the remaining extent of vegetation complexes. The national objectives and targets for biodiversity conservation in Australia have been set to prevent clearance of ecological communities with less than 30% of their pre-European extent as below this value, species loss appears to accelerate exponentially (Commonwealth of Australia, 2001).

The Government of Western Australia has assessed vegetation complexes mapped against presumed pre-European extents within the SCP IBRA bioregion and LGA levels (Table 4.2).The Bassendean vegetation system (ID 1030) covers the extent of the DE and has over 60% of its pre-European extent remaining at all scales (DPIRD, 2019). The proposed vegetation clearing of 59.14 ha within the DE amounts to 0.07% of the local and SCP scale of the Bassendean vegetation system in WA.

4.3.1.2 Significant ecological communities

The Proposal will result in the clearing of 33.37 ha of the Banksia woodlands of the SCP PEC which is in Excellent condition. Table 4.6 presents a patch analysis for patches of Banksia Woodlands of the SCP PEC that intersect with the DE. Clearing for this Proposal is not likely to result in the ecological community being listed as a TEC. Banksia woodlands of the SCP in the DE is also considered to be foraging habitat for the Carnaby's Black Cockatoo.

Table 4.6 Banksia Woodlands of the SCP PEC Patch Analysis

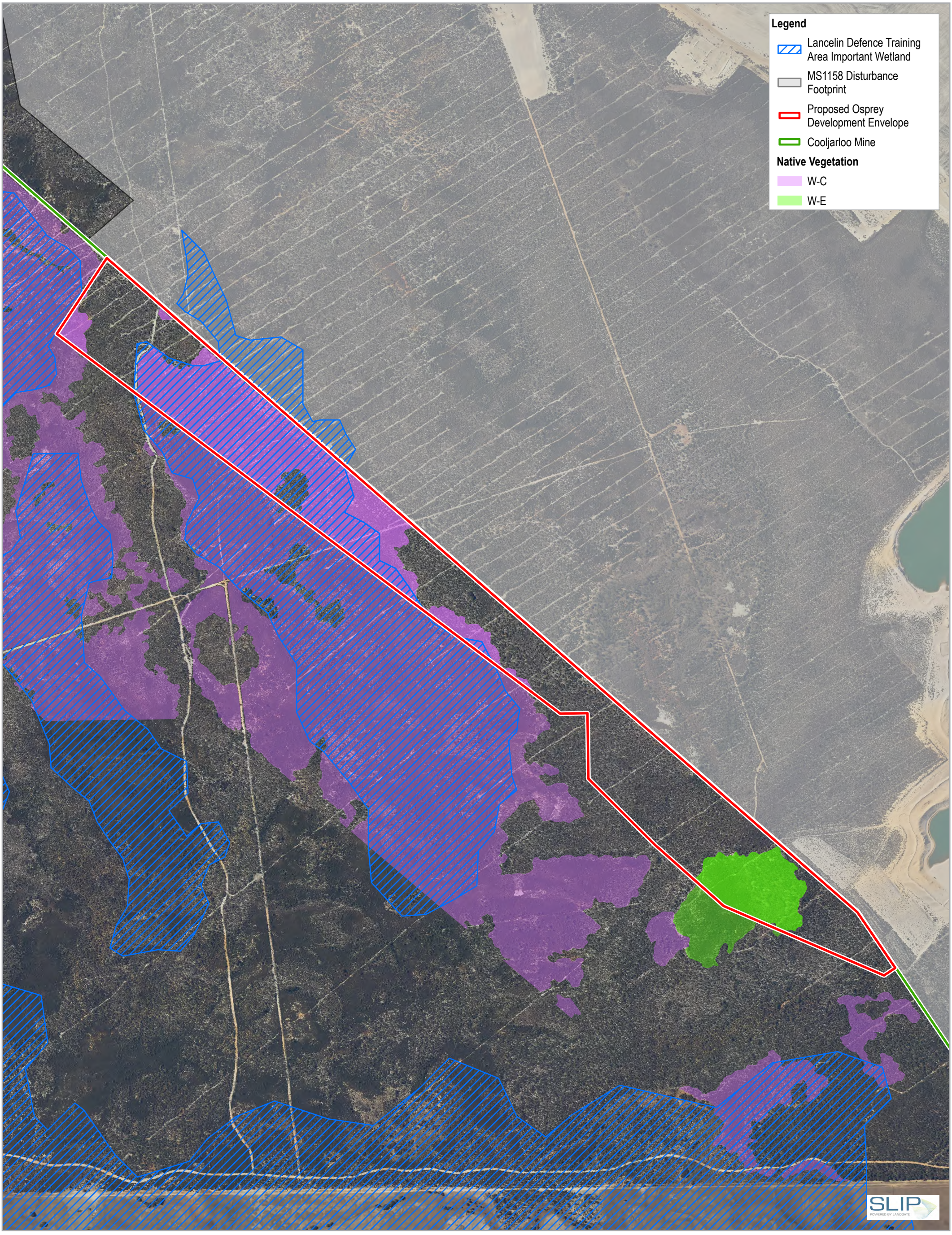
Potential Patch Number	Area Mapped in Detailed Survey (ha)[1]	Area to be cleared in DE (ha)	Remaining patch size after clearing (ha)	Criteria outcome after clearing[2]
12	25.02	6.56	18.46	
24	0.92	0.86	0.06	No longer meets minimum patch size
26	99.06	25.95	73.11	

[1](Umwelt, 2024a), (DEE, 2016b) [2];

4.3.1.3 Wetland and groundwater dependent vegetation (GDV)

The Proposal will result in the clearing of vegetation that grows in association with seasonally inundated soils. There is approximately 17 ha of native vegetation in the DE that intersects with the Lancelin Defence Training Area, a classified important wetland. Vegetation types W-C (20.56 ha) and W-E (5.20 ha) within the DE were recorded to have obligate and facultative phreatophytes, and are therefore likely to represent GDV, as well as likely having some dependence on surface water flows (Umwelt, 2024a). Vegetation types D-A and D-B contain co-dominant facultative phreatophytes, and therefore potentially represent GDV where the depth to groundwater is less than 10 metres below ground level (mbgl). Figure 4 maps the Lancelin Defence Training Area and vegetation types W-C and W-E.

The clearing of vegetation in these vegetation types could potentially disrupt water dependent ecosystems (Umwelt, 2024a). To mitigate these effects revegetation will include reconstitution of landforms and re-vegetation with local flora species present pre-mining.



Paper Size ISO A3
at Scale: 1:10,000

0 100 200 300 400

Meters

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Wetland and Groundwater Dependent Vegetation

Project No. **12649786**
Revision No. **1**
Date **01/03/2025**

FIGURE 4-5

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4.3.2 Clearing of conservation significant flora

The Proposal will affect the following Priority Flora through clearing:

- *Levenhookia preissii* (DBCA: P1)
- *Poranthera asybosca* (DBCA: P1)
- *Chordifex reseminans* (DBCA: P2)
- *Poranthera moorokatta* (DBCA: P2)
- *Babingtonia urbana* (DBCA: P3)
- *Comesperma rhadinocarpum* (DBCA: P3)
- *Hensmania stoniella* (DBCA: P3)
- *Hypocalymma quadrangulare* (DBCA: P3)
- *Isopogon panduratus* subsp. *palustris* (DBCA : P3)
- *Schoenus pennisetis* (DBCA: P3)
- *Anigozanthos humilis* subsp. *chrysanthus* (DBCA: P4)
- Schoenus griffinianus (DBCA: P4).

Umwelt (2024b; 2024c) recorded single individuals of the above flora in the DE (Figure 4.3). Refer to Sections 4.3.2.1 to 4.3.2.12 and Table 4.7 for potential impacts to priority species recorded in the DE during the Umwelt (2024b; 2024c) surveys. Note that known local extent is defined as the combined areas of the DE, Cooljarloo West Study Area (Woodman Environmental, 2015) and Targeted Survey Area (Umwelt, 2024b), noting that there remains unsurveyed areas of vegetation and suitable habitat within the local area. Significance of impacts to Priority Flora is discussed in sections 4.3.2.1 to 4.3.2.12 below.

4.3.2.1 *Levenhookia preissii* (Priority 1)

Within the DE, 366 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of 230 km from Cervantes to Pinjarra and is known from three disjunct areas: the Cooljarloo area, Perth area, and Pinjarra, with approximately 17 populations recorded in DBCA databases. Given the large known range and 17 populations in its known range, the Proposal will result in a local impact, however it is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.2 *Poranthera asybosca* (Priority 1)

Within the DE, 1588 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). The species has a geographical distribution of approximately 100 km occurring from Beekeepers Nature Reserve to Wongonderrah. Umwelt has made collections of the taxon from Arrowsmith to Cooljarloo, extending the known range to 150 km (Umwelt, 2024b). Two populations are recorded in the WA Herbarium but including Umwelt records approximately 110 populations are known. Given the large known range and 110 populations in its known range, the Proposal will result in a local impact, however it is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.3 *Chordifex reseminans* (Priority 2)

Within the DE, 10 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of approximately 130 km from Eneabba to Regans Ford, with approximately 29 populations recorded in DBCA databases. While the Proposal will impact on the local population of this species, given the large range with 29 populations and that a large proportion of local records are located outside the DE the Proposal is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.4 *Poranthera moorokatta* (Priority 2)

Within the DE, 551 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of approximately 345 km from Nambung National Park to Tutunup, with three disjunct areas: the Cooljarloo area, Gingin to Perth area, and south of Capel. It is known from approximately 15 populations recorded in DBCA databases. Given the large known range and 15 populations in its known range,

the Proposal will result in a local impact, however it is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.5 *Babingtonia urbana* (Priority 3)

Within the DE, 107 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of approximately 200 km from Cooljarloo to west of Mundijong, with three disjunct areas: the Cooljarloo area, Perth area, and near Moora. It is known from approximately 26 populations recorded in DBCA databases. While the Proposal will impact on the local population of this species, given the large range with 26 populations and that a large proportion of local records are located outside the DE, the Proposal is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.6 *Comesperma rhadinocarpum* (Priority 3)

Within the DE, 1 individual was recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a main distribution of 550 km north-south from Port Gregory to Kenwick, with disjunct records at Koolyanobbing and Great Victoria Desert extending the east-west distribution to 850 km. It is known from approximately 18 populations recorded in DBCA databases. While the Proposal will impact on the local population of this species, given the large range with 18 populations and that a large proportion of local records are located outside the DE, the Proposal is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.7 *Hensmania stoniella* (Priority 3)

Within the DE, 5 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of approximately 200 km from Arrowsmith East to Regans Ford, with approximately 47 populations recorded in DBCA databases. While the Proposal will impact on the local population of this species, given the large range with 47 populations and that a large proportion of local records are located outside the DE, the Proposal is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.8 *Hypocalymma quadrangulare* (Priority 3)

Within the DE, 859 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of approximately 100 km from Badgingarra to Yeal, with approximately 9 populations recorded in DBCA databases (excluding a cultivated record at the WA Herbarium). While the Proposal will impact on the local population of this species, given the large range with 9 populations and that a large proportion of local records are located outside the DE, the Proposal is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.9 *Isopogon panduratus* subsp. *palustris* (Priority 3)

Within the DE, 45 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical range of approximately 33 km with records from Nambung to Cooljarloo, with approximately 23 populations recorded in DBCA databases. While the Proposal will impact on the local population of this species, given the large range with 23 populations and that a large proportion of local records are located outside the DE, the Proposal is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.10 *Schoenus pennisetis* (Priority 3)

Within the DE, 196 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of 675 km from near Mullewa to Wamballup Nature Reserve (northwest of Mount Barker), with approximately 44 populations recorded in DBCA databases. While the Proposal will impact on the local population of this species, given the large range with 44 populations and that a large proportion of local records are located outside the DE, the Proposal is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.11 *Anigozanthos humilis* subsp. *chrysanthus* (Priority 4)

Within the DE, 9 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of approximately 160 km from Cooljarloo to Clackline, with approximately

65 populations recorded in DBCA databases. Given the large known range and 65 populations in its known range, the Proposal will result in a local impact, however it is unlikely to significantly impact the regional extent or viability of this species.

4.3.2.12 *Schoenus griffinianus* (Priority 4)

Within the DE, 22 individuals were recorded during recent field surveys (Umwelt, 2024b; Umwelt, 2024c). This species has a geographical distribution of approximately 560 km from Geraldton to Perth, with disjunct records at Wongan Hills and Lake Grace, and 44 populations recorded in DBCA databases. While the Proposal will impact on the local population of this species, given the large range with 44 populations and that a large proportion of local records are located outside the DE, the Proposal is unlikely to significantly impact the regional extent or viability of this species.

Table 4.7 Potential impacts to conservation significant species recorded in the Development Envelope

Taxon	State cons sig	Commonwealth con sig[1]	Individuals in the DE[3, 4]	Records in the Cooljarloo West (CW) Study Area[5]	Individuals in the Targeted Survey (TS) Area[3]	WA Herbarium Records[6]	Approximate Regional Populations [3, 6]
Levenhookia preissii	DBCA: P1	-	366	-	27	17	9
Poranthera asybosca	DBCA: P1	-	1588	-	716	2 (or 110 locations including Umwelt records)	16 (including consideration of Umwelt records)
Chordifex reseminans	DBCA: P2	-	10	35	319	29	21
Poranthera moorokatta	DBCA: P2	-	551	-	50	15	14
Babingtonia urbana	DBCA: P3	-	107	1,915	7,517	26	13
Comesperma rhadinocarpum	DBCA: P3	-	1	-	20	18	17
Hensmania stoniella	DBCA: P3	-	5	134	5	47	37
Hypocalymma quadrangulare	DBCA: P3	-	859	-	7,755	9	7
Isopogon panduratus subsp. *palustris*	DBCA: P3	-	45	4,771	4,796	23	20
Schoenus pennisetis	DBCA: P3	-	196	1,759	66	44	35
Anigozanthos humilis subsp. *chrysanthus*	DBCA: P4	-	9	5	10	65	32
Schoenus griffinianus	DBCA: P4	-	22	275	16	44	39

[1]EPBC Act; [2](Atlas of Living Australia, 2024), [3](Umwelt, 2024b); [4] (Umwelt, 2024c); [5](Woodman Environmental, 2015); [6] (DBCA, 2024b)
* Likely not representative of actual impact due to lack of data

4.3.3 Indirect impacts

4.3.3.1 Fragmentation of native vegetation and flora habitat

The potential for habitat fragmentation is most likely to occur where vegetation and flora with limited populations exist immediately adjacent to areas of disturbance associated with the Proposal. Native vegetation is already fragmented due the existing Cooljarloo mining area; however, the Proposal involves the clearing of previously undisturbed patches of native vegetation. The Proposal will involve clearing which attaches the eastern side of the DE with the current operating site which will reduce fragmentation of vegetation and flora habitat. The large majority of area surrounding the Proposal is within uncleared native Unallocated Crown Land (UCL) with the remainder being freehold land cleared in the early 1970's. Consistent with the native vegetation of the Northern Sandplains, UCL areas surrounding the Proposal are considered to have a high biodiversity value (Tronox, 2013).

4.3.3.2 Introduction and/or spread of weeds

The distribution of weeds within the DE is generally low but variable, with wetland areas being more prone to invasion by introduced flora taxa. The highest risk of weed spread is likely to be associated with importation of contaminated material on vehicles or for mining activities. The spread of weeds in areas cleared for the Proposal from surrounding areas may result in further intrusion into surrounding vegetation, especially if that vegetation is under stress due to groundwater drawdown or another disturbed state.

The implementation of existing weed hygiene measures are expected to reduce the Proposal's risk of introduction and spread of weeds. The Proposal is not expected to result in the introduction or spread of weeds that could result in significant impacts on vegetation and flora.

4.3.3.3 *Phytophthora* dieback

The DE is located within a dieback risk area as it receives more than 400 mm of average annual rainfall and is south of the 26˚ parallel (DBCA, 2024d). Weather data from nearby weather stations are provided in Table 4.8. Furthermore, the DE is in the Drummond Botanical Subdistrict which typically experiences predominantly winter rainfall with 600 to 1,000 millimetres (mm) annually (Beard, 2015).

The *Phytophthora cinnamomic* occurrence assessments by Glevan Consulting (2012) throughout the life of the Cooljarloo operations have recorded the presence of *Phytophthora cinnamomi* from several places adjacent to Cooljarloo near Cooljarloo West and within the creek system on Munbinea Road at Jurien. Sites of P. *cinnamomi* infestation also occur along the Brand Highway roadside vegetation near Cataby. The infestations near Cataby and Cooljarloo West do not affect the management of activities at Cooljarloo. Recoveries of *P. multivora* have also been made in the vegetation adjacent to the Brand Highway.The spread of *phytophthora* dieback from vehicle movements, introduced material, earthworks or surface and/or subsurface water flow have the potential to introduce and spread dieback within the DE. The introduction of dieback with the DE may result in significant impacts considering the large proportion of vegetation at the site susceptible to dieback and the high conservation significance of some of the areas at the greatest risk of dieback establishment.

Tronox will undertake *Phytophthora* dieback surveys of the DE and existing hygiene management measures will be implemented. The Proposal will adopt the dieback hygiene measures outlined in the EMP to reduce the risk of introduction and spread of dieback as well as protect adjacent vegetation that may be uninfected and vulnerable (Appendix A).

Table 4.8 Mean annual rainfall of nearest Bureau of Meteorology (BoM) weather stations (source: BoM, 2024a))

Year	Nambung Station (9276)	Dandaragan West (9014)	Lancelin (Defence) (9280)	Badgingarra Research Station (9037)
2024 (to October)	477.0 mm	n/a	428.0 mm	452.6 mm
2023	327.2 mm	n/a	363.4 mm	314.0 mm
2022	660.1 mm	n/a	612.8 mm	n/a
2021	703.2 mm	461.7 mm	771.0 mm	n/a

4.3.3.4 Alteration to hydrology

The Proposal has the potential to impact local hydrology and adversely impact adjacent native vegetation. There is approximately 17 ha of native vegetation in the DE that intersects with the Lancelin Defence Training Area, a classified important wetland (DCCEEW, 2018). The clearing of vegetation in this Palusplain wetland could potentially disrupt water dependent ecosystems, surface water and subsurface drainage to wetlands and/or surface watercourses such as the Mullering Brook which is an ephemeral stream located to the south of the DE that has historically been diverted for the existing mining operation (Syrinx, 2013).

4.3.3.5 Dust emissions

Vegetation clearing and earthworks for construction, and vehicle movements on unsealed roads have the potential to generate dust emissions. Airborne dust has the potential to smother vegetation causing blockage and damage to stomata, shading and abrasion of leaf surface or cuticle. It can also lead to sand creep and land contamination.

The Midwest Region experiences windy conditions typified by strong, dry easterly winds from the interior during summer months, which likely contributes to background airborne dust levels. Most of the average annual rainfall of over 500 mm at Badgingarra is regularly received during May to September (BoM, 2024b). Rainfall is likely to remove deposited dust from vegetation, reducing the opportunity for any substantial effects over the long-term.

The Proposal (which will use dredge mining and generates less dust than dry mining) is unlikely to result in an increase in ambient airborne dust levels and existing management measures from the Cooljarloo operations will be implemented to minimise dust.

4.3.3.6 Alteration of fire regimes

A change in fire regimes is often associated with increased human activity, leading to a degradation of natural ecosystems. Fire is a major determining factor in affecting species composition. It can cause disturbance of vegetation but can also be required for regeneration of some species. The DE lies within areas of native vegetation, including Banksia woodlands, which are susceptible to impacts from high frequency fire regimes (DEE, 2016b). A significant proportion of the land surrounding the Proposal is Unallocated Crown Land (UCL), which is vested in the Department of Planning, Lands and Heritage with the environmental aspects of land management being the responsibility of the Department of Biodiversity, Conservation and Attractions.

Tronox will implement existing operational controls to appropriately control the risk of fire in the EMP (Appendix A). This will include identifying potential ignition sources and/or activities with the potential to lead to fire, and preventable measures. Weed management and fire-break upkeep will reduce the risk of fires caused by the Proposal spreading to nearby vegetation.

The vegetation within the DE and surrounds is generally fire-dependent and was recently burnt in November 2024. As the surrounding vegetation was recently burnt, it is unlikely that during the lifecycle of the project, vegetation will return to a capacity in which the risk of fire recruitment increases.

4.4 Cumulative impacts

The most significant cumulative impact on vegetation and flora arising from the Proposal is the loss of native vegetation and flora due to clearing, especially the clearing of Banksia Woodlands of the Swan Coastal Plain and conservation significant flora. Cumulative impacts to vegetation and flora are presented in Table 4.9

Table 4.9 Cumulative vegetation and flora impacts

Aspect	Atlas Project (EPA, 2024b)	Cooljarloo West Titanium Minerals Project (EPA, 2021)	Cooljarloo Mineral Sands Project (EPA, 2021)	Cataby Mineral Sands Project (EPA, 2014a)	Yandin Windfarm Project (DER, 2018)	Waddi Wind Farm (Outback Ecology, 2014)
Proponent	Image Resources NL	Tronox	Tronox	Iluka resources	Wind Prospect Pty Ltd	Waddi Wind Farm Pty Ltd
Date of Approval	22/01/2024	22/01/2021	03/10/1988	18/04/2006	29/06/2020	16/02/2012
Description	The construction of a heavy mineral sand mining and processing operation.	Western expansion of the Cooljarloo titanium mine to commence dredge mining of three ore-bodies	The construction of a heavy mineral sand mining and processing operation.	Construction and operation of Mineral sands mine in Cataby area. Consisting of multiple open pits along a 25km area	Development of wind farm	Development of wind farm
Location	18 km east of Cervantes in the Wheatbelt region of Western Australia.	Tronox Mine Cooljarloo, Shire of Dandaragan	Tronox Mine Cooljarloo, Shire of Dandaragan	The Cataby Mineral Sands mine Cataby area, Shire of Dandaragan	Yandin road, Dandaragan	Brand Highway, Dandaragan
Proposed native vegetation clearing	318 ha	2,033 ha	5,807 ha (of this 1,900 ha already rehabilitated (Tronox 2022))	2,093.5 ha (153.1 ha of native vegetation)	4 ha of clearing in 4,594 ha footprint	1 ha of clearing
Significant vegetation	236.2 ha of Banksia woodlands of the Swan Coastal Plain of Western Australia cleared	1,532 ha of Banksia woodlands of the Swan Coastal Plain of Western Australia cleared			Four patches of Banksia Woodlands of the Swan Coastal Plain adjacent to study area. Will not be cleared but may be impacted.	Banksia woodland and Kwongan
Significant flora	– 21 Priority taxa	– 5 Threatened taxa – 52 Priority taxa – 2 potentially undescribed taxa – 167 individuals or 296 ha of preferred habitat for *Andersonia gracilis* – 165 individuals or 201 ha of preferred habitat for *Anigozanthos*			– No significant flora will be cleared – 1 Threatened taxa – 1 Priority taxa – *Chamelaucium* sp. Cataby (T) – 85-205 individuals of *Hypocalymma tetrapterum* (P3)	– 6 Priority taxa

Aspect	Atlas Project (EPA, 2024b)	Cooljarloo West Titanium Minerals Project (EPA, 2021)	Cooljarloo Mineral Sands Project (EPA, 2021)	Cataby Mineral Sands Project (EPA, 2014a)	Yandin Windfarm Project (DER, 2018)	Waddi Wind Farm (Outback Ecology, 2014)
		viridis subsp. *terraspectans* – 1,1511 ha of preferred habitat for *Macarthuria keigheryi*				

4.5 Mitigation

Proposed control measures to minimise identified potential impacts to vegetation and flora are presented in Table 4.10.

Table 4.10 Proposed management actions to minimise identified impacts to flora and vegetation

Potential impact	Avoid	Minimise	Rehabilitation	Residual impacts
Loss of vegetation complexes and types	– Avoid the indirect disturbance of vegetation by using a dredge mining method which avoids pit dewatering and consequential groundwater drawdown – Where possible, adjusting clearing areas to incorporate lower conservation significance areas rather than higher conservation significance areas	**Vegetation clearing controls** – Ensuring clearing does not exceed the authorised extent and is minimised where possible – Clearing activities are controlled and monitored to minimise the risk of unauthorised clearing – Vehicles, machinery and personnel will be restricted to designated areas	– Rehabilitating all areas of disturbance. – Progressively backfilling to minimise time between clearing and rehabilitation to reduce the time habitat is lost over. – Topsoil from native is stripped, stockpiled, returned separately and selectively managed according to vegetation type – Following mine closure, cleared land will be rehabilitated in line with the Mine Closure Plan.	Residual impact is not considered significant. This Proposal will not reduce the system below 10% of the preclearing extent and thus the proposed clearing is not considered a significant residual impact to the Vegetation System present.
Loss of significant ecological communities	– Where possible, adjusting clearing areas to incorporate lower conservation significance areas rather than higher conservation significance areas	**Vegetation clearing controls** – Ensuring clearing does not exceed the authorised extent and is minimised where possible – Clearing activities are controlled and monitored to minimise the risk of unauthorised clearing – Vehicles, machinery and personnel will be restricted to designated areas	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over. – Use of offsetting to decrease impact to Banksia Woodlands of the SCP	Residual impact is considered significant. In the rehabilitated area it is expected that the environmental value of the area will not be regained for a minimum of 10 years (due to the loss of biodiversity) this is likely to be a significant residual impact.
Loss of wetland and groundwater dependent vegetation	– Groundwater drawdown from pit dewatering has been avoided through the implementation of dredge mining over dry mining	**Water use** – Site water balance is maintained to assess groundwater use, including water abstracted from mining voids, water dams and with consideration to water return via tailing discharge – Water balance will be reviewed on a regular basis to ensure use is within the limits stated in the Groundwater licence – Ground water abstraction is conducted as per the conditions in the DoW groundwater licence – **Water Quality** – Water quality monitoring programme is undertaken to commensurate with the risks – **Vegetation monitoring** – Monitor vegetation composition in permanent plots to assess changes over time – Assess vegetation health within high-risk areas to determine if groundwater drawdown is impacting vegetation	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time groundwater interfaces with mining – Groundwater level monitoring to track groundwater recovery post-mining.	Due to these proposed mitigation measures, impacts to wetland and groundwater dependent vegetation is not considered a significant residual impact.
Loss of significant flora	– Where possible, adjusting clearing areas to avoid higher conservation significance areas	– Spatial dataset of significant flora species is maintained to include records of site surveys and other reliable data sources – A plant herbarium is maintained to facilitate accurate species identification **Contingencies** – Assess if the surveyed plant/s can be avoided – If clearing is necessary, apply for a flora taking permit – Target the return of threatened species into rehabilitation	– Osprey will be incorporated in the established and successful rehabilitation programme for Cooljarloo – A programme is maintained targeting the establishment of recalcitrant species and conservation significant flora within rehabilitation – Conservation significant flora have been returned in the Cooljarloo rehabilitation	Residual impact is not considered significant.
Fragmentation of habitat	– Avoid clearing vegetation that provides linkages between remnants and ensure than any linkages remain viable.	– Ensuring clearing does not exceed the authorised extent and is minimised where possible – Managing disturbance to maintain habitat connections as far as practical	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over.	Residual impact is not considered significant as the Proposal will involve clearing which attaches the eastern side of the DE with the current operating Cooljarloo Mine site which will reduce fragmentation of vegetation and flora habitat.
Introduction of Weeds and phytophthora dieback	– Where possible, adjusting clearing areas to incorporate lower conservation significance	**Controlling Access**	– Rehabilitating all areas of disturbance and minimising time between clearing and	Residual impact is not considered significant

Potential impact	Avoid	Minimise	Rehabilitation	Residual impacts
	areas rather than higher conservation significance areas – Access to mining lease is restricted by use of fencing and/or signage – The importation of soil and vegetation matter to site is restricted to low-risk material and must be approved by the Group Leader Environment	– Vehicles, machinery and personnel will be restricted to designated areas – Vehicles/machinery to be clean of soil and vegetation upon entry and exit from site – Vehicles to pass through hygiene wash bay and/or inspected by an authorised person – Access to known Dieback areas will be restricted to essential services **Site operations** – Drainage is minimised to manage the spread of dieback – Particularly around known infestations – Implementation of Dieback and weed monitoring programme (Appendix A)	rehabilitation to reduce the time habitat is lost over. – Rehabilitation is constructed to minimise spread and reduce impact of Phytophthora species – Hygiene control procedures are implemented to minimise the risk of spreading phytophthora species	
Dust emissions	– Preference dredge mining over dry mining to ensure active mining area is damp/wet to prevent fugitive dust lift off from active mining face. Dredge mining avoids earthmoving dry ore via heavy vehicles and instead processes a slurry.	**Mining operations** – Traffic is restricted to established roads and tracks with a maximum speed of 60km/h on unsealed roads – Water trucks used on haul roads and pit areas to minimise dust generation – Non active areas are sheeted with clay fines (or similar) to minimise the area of waste exposed. **Topsoil handing** – Dust generating activities such as topsoil stripping and placement are avoided during high winds **Process waste disposal facility** – Process waste is progressively capped to minimise the area of waste exposed **Transport** – Haulage trucks are covered on public roads during transport – Haulage tracks are cleaned on entry to and exit from the site, during winter, to minimise the material tracking onto internal and external roads	– Annual stabilisation plan is developed and implemented to minimise dust from open areas – Progressive rehabilitation of disturbed areas is undertaken to minimise the total area open	Residual impact is not considered significant as the Proposal will use dredge mining which will generate less dust than the existing dry mining operations. In addition, dust emissions from the project will be regulated under the Part V Prescribed Premises Licence (L5319/1988/12) where required management controls and monitoring in licence conditions will be implemented to minimise dust emissions.
Alteration to hydrology	No control measures proposed due to likely low connectivity between the Project Osprey DE and nearest surface water bodies (Mullering Brook and Mount Jetty Creek)			Residual impact is not considered significant.
Alteration of fire regimes	– Avoid burning vegetative material onsite and instead mulch the material and use in rehabilitation.	**Planning and Controls** – Fire management plan implemented – Fire breaks maintained annually – Fire unit on standby for local fires to reduce damage caused by an outbreak **Hot work** – Hot work will only be completed when permitted via grant of hot work permit – Adopt the permitted measures for fire prevention and use a fire spotter during high-risk works	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over.	Residual impact is not considered significant. The fire risk is considered manageable, and the implementation of the Proposal is unlikely to significantly alter existing fire regimes or increase the likelihood of fires.

4.6 Predicted environmental outcomes

Following the implementation of the proposed mitigation measures, the Proposal is anticipated to yield the following outcomes regarding the environmental quality of flora and vegetation:

- No decline in any vegetation association to a point below 30% pre-European extent.
- The Proposal will result in the temporary loss of 33.37 ha of Banksia Woodlands of the SCP PEC that is also foraging habitat for Carnaby's Black-Cockatoo. This will likely have a significant residual impact even after rehabilitation due to loss of biodiversity and the lag time (i.e., 10 to 20-years) until environmental values (i.e., Black Cockatoo foraging quality) are restored again. Rehabilitation and offsets are proposed to decrease this impact.
- The Proposal will result in the loss of the important populations of priority flora (Table 4.7). Rehabilitation and offsets are proposed to decrease impact.
- No significant risk of an increase in the prevalence of weeds.
- Minimal risk of the introduction of dieback.
- No measurable impact on native vegetation from groundwater drawdown.
- The Proposal is not located in a Conservation Area. The environmental and social values of Conservation Reserves are not anticipated to be affected.

Based on this evaluation and the proposed management strategies that Tronox have successfully implemented in the existing Cooljarloo Mine operations, it is expected that the EPA's objectives for flora and vegetation environmental quality will be achieved.

5. Terrestrial fauna

The objective of the factor Terrestrial Fauna is '*To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.'*

For the purposes of Environmental Impact Assessment (EIA), the EPA defines terrestrial fauna as animals living on land or using land (including aquatic systems) for all or part of their lives.

5.1 Relevant policy and guidance

The following policy and guidance documents have been considered throughout this section:

– Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016c)
– Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020a)
– Conservation codes for Western Australia Flora and Fauna (DBCA, 2020)
– Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan: Western Australian Wildlife Management Program No. 52, (Department of Parks and Wildlife, 2013).
– WA Environmental Offsets Guidelines (EPA, 2014b)
– Environmental offsets metric: Quantifying environmental offsets in Western Australia (Department of Water and Environmental Regulation (DWER), 2021)

5.2 Studies and surveys

Table 5.1 presents the relevant studies undertaken for the Project. These are in addition to extensive studies conducted at the Cooljarloo mine sites and surrounds since 1986.

Table 5.1 Fauna studies and surveys

Survey	Date	Author
Completed		
Level 1 Fauna and Targeted Black-Cockatoo Assessment of the Lone South and Osprey Survey Areas (November 2023, January 2024, November 2024)	January 2025	Bamford

5.2.1 Fauna habitat

The DE contains four fauna habitats, comprising native vegetation (59.14 ha) and cleared areas (1.86 ha) (Bamford, 2025). The DE and surrounding habitat is largely intact native vegetation, intersected by narrow access tracks. A summary of fauna habitat types within the DE is presented in Table 5.2 and Figure 5.1.

Table 5.2 Fauna habitats recorded in the Development Envelope

Vegetation and substrate association	Fauna habitat type	Extent/proportion in the DE		Photograph
		(ha)	(%)	
VSA 1	***Banksia attenuata* and *B. menziesii* Low Woodland**. Vegetation: Low woodland to isolated trees of *Banksia attenuata* and *Banksia menziesii*, occasionally with *B. prionotes*, *Eucalyptus todtiana* and *Nuytsia floribunda*, over diverse mixed shrubland. Substrate: grey, yellow-brown or brown deep sands or sandy loam Landforms: plains or flats within undulating plains and slopes of low dunes.	33.38	54.72	
VSA 4	**Dampland Shrubland/Open Woodland.** Vegetation: Sparse mixed shrubland, often dominated by *Acacia saligna* with occasional low isolated trees of *Melaleuca rhaphiophylla*, *Eucalyptus rudis* and *Banksia littoralis* Substrate: brown or grey clay loam or sandy loam Landforms: damp to wet flats or plains	5.20	8.52	

Vegetation and substrate association	Fauna habitat type	Extent/proportion in the DE		Photograph
		(ha)	(%)	
VSA 5	***Banksia telmatiaea* Heathland.** Vegetation: Heathland dominated by *Banksia telmatiaea* with *Regelia ciliata*, *Hakea obliqua*, and occasionally low isolated *Banksia* spp., *Melaleuca preissiana* and *Nuytsia floribunda* trees Substrate*:* grey, brown or yellow sandy loam or sand Landforms*:* seasonally damp to wet low-lying plains, flats, open depressions and swamps	20.26	33.70	
VSA 7	**Cleared areas**	1.86	3.05	

Legend

- MS1158 Disturbance Footprint
- Proposed Osprey Development Envelope
- Cooljarloo Mine

Vegetation and Substrate Associations

- VSA 1: *Banksia attenuata* and *Banksia menziesii* Low Woodland
- VSA 3: *Banksia sessilis* Shrubland
- VSA 4: Dampland Shrubland/ Open Woodland
- VSA 5: *Banksia telmatiaea* Heathland
- VSA 6: Mixed Heathland
- VSA 7: Cleared

Paper Size ISO A3
at Scale: 1:10,000

0 100 200 300 400

Meters

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Fauna Vegetation and Substrate Associations in the Development Envelope

Project No. **12649786**
Revision No. **4**
Date **01/03/2025**

FIGURE 5-1

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5.2.2 Fauna diversity

The field survey identified 14 vertebrate species within the DE including, 13 birds and one mammal (Bamford, 2025). While the assemblage recorded within the DE during the field survey is not an adequate representation of fauna values within the area (Bamford, 2025), using desktop assessments and previous survey data the expected vertebrate fauna assemblage within the DE have been described (Table 5.3). These species are categorised based on their expected presence within the DE.

Table 5.3 Composition of expected vertebrate fauna assemblage in the Development Envelope

Taxon	Number of species in each status category				
	Resident	**Regular visitor**	**Irregular visitor**	**Vagrant**	**Total**
Frogs	6	4	0	0	**10**
Reptiles	44	0	1	1	**46**
Birds	26	44	25	25	**120**
Native mammals	12	3	2	0	**17**
Introduced mammals	4	1	0	0	**5**
Total	**92**	**52**	**28**	**26**	**198**

Introduced species expected to occur in the DE include the Feral Cat (*Felis catus*), Fox (*Vulpes vulpes*), Feral Goat (*Capra hircus*), Rabbit (*Oryctolagus cuniculus*), House Mouse (*Mus musculus*), Rock Dove (*Columba livia*), Laughing Dove (*Spilopelia senegalensis*), and the Laughing Kookaburra (*Dacelo novaeguineae*).

5.2.3 Conservation significant fauna

5.2.3.1 Threatened Fauna Species

The desktop assessment identified four vertebrate fauna species listed under the BC Act as potentially present within the DE. None of these species were sighted during the Bamford (2025) survey; however, evidence of foraging by Carnaby's Black-Cockatoo (*Zanda latirostris*) was found across the DE.

Of the four species, only one was regarded as potentially present within the DE on the consideration of availability of suitable habitat. The remaining species are considered unlikely to occur in the DE due to either recorded local extinction or lack of suitable habitat and are therefore not considered further in the sections below (Table 5.4).

Table 5.4 Habitat classification in relation to likelihood of occurrence assessment for significant fauna in the Development Envelope – Threatened fauna species

Species	State protection status	Likelihood of occurrence	Core habitat
Zanda latirostris Carnaby's Black-Cockatoo	BC Act: Endangered	Previously recorded (Foraging)	Banksia woodland (VSA 1,2,3,5) Proteaceous shrubland/heath
Apus pacificus Pacific Fork-tailed Swift	BC Act: Migratory	Unlikely (in transit)	-
Falco peregrinus Peregrine Falcon	BC Act: Specially protected species	Unlikely (foraging visitor)	-
Leipoa ocellata Malleefowl	BC Act: Vulnerable	Unlikely	-

5.2.3.2 Carnaby's Black-Cockatoo

During the Bamford (2025) survey, no Black-Cockatoo individuals were recorded within the DE, however foraging evidence was recorded. The DE is located within the mapped distribution of Carnaby's Black-Cockatoo (Endangered EPBC/BC Act) (DBCA, 2018 & Department of Agriculture, Water and the Environment (DAWE), 2022).

Carnaby's Black-Cockatoos have been regularly recorded directly in the surrounding area (Bancroft & Bamford, 2022) and are known to forage extensively in similar VSAs throughout the region (Bancroft & Bamford, 2023). Given the roosting data (see below) and review of current species distributions (Figure 5.2), it is considered that Carnaby's Black-Cockatoos are likely regular breeding migrants to the surrounding region and in-turn are regular foraging migrants to the DE.

5.2.3.2.1 Breeding Habitat

Carnaby's Black Cockatoo breeding habitat is considered to consist of tree species known to support breeding within the range of the species, which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow (being greater than 500 mm DBH for most Eucalypts or 300 mm DBH for Wandoo and Salmon Gum) (DAWE 2022).

Whilst Carnaby's Black-Cockatoos are likely to forage within the DE, they are unlikely to breed within it as there are no trees recorded within the area that meet the criteria (Bamford, 2025). Similarly, no breeding activity nor definitive evidence of breeding was observed within the DE during the survey. Figure 5.2 shows the known breeding and roosting sites of Carnaby's Black-Cockatoo's within a 30 km of the DE, whereby the nearest breeding site is recorded as being 15 km away from the DE.

5.2.3.2.2 Roosting Habitat

Roosting habitat refers to habitat which contains known roosting, or potential roosting trees, and roosting locations are generally in proximity (usually within 2 km) of a permanent water source and in areas of high-quality foraging habitat (DAWE 2022). Potential roosting habitat is generally a tall tree or group of trees (typically the tallest), usually close to an important water source (generally within 2 km), and within an area of quality foraging habitat (Bamford, 2025). The nearest confirmed roost is less than 2 km from the Proposal boundary.

The region around the DE is known to support Carnaby's Black-Cockatoo roosting; however, no roosting habitat was detected within the DE (Figure 5.2). There are also no potential water sources for Carnaby's Black-Cockatoos within the DE (Bamford, 2025).

Due to the lack of suitable roosting habitat, Carnaby's Black-Cockatoos are not expected to roost within the DE.

5.2.3.2.3 Foraging Habitat

Foraging evidence for Carnaby's Black-Cockatoo was recorded from the Bamford fauna survey (Bamford, 2025) and previous ecological surveys (Bancroft & Bamford, 2023) throughout the DE. Foraging resources for Black-Cockatoo species are available across the DE. Key Banksia species which are mainstays in the Carnaby's Black-Cockatoo diet are found across the VSAs of the DE, and include *B. attenuata*, *B. menziesii* and *B. prionotes*.

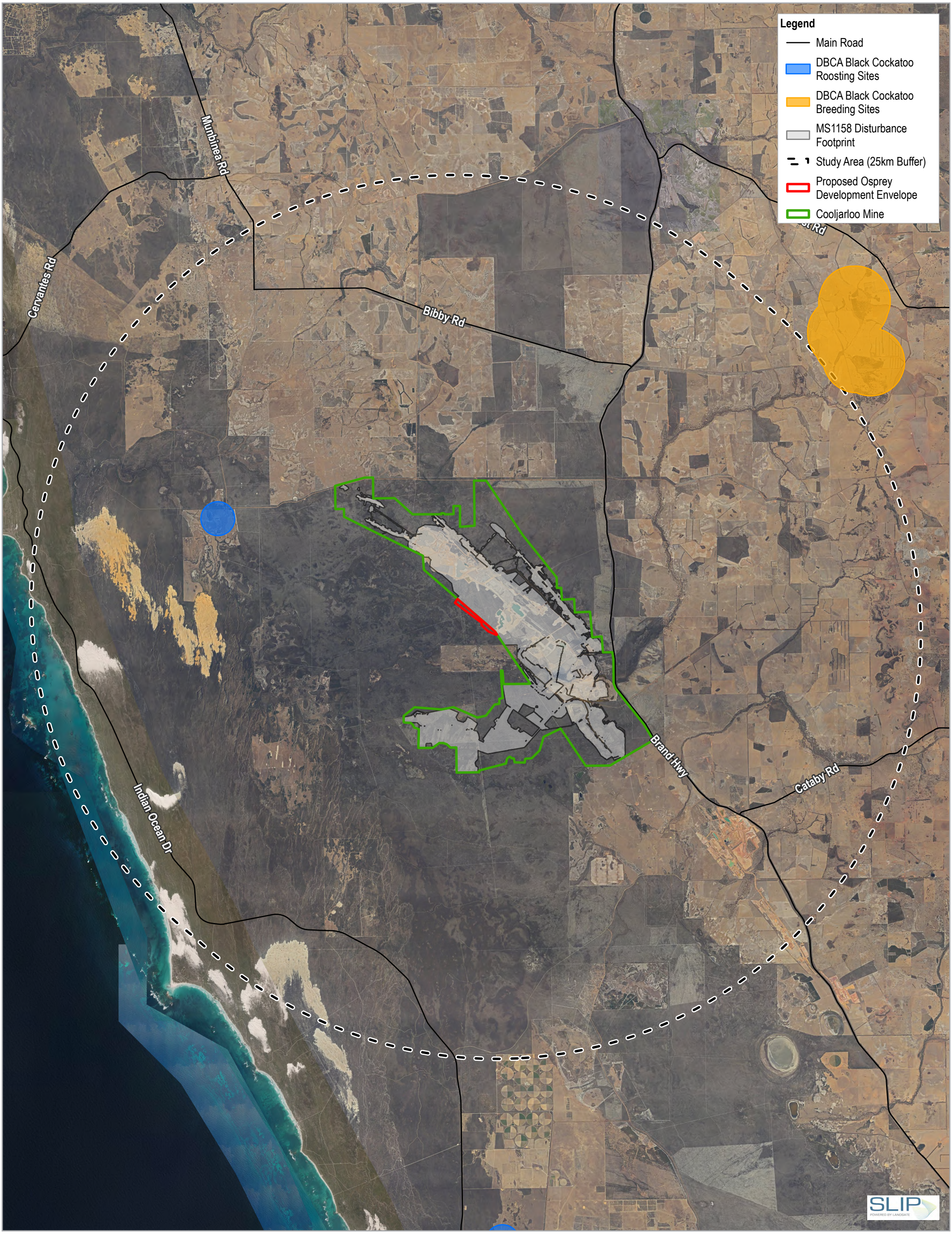
The extent of Carnaby's Black-Cockatoo foraging habitat within the DE is shown in Figure 5.3.

There is approximately 39,130 ha of surrounding remnant native vegetation within a 12 km radius of the DE (DPIRD, 2023). The DE contains approximately 59.14 ha of native vegetation therefore comprising of approximately 0.15% of native vegetation in the 'local area'.

A single site context score for the foraging capacity of the DE for the Carnaby's Black-Cockatoo species was calculated by Bamford (2025) based on vegetation condition, context of vegetation within local area and density of the species. The foraging score of each VSA is shown in Table 5.5. Overall, the DE was given a foraging score of 6, with the area having an extensive moderate foraging value Table 5.5. Mapped forage quality over the DE is presented Figure 5.3.

Table 5.5 ***Vegetation and substrate associations in the Development Envelope scored against the BCE assessment of foraging value of vegetation for Carnaby's Black-Cockatoo***

Vegetation and substrate association		Extent in the DE (ha)	Foraging score
VSA 1: *Banksia attenuata* and *B. menziesii* Low Woodland	a	3.38	6
	b	30.00	7
VSA 4: Dampland Shrubland/Open Woodland		5.20	5
VSA 5: *Banksia telmatiaea* Heathland		20.56	5
VSA 7: Cleared		1.86	0
Total (ha)		61.00	6/10



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Environmental Approval Support for Osprey Expansion

Carnaby's Black-Cockatoo known Breeding and Roosting Sites around the Development Envelope

Project No. **12649786**
Revision No. **2**
Date **01/03/2025**

FIGURE 5-2

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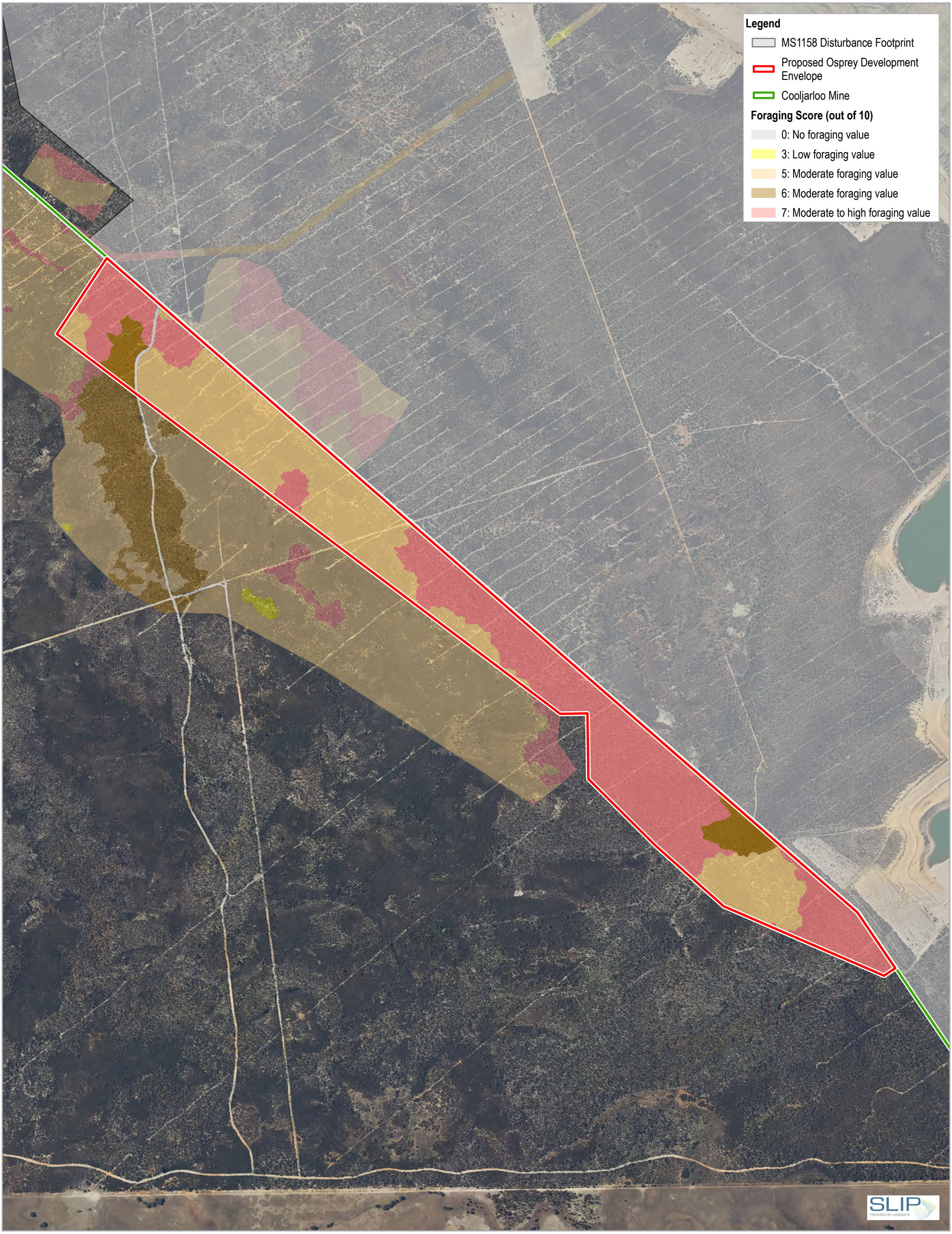

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Carnaby's Black-Cockatoo Foraging Habitat Quality in the Development Envelope

Project No. **12649786**
Revision No. **4**
Date **01/03/2025**

FIGURE 5-3

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5.2.3.3 Priority Fauna Species

The desktop searches identified nine DBCA Priority fauna species as potentially present within the DE. None of these species were sighted during the Bamford (2025) survey.

For the likelihood of occurrence assessment undertaken for these species, Bamford (2025) also included assessments for another three vertebrate and three invertebrate conservation significant species due to previous records within the buffer area and/or suitable habitat available within the DE. These species are:

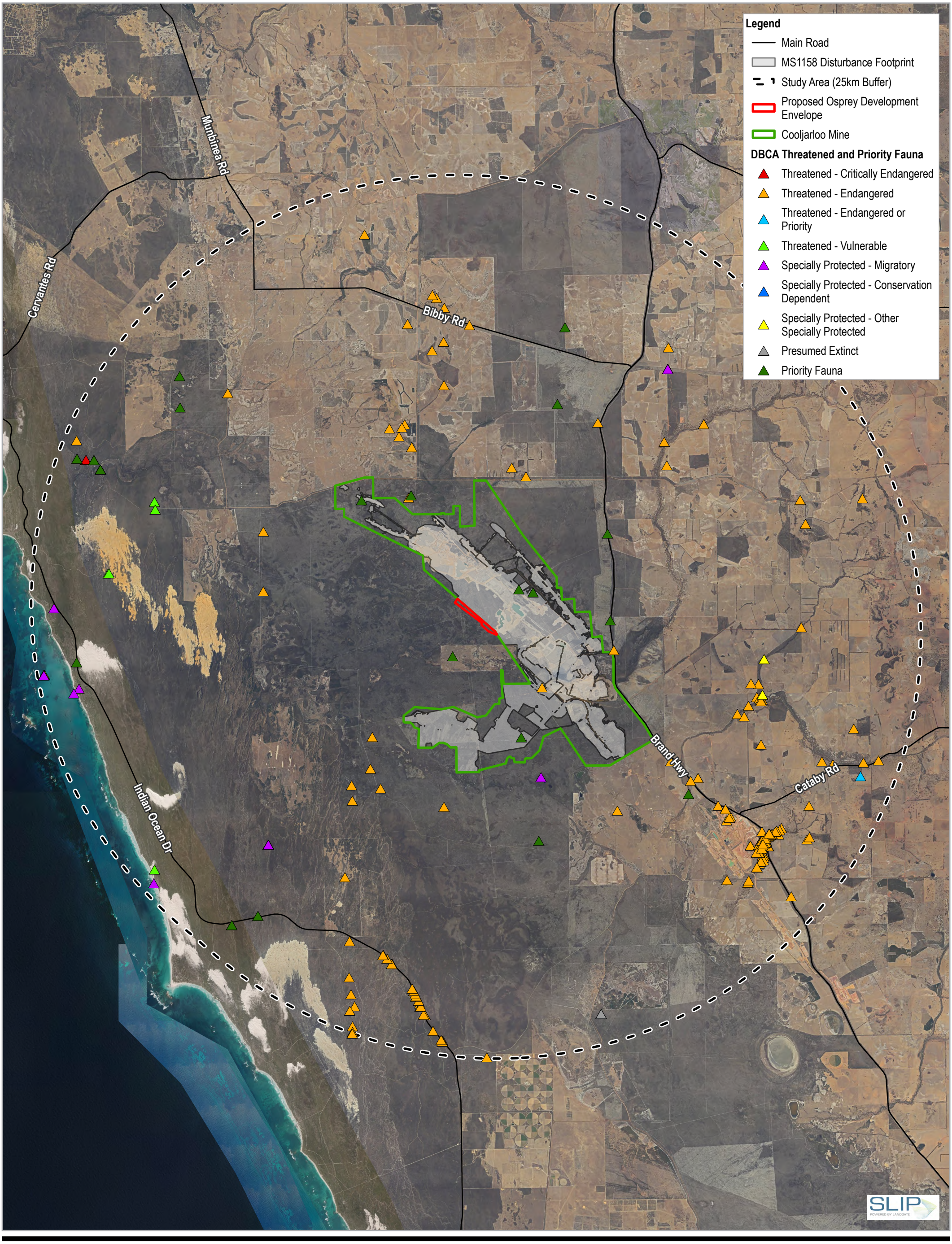
– Jewelled Southwest Ctenotus (*Ctenotus gemmule*)
– Black striped snake (*Neelaps calonotos)*
– Brush Wallaby *(Notamacropus Irma)*
– Moore River Land Snail *(Bothriembryon perobesus)*
– Spiny Katydid *(Austrosaga spinifer)*
– Graceful Sunmoth *(Synemon gratiosa).*

Of the nine species, five were regarded as potentially present within the DE on the consideration of availability of suitable habitat. The remaining species are considered unlikely to occur in the DE due to either recorded local extinction or lack of suitable habitat and are therefore not considered further in the sections below.

A summary of the listed significant fauna likelihood of occurrence assessment for the DE is provided in Table 5.6. Figure 5.4 shows the distribution of conservation significant species within a 25 km buffer of the DE.

Table 5.6 Habitat classification in relation to likelihood of occurrence assessment for significant fauna in the Development Envelope – DBCA listed priority species

Species	State protection status	Likelihood of occurrence	Core habitat
Bothriembyron perobesus Moore River Land Snail	DBCA: P1	Likely	VSA 1, 3 and 5
Austrosaga spinifer Spiny Katydid	DBCA: P2	Likely	VSA 1, 3 and 5
Neelaps calonotos Black-stripe Snake	DBCA: P3	Likely	VSA 1
Ctenotus gemmula Jewelled Southwest Ctenotus (Swan Coastal Plain subpopulation)	DBCA: P3	Likely	VSA 1
Notamacropus Irma Brush Wallaby	DBCA: P4	Likely	Most VSAs
Synemon gratiosa Graceful Sunmoth	DBCA: P4	Unlikely	-



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Distribution of Conservation Significant Vertebrates around the Development Envelope

Project No. **12649786**
Revision No. **3**
Date **01/03/2025**

FIGURE 5-4

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5.2.3.4 Moore River Land Snail

The Moore River Land Snail is mainly found in the Moore River area but extends north to Cooljarloo (Bennelongia Environmental Consultants, 2013a). The preferred habitat for the species includes Banksia Low Woodland (Bamford, 2025).

Moore River Land Snails are considered likely to occur within the DE (Bamford, 2025). One record of this species occurs within 25 km of the DE. This species is known to have a linear range of more than 100km and extends to 50 km inland, positioning the DE within its likely range. There is 53.94 ha of suitable habitat (Banksia Low Woodland on sand) for the Moore River Land Snail present in the DE.

5.2.3.5 Spiny Katydid

The Spiny Katydid occurs in banksia woodland and heathland (Bamford & Knowles, 2019). Spiny Katydid are likely to occur in the DE (Bamford, 2025). There are limited records of this species, and the closest records of the species were within 25 km of the DE. There is 53.94 ha of suitable habitat for the Spiny Katydid within the DE in fauna habitat type Banksia Low Woodland and Banksia Heathland (Wilson & Swan, 2021).

5.2.3.6 Black-stripe Snake

The Black-striped Snake is restricted to the coastal sandplains from Dongara to Mandurah (Bush et al., 2010) Preferred habitat for the species includes dunes, sandplains vegetated with heaths and banksia woodlands.

Black-stripe Snakes are considered likely to occur within the DE. Although not recorded in the Bamford (2025), there are multiple records of this species occurring within 15 km of the DE. There is 33.38 ha of suitable habitat for the Black-striped Snake present in the DE in Fauna habitat type Banksia Low Woodland on sand.

5.2.3.7 Jewelled Southwest Ctenotus

The Jewelled Southwest Ctenotus occurs in two subpopulations in Western Australia: one on the Swan Coastal Plain from Cataby south to Perth, and another along the south coast. Preferred habitat for this species includes Banksia and Mallee Woodlands and heath on sandplains (Wilson & Swan, 2021).

The Jewelled Southwest Ctenotus is likely to occur in the DE (Bamford, 2025). Although not recorded in the current survey, there are historical records of the species within 2-3 km of the DE. There is 33.38 ha of suitable habitat for the Jewelled Southwest Ctenotus present in the DE in the fauna habitat type of Banksia Low Woodland on sand.

5.2.3.8 Brush Wallaby

Brush Wallabies occur from Geraldton to Esperance. The species occurs in a wide range of vegetation types from Eucalypt Woodland to Banksia Woodland, Shrublands and Kwongan (Bamford, 2025). It also favours areas of dense shrubland, including the understory of low woodlands. Individuals occupy home ranges of up to 10 ha.

Brush Wallabies are considered likely to occur within the DE, with four records of the species within 15 km. There is 59.14 ha of suitable habitat for Brush Wallabies in the DE, including all vegetated Fauna Habitat types (Bamford, 2025).

5.2.3.9 Pacific Fork-tailed Swift

The Pacific Fork-tailed Swift is a migratory species with widespread recordings of the species from Esperance to Carnarvon. The species spends the non-breeding season in Australia, so it does not require habitat for breeding.

The Pacific Fork-tailed Swift is unlikely to occur in the DE, with only one historical record of the species within 25 km. The species may occasionally fly over the DE but is unlikely to utilise it in any significant manner (Bamford, 2025).

5.2.3.10 Peregrine Falcon

The Peregrine Falcon occurs Australia-wide and inhabits a wide range of habitats, including forests, woodland, wetland and coastal areas, and open country (Menkhorst, et al., 2017).

The Peregrine Falcon is unlikely to occur in the DE as there are no suitable nesting sites. There are only three historical records of the species within 25 km.

5.2.3.11 Malleefowl

Malleefowl live within scrubland and woodland dominated by mallee eucalypts and wattle species found throughout the southern third of Western Australia (Menkhorst, et al., 2017).

Malleefowl are unlikely to occur in the DE as the habitat is not typically associated with Malleefowl. There are three historical records of the species within 15 km of the DE.

5.2.3.12 Graceful Sunmoth

Graceful Sunmoth's are only found in Western Australia, between Kalbarri and Binningup along a narrow corridor of suitable coastal habitat. The species has specific habitat requirements and is found in strong association with one of two closely related host plants, *Lomandra hermaphrodita* or *Lomandra maritima* (Department of Environment and Conservation (DEC), 2013.

There are 17 records of the species within 25 km of the DE due to the Wanagarren National Park (15 km away) which has a great presence of the necessary plant species. The DE has very low occurrence of the species preferred food plants and therefore Graceful Sunmoth's are unlikely to occur within the DE (Bamford, 2025).

5.3 Potential impacts

The implementation of the Proposal will result in the direct loss of fauna habitat, including:

- Loss and fragmentation of 61 ha of fauna habitat, comprising native vegetation (59.14 ha) and cleared areas (1.86 ha)
- Loss of habitat for listed fauna species including:
  - 53.94 ha foraging habitat for Carnaby's Cockatoo (VSA 1,3,5)
- Loss of habitat for priority fauna species including:
  - 53.94 ha of potential habitat for Moore River Land Snail (VSA 1,3,5)
  - 53.94 ha of potential habitat for Spiny Katydid (VSA 1,3,5)
  - 33.38 ha of potential habitat for Black-stripe Snake (VSA 1)
  - 33.38ha of potential habitat for Jewelled Southwest Ctenotus (VSA 1)
  - 59.14 ha of potential habitat for Brush Wallaby (Most VSAs)
- Fragmentation of fauna habitat

The Proposal also has the potential to result in the following indirect impacts to fauna values:

- Fauna injury or mortality from strike
- Habitat degradation from edge effects, weeds, dieback, rubbish and vehicle tracks
- Attraction of feral animals
- Disturbance of fauna due to light, noise and vibration from construction activities and road use by vehicles
- Generation of dust

5.3.1 Loss and fragmentation of habitat

The Proposal will result in the temporary clearing of up to 61 ha of fauna habitat, comprising native vegetation (59.14 ha) and cleared areas (1.86 ha). The habitat present within the DE comprises a mixture of heathlands, woodlands and shrublands (Table 5.2). This habitat is mostly intact and in excellent condition with only access tracks breaking the habitat.

The Proposal will result in a moderate loss of native vegetation, an area of 59.14 ha. This represents 0.15% of the remaining native vegetation within 12 km. The DE occurs within the Bassendean 5 and Bassendean 3 soil subsystems; neither of which is restricted in the broader region. The impact on significant species is expected to

be minor, given that the proposed developments are not extensive and do not impact particularly sensitive or restricted environments.

Regarding habitat fragmentation, the proposed development still facilitates connectivity across the area so is considered unlikely to lead to population fragmentation on a local scale. The habitat around the DE is continuous and in excellent condition (Bamford, 2025). On a regional scale however, human activities (i.e. agricultural land clearing) have resulted in highly fragmented vegetation. The Proposal will involve clearing which attaches the eastern side of the DE with the current operating site and will not result in fragmentation of fauna species.

5.3.2 Loss of habitat for conservation significant fauna

5.3.2.1 Carnaby's Black-Cockatoo

The Proposal will require the clearing of up to 53.94 ha of foraging habitat for Carnaby's Cockatoo. The Proposal is surrounded by approximately 31,524 ha of potential Black Cockatoo foraging habitat within a 12 km radius of the DE. Proposed clearing (53.94 ha) within the DE will result in a 0.19% reduction in foraging habitat in the local area (within 12 km radius) and a 0.03% reduction in foraging habitat on a regional scale (within 50 km radius) (Table 5.7).

Table 5.7 Estimated local and regional Black-Cockatoo foraging habitat around the Development Envelope and expected impact from proposed clearing (DBCA, 2018)

DE Buffer radius	Potential Black-Cockatoo foraging habitat	Reduction in foraging habitat from proposed clearing (%)
12 km	31,524 ha	0.19%
50 km	196,948ha	0.03%

Carnaby's Cockatoo occurs throughout the Southwest of WA, utilising Eucalyptus species for nesting habitat and feeding on a variety of species in proteaceous heathlands and Eucalyptus woodlands. The species is under threat due to the loss of both nesting and foraging habitat, particularly on the Swan Coastal Plain whereby clearing for urban development continues.

Black Cockatoos are highly mobile species and are expected to forage outside the DE amongst foraging resources in the vicinity and are not dependent on a particular patch of foraging habitat within the DE. Clearing for this Proposal will not fragment local populations of the species.

No Carnaby's Cockatoos were recorded during the field surveys however evidence of foraging was found across VSAs. No suitable roosting or breeding sites were found within the DE and is therefore not considered utilised for breeding purposes. Impacts to the species resulting from the Proposal predominantly relate to the loss of foraging habitat (refer to Section 4.3.1.2).

5.3.2.2 Priority Fauna

Potential impacts to Priority Fauna species recorded in the DE are outlined in Table 5.8.

Table 5.8 Potential impacts to other conservation significant fauna species recorded in the Development Envelope

Conservation significant species	State protection status	Potential impacts
Moore River Land Snail	DBCA: P1	There is 53.94 ha of suitable habitat for the Moore River Land Snail in the DE. This species is known to have a linear range of more than 100km and extends 50km inland. Given the widespread distribution of this species and its preferred habitat, impacts of the Proposal upon this land snail are unlikely to be significant.
Spiny Katydid	DBCA: P2	There is 53.94 ha of suitable habitat for the Spiny Katydid in the DE. Distribution of this species is poorly understood due to low records of this species; however, suitable habitat is thought to consist of Banksia woodland and associated heaths. A loss of a portion of habitat of this magnitude is

Conservation significant species	State protection status	Potential impacts
		unlikely to pose a significant risk to the survival of the local population.
Jewelled Ctenotus	DBCA: P3	There is 33.38 ha of suitable habitat for the Jewelled Ctenotus in the DE. The species occurs in two isolated subpopulations in WA: one on the Swan Coastal Plain from Cataby south to Perth and the other along the south coast. This species prefers areas of Bankia and Mallee woodlands and heath on sandplains. A loss of a portion of habitat of this magnitude is unlikely to pose a significant risk to the survival of the local population.
Black-striped Snake	DBCA: P3	There is 33.38 ha of potential habitat for the Black-striped Snake in the DE, which is predominately in excellent condition. The Proposal will result in local, Black-striped Snake habitat loss. The Black-striped snake is generally found in coastal areas across the southwest of WA. The species prefers areas of Banksia woodland. A loss of a portion of habitat of this magnitude is unlikely to pose a significant risk to the survival of the local population.
Brush Wallaby	DBCA: P4	There is 59.14 ha of habitat for the Western Brush Wallaby in the DE, which is predominately in excellent condition. The Proposal will result in local Brush Wallaby habitat loss. Being regularly recorded during fauna surveys and opportunistically, the Western Brush Wallaby is assumed to be widespread through the regional area as its range covers the Southwest of WA. Potential impacts to the species resulting from the Proposal include habitat loss, road mortalities and increased predation. Given the low overall level of impact to habitat and already present predatory introduced species, impacts to the species are unlikely to be significant.

5.3.3 Indirect impacts

5.3.3.1 Vehicle strike

As the Proposal will be incorporated into current operations the movement of vehicles around the site are not expected to increase significantly. Terrestrial fauna may be struck by vehicles and machinery during operation. Direct mortality is anticipated to be low as vehicle access and speeds will be limited to manage other potential impacts such as dust emissions. Activities will be undertaken in accordance with measures identified in the EMP. The Proposal is not expected to result in significant impacts on terrestrial fauna from vehicle strike.

5.3.3.2 Habitat degradation

There is potential for development to increase the spread of weeds. Increased weed incursion and the introduction of dieback into fauna habitat located adjacent to the DE may cause the degradation of fauna habitat values. Weed species and dieback are most likely to be introduced during construction activities. Current levels of weed invasion are very low (Bamford, 2025). Degradation due to increased rubbish is likely throughout the lifecycle of the project. There are management procedures within the EMP to reduce these risks. The Proposal is not expected to result in the introduction or spread of weeds or dieback that could result in significant impacts on terrestrial fauna.

5.3.3.3 Attraction of feral species

Some of the native fauna is sensitive to feral species such as cats and foxes. Feral species are present already and may be attracted to worksites and gain improved access into native vegetation via tracks and roads. Aspects of human activities that may encourage introduced species include:

– Inappropriate management of food scrap generation and other wastes may provide additional food sources
– Clearing/disturbance may result in increased predation opportunities (loss of cover) or an increased prevalence of flora species (e.g. grasses) more favoured to introduced species

– Introduction of permanent and semi-permanent water sources may attract and concentrate fauna, increasing predation potential and a dependence on a short-term water source

An increased prevalence of introduced species may result in several impacts to native fauna including:

– Higher rates of predation
– Increased competition for food sources
– Degradation of habitat.

Potential impacts from feral species will be managed by a Fauna Management Plan (refer to EMP in Appendix A) that includes the following specific measures to manage feral species:

– Implementation of control programmes for feral species observed to be significantly impacting native fauna, rehabilitation or operations
– Feral cat trapping in response to reported sightings
– Banning of domestic animals on Mine site.

Given the above proposed control measures that will be put in place, the risk of feral species impacting native fauna is considered low.

5.3.3.4 Noise, light and vibrations

During operation, there will be noise and vibration emissions due to vehicle movements. Noise and vibration associated with the Proposal has the potential to result in short-term disturbance to fauna on a local scale. There are management procedures within the EMP (Appendix A) to minimise these and reduce impacts to fauna.

5.3.3.5 Dust

Dust emissions from mining activities and operational vehicle movements will continue throughout the life of the mine. During the clearing of vegetation and set-up of the dredge mine, the disturbance may increase the production of dust around the area.

The Midwest Region experiences windy conditions typified by strong, dry easterly winds from the interior during summer months. This likely contributes to background airborne dust levels. Most of the average annual rainfall of 519.3mm at Badgingarra is regularly received during May to September (BoM, 2024b). Rainfall is likely to remove deposited dust from vegetation, reducing the opportunity for any substantial effects over the long-term.

As the Proposal will involve dredge mining it is unlikely to significantly increase the production of dust during its operational lifecycle. Dust emissions from vehicle movements will not be significant as the project will be incorporated in current operations. The dust emissions produced will be managed through the ongoing implementation of the EMP (Appendix A).

5.3.3.6 Alteration of fire regimes

A change in fire regimes is often associated with increased human activity, leading to a degradation of natural ecosystems. Fire is a major determining factor in affecting species composition. It can cause disturbance of vegetation but can also be required for regeneration of some species. The Proposal lies adjacent to areas of native vegetation, including Banksia woodlands, which are susceptible to impacts from high frequency fire regimes (Department of the Environment and Energy, 2016).

The vegetation within the DE and surrounds is generally fire-dependent and was recently burnt in November 2024. As the surrounding vegetation was recently burnt, it is unlikely that during the lifecycle of the project, vegetation will return to a capacity in which the risk of fire recruitment increases.

5.4 Cumulative impacts

The DE is located in a region which has experienced and continues to experience land clearing, particularly of Banksia woodlands which are rich in fauna (Bamford, 2025), that results in mortality of fauna and the decline of local populations. While clearing for agriculture has largely ceased, there is ongoing clearing (with some

rehabilitation) for mining and renewable energy projects within 50 km of the DE (DWER, 2023). The impact on fauna habitat caused by these projects are outlined in Table 5.9.

The most significant cumulative impact on native fauna arising from the Proposal is the loss of habitat due to vegetation clearing, in particular the clearing of foraging habitat for conservation significant species such as Carnaby's Black-Cockatoo. (Bamford, 2025) considers VSAs 1,3,4,5 and 6 to be foraging habitat for Carnaby's Black-Cockatoo. Of the 59.14 ha proposed to be disturbed during the project, 53.94 ha is within these VSAs representing 88.43% of the mapped area within the DE. Within a 50 km radius of the DE there is 196,948 ha of suitable Carnaby foraging habitat (DBCA, 2018) and 266,505 ha of native vegetation (DPIRD, 2023). This will result in a loss of 0.03% of suitable Carnaby foraging habitat and 0.02% of native vegetation regionally. This a very small portion of the Carnaby's Black-Cockatoo regional foraging habitat, suggesting the cumulative impact from the proposed clearing will be low.

Tronox maintains an ongoing rehabilitation program for disturbed areas throughout the lifecycle of the mine. As the rehabilitated areas mature, the foraging values for rehabilitated Carnaby's Black-Cockatoo foraging habitat is expected to recover to pre-disturbance levels.

Table 5.9 Cumulative fauna impacts from other projects in the vicinity of the Proposal

Aspect/proposal	Atlas Project (EPA, 2024b)	Cooljarloo West Titanium Minerals Project (EPA, 2021)	Cooljarloo Mineral Sands Project (EPA, 2021)	Cataby Mineral Sands Project (EPA, 2014a)	Yandin Windfarm project (DER, 2018)
Proponent	Image Resources NL	Tronox	Tronox	Iluka resources	Wind Prospect Pty Ltd
Date of Approval	22/01/2024	22/01/2021	03/10/1988	18/04/2006	16/02/2012
Description	The construction of a heavy mineral sand mining and processing operation.	Western expansion of the Cooljarloo titanium mine to commence dredge mining of three ore-bodies	The construction of a heavy mineral sand mining and processing operation.	Construction and operation of Mineral sands mine in Cataby area. Consisting of multiple open pits along a 25km area	Development of wind farm
Location	18 km east of Cervantes in the Wheatbelt region of Western Australia.	Tronox Mine Cooljarloo, Shire of Dandaragan	Tronox Mine Cooljarloo, Shire of Dandaragan	The Cataby Mineral Sands mine Cataby area, Shire of Dandaragan	Yandin road, Dandaragan
Proposed vegetation clearing (terrestrial)	318 ha	2,033 ha	5,807 ha (of this 1,900 ha already rehabilitated (Tronox 2022))	2,093.5 ha (153.1 ha of native vegetation)	4 ha
Terrestrial Fauna	– 318 ha of fauna habitat – 289 ha of very high foraging habitat for Carnaby's Cockatoo – 318 ha of potential SRE habitat	– 1,884 ha of fauna habitat – 1,884 ha of core foraging habitat for Carnaby's Cockatoo – 351 ha of habitat for Moore River Land Snail – 351 ha of habitat for Spiny Katydid – 1,535 ha of habitat for Jewelled Ctenotus – 1,437 ha of habitat for Black-striped Snake – 1,890 ha of habitat for Brush Wallaby	– 5,807 ha of Fauna habitat	– 153.1 ha of fauna habitat – 26 suitable DBH trees. Of these, 26 trees contained 28 hollows that were considered of suitable depth and shape for black cockatoo breeding – 153.1 ha of foraging habitat for Carnaby's Cockatoo –	– 4 ha of fauna habitat – 3 individual trees suitable for foraging by Carnaby's cockatoo

5.5 Mitigation

The planned management measures are designed in accordance with management hierarchy of avoid, minimise and rehabilitate to ensure impacts arising from the project on native fauna are as low as reasonably practicable and meet the EPA's objective for this factor.

To limit the impacts on terrestrial fauna, management actions will be implemented in line with the Fauna Management Plan section of the EMP (Appendix A). These actions are outlined in Table 5.10.

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Table 5.10 Proposed management actions to minimise identified impacts to fauna

Potential impact	Avoid	Minimise	Rehabilitate	Residual impact
Loss of fauna habitat	Using a dredge mining method which avoids pit dewatering and consequential groundwater drawdown and avoids indirect impacts on groundwater dependent vegetation and fauna habitat.	– Minimise the proposed land-clearing to only what is critically necessary for the Project **Vegetation clearing controls** – Ensuring clearing does not exceed the authorised extent and is minimised where possible – Where possible, adjusting clearing areas to incorporate lower conservation significance areas rather than higher conservation significance areas – Vehicles, machinery and personnel will be restricted to designated areas – Progressive backfilling to minimise clearing footprint.	**Mulch** – Where native vegetation mulch is utilised, the vegetation type of the mulch sourced is matched with the target vegetation group in the rehabilitation area – Logs and wood material not required as mulch to be distributed in rehabilitation areas to provide habitat for fauna **Vegetation types** – Keystone species are defined for each vegetation group and targeted for return into rehabilitation via a systematic management of propagules sources – Trees/shrub species are included in native seed mixes at targeted densities to provide a feeding resource for Carnaby's Black-Cockatoo and other native bird species **Rehabilitation implementation** – Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over. – Vegetation groups established are similar to those in surrounding undisturbed areas – Fauna is colonising rehabilitated DE • Vertebrate and invertebrate fauna indices for key bio-indicator species or groups are trending towards those recorded in surrounding undisturbed areas. • Key fauna habitat characteristics are present in rehabilitation	Residual impact is not considered significant
Loss of Conservation significant fauna	Using a dredge mining method which avoids pit dewatering and consequential groundwater drawdown and avoids indirect impacts on groundwater dependent vegetation and fauna habitat.	– Minimise the proposed land-clearing to only what is critically necessary for the Project **Vegetation clearing controls** – Ensuring clearing does not exceed the authorised extent and is minimised where possible – Where possible, adjusting clearing areas to incorporate lower conservation significance areas rather than higher conservation significance areas – Clearing will be undertaken progressively with the amount of active disturbance minimised – Native animals encountered on site will be given the opportunity to move on if there is no real threat to personnel safety – Feral cat trapping is undertaken in response to reported sightings	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over. – Following mine closure, cleared land will be rehabilitated in line with EMP and rehabilitation strategy. Successful rehabilitation of fauna habitat will need to achieve the following: • Vegetation groups established are similar to those in surrounding undisturbed areas • Fauna is colonising rehabilitated DE • Vertebrate and invertebrate fauna indices for key bio-indicator species or groups are trending towards those recorded in surrounding undisturbed areas. • Key fauna habitat characteristics are present in rehabilitation	Residual impact is not considered significant
Habitat fragmentation	The single DE has been designed to avoid habitat fragmentation by not creating vegetated islands between areas of mine disturbance.	– Ensuring clearing does not exceed the authorised extent and is minimised where possible – Managing disturbance to maintain habitat connections as far as practical	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over.	Residual impact is not considered significant
Habitat degradation	Access to mining lease is restricted by use of fencing and/or signage avoiding potential impacts from off-road vehicle use.	– Where possible, adjusting clearing areas to incorporate lower conservation significance areas rather than higher conservation significance areas **Weed and dieback spread** – Vehicles, machinery and personnel will be restricted to designated areas – Vehicles/machinery to be clean of soil and vegetation upon entry and exit from site • Vehicles to pass through hygiene wash bay and/or inspected by an authorised person – Access to known Dieback areas will be restricted to essential services – Implementation of Dieback and weed monitoring programme (Appendix A) **Pollution reduction** – Feeding of fauna, hunting or keeping of pets on site will be prohibited	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over. – Rehabilitation is constructed to minimise spread and reduce impact of Phytophthora species • Hygiene control procedures are implemented to minimise the risk of spreading phytophthora species	Residual impact is not considered significant
Vehicle strike	Vehicles, machinery and personnel will be restricted to designated areas	**Speed controls** – Signs will be installed on internal roads warning of the potential for fauna to be mobile in the area – All personnel will be required to observe on-site vehicle speed limits to prevent the likelihood of road mortalities – Speed limits of no greater than 60 km/h will be applied to all roads within the DE	-	Residual impact is not considered significant

Potential impact	Avoid	Minimise	Rehabilitate	Residual impact
		– Native animals encountered on site will be given the opportunity to move on if there is no real threat to personnel safety		
Noise, light and vibration	Avoid excessive lightshed by adhering to Australian Standard	– Vehicles, machinery and personnel will be restricted to designated areas – Education of personnel as part of inductions to ensure staff are familiar with the fauna of the area and how to avoid negative impacts	-	Noise, Light, Vibration management managed under Part V Licence. Residual impact is not considered significant
Dust	Dredge mining avoids earthmoving dry ore via heavy vehicles and instead processes a slurry, preventing fugitive dust lift off from active mining face.	**Planning and Controls** – Enforcement of Dust Management Procedure – Monitoring and reporting on the effectiveness of dust controls **Dust production** – Vehicles, machinery and personnel will be restricted to designated areas – Speed limits of no greater than 60 km/h will be applied to all unsealed roads within the DE – Water trucks are used on hail roads and pit areas to minimise dust generation **Dust movement** – Haulage trucks are clean on entry to and exit from the site to minimise the material tracking onto roads and surrounding habitat	– Progressive rehabilitation of disturbed areas is undertaken to minimise the total area open – Annual stabilisation plan implemented to minimise dust from open areas	Dust management managed under Part V Licence. Residual impact is not considered significant
Attraction of feral species	Feeding of fauna, hunting or keeping of pets on site will be prohibited.	– Food scraps and other waste will be disposed of in covered waste facilities.	– Feral cat trapping is undertaken in response to reported sightings	Residual impact is not considered significant
Altering fire regimes	Vegetation material onsite will be mulched and used during rehabilitation, avoiding the need to burn cleared vegetative material.	**Planning and Controls** – Fire management plan implemented – Fire breaks maintained annually – Fire unit on standby for local fires to reduce damage caused by an outbreak **Hot work** – Hot work will only be completed when permitted via grant of hot work permit – Adopt the permitted measures for fire prevention and use a fire spotter during high-risk works	– Rehabilitating all areas of disturbance and minimising time between clearing and rehabilitation to reduce the time habitat is lost over.	Residual impact is not considered significant

5.6 Predicted environmental outcomes

Following the implementation of the proposed mitigation measures, the Proposal is anticipated to yield the following outcomes regarding the environmental quality of fauna habitat and presence of fauna species

- Loss of 61 ha of fauna habitat, comprising native vegetation (59.14 ha) and cleared areas (1.86 ha)
- Loss of habitat for significant fauna species, described in 5.3.2.1 and Table 5.8
- Minimal fragmentation of fauna habitat
- Minimal disturbance of fauna due to light and noise from construction activities and road use by vehicles
- Minimal degradation of fauna habitat due to rubbish, vehicle tracks and dust emissions.
- No significant risk of an increase in the prevalence of weeds, introduction of dieback or presence of feral species.
- The return of biological diversity and ecological integrity following the successful progressive rehabilitation of the DE.

Based on this evaluation, the proposed management strategies that Tronox have successfully implemented in the existing Cooljarloo Mine operations, it is expected that the EPA's objectives for terrestrial fauna will be achieved.

6. Inland waters

The objective of the factor Inland Waters is *'To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected'* (EPA, 2018a).

For the purposes of EIA, the EPA (2018) defines inland waters as the occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological, and aesthetic characteristics (quality).

6.1 Relevant policy and guidance

The following policy and guidance documents have been considered throughout this section:

– Environmental Factor Guideline – Inland Waters (EPA, 2018a)

6.2 Studies and surveys

Table 6.1 presents the relevant studies undertaken and proposed.

Table 6.1 Inland waters studies and surveys

Survey	Date	Author
Completed		
Modelled groundwater drawdown – Cooljarloo Mine operations with planned Osprey expansion	Feb 2024	HGEO Pty Ltd

6.2.1 Regional hydrogeology

The Proposal footprint is within the Jurien Groundwater Area, which is proclaimed under the Rights in Water and Irrigation Act 1914 (RIWI Act), but it is not located in a Public Drinking Water Source Area (DWER, 2024a).

There are two main regional aquifer systems in the vicinity of the project area: the Superficial Formations and the Yarragadee Formation (Figure 6.1).

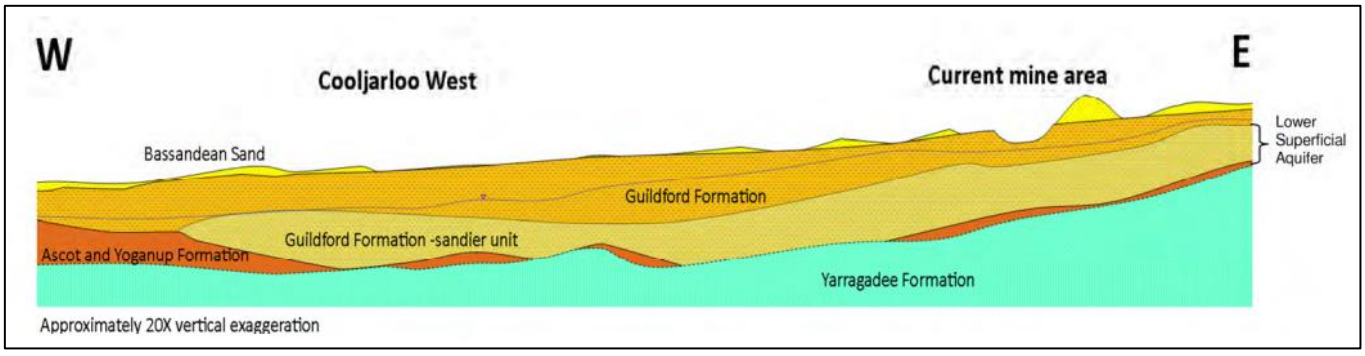


Figure 6.1 Geological cross-section of Cooljarloo Mine site (source: Tronox, 2017)

The Superficial Formations comprise alternating layers of sands and clays, which form an unconfined to semi-confined anisotropic groundwater flow system and hosts most of the ore that will be mined. This unconfined aquifer extends from the ground surface to a depth ranging from approx. 26 to >46 m bgl and is recharged via direct infiltration of rainfall and upward leakage of groundwater from the Yarragadee Formation. Groundwater flows in a westerly direction and discharges to wetlands and coastal areas (Tronox, 2017).

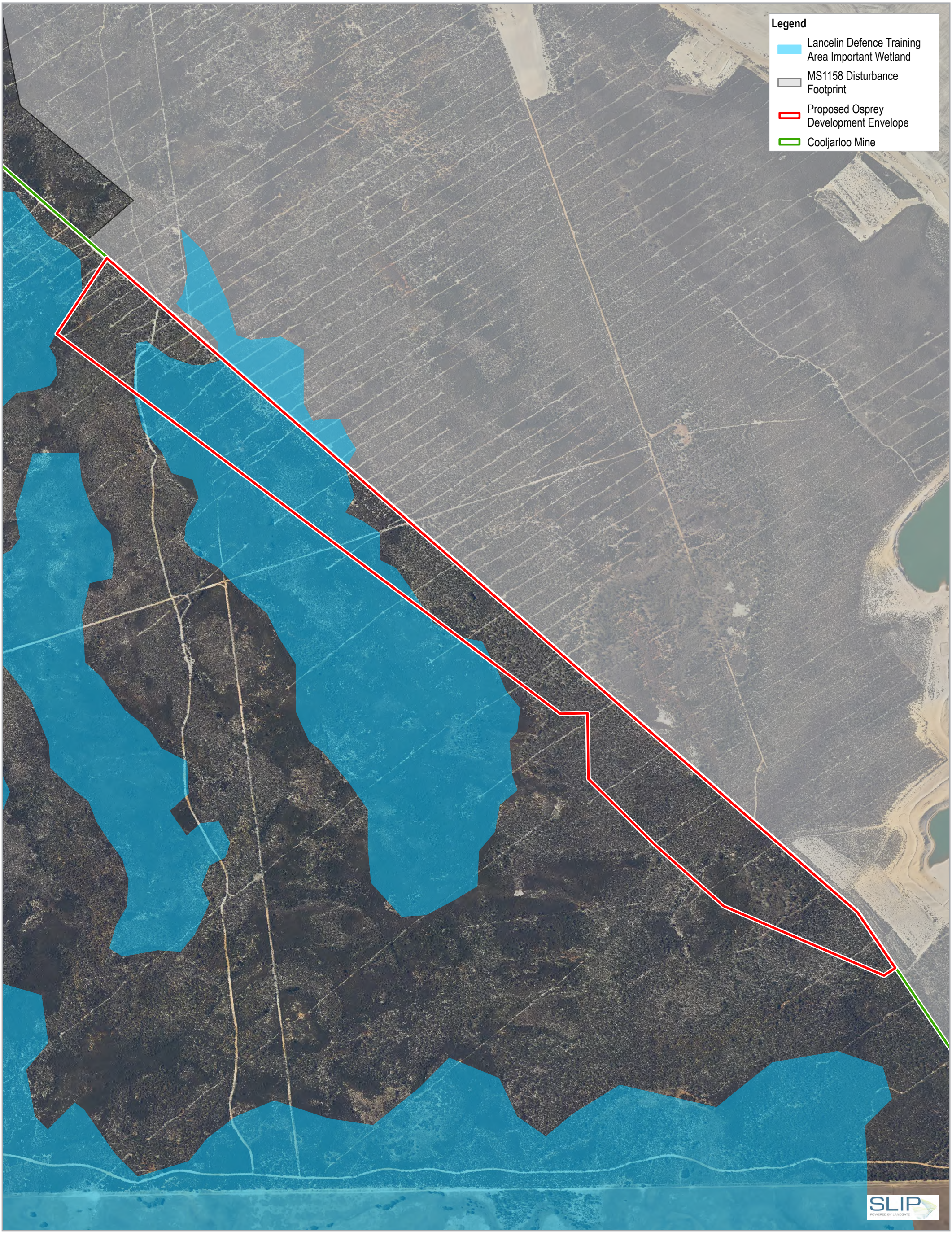
The Yarragadee Formation is predominantly comprised of sandstone and forms both the thickest and most extensive aquifer system within the region, with depths to many hundreds of metres. This aquifer is overlain in part

by the Superficial Formations and is recharged via direct infiltration of rainfall through the Superficial Formations. Groundwater in this aquifer system flows through in a south westerly direction (Tronox, 2017).

6.2.2 Regional hydrology

There are no surface water courses running through the DE, with the nearest surface watercourse being the Mullering Brook located approximately 1.5 km directly south of the Project boundary (Figure 2.1), and Mount Jetty Creek located approx. 7 km to the north. Both water courses are seasonal with highly variable flows, that flow in a westerly direction before discharging to wetlands in the Bassendean dunes.

The DE intersects approximately 37 ha the Nambung/Cataby Coastal Tributaries Surface Water Management Area and Sub-Area, which is proclaimed under the RIWI Act. The DE also intersects approximately 17 ha of the geomorphic Palusplain wetland (classified as flat land that is subject to seasonal waterlogging (DEC, 2010)) (Figure 6.2) that is part of the listed Lancelin Defence Training Area Important Wetland (DCCEEW, 2018).



Paper Size ISO A3
at Scale: 1:10,000

0 100 200 300 400

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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GHD

Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Listed Important Wetland (Lancelin Defence Training Area) that intersects the Development Envelope

Project No. **12649786**
Revision No. **3**
Date **01/03/2025**

FIGURE 6-2

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6.3 Potential impacts

Activities or aspects of the Proposal that have the potential to affect hydrological processes (surface water and groundwater flows) include:

– Changes to groundwater levels from ore excavation
– Disruption of existing surface and/or sub-surface drainage systems
– Disturbance and exposure of Acid Sulfate Soils (ASS) and potential Acid Sulfate Soils (PASS)
– Unplanned events – spills, ruptures, loss of containment, or incorrect disposal of waste.

6.3.1 Changes to groundwater levels

Changes to groundwater levels from mining activities can impact nearby water users, flora and vegetation, terrestrial fauna habitat, and groundwater dependent ecosystems (GDEs) (i.e., wetlands, subterranean fauna, and aquatic ecosystems).

Dredge mining offers a lower impact mining method to access mineral resources that are below the water table as it requires the least modification to groundwater levels (i.e., no drawdown impacts from dewatering operations). The safe operating range for the pond water depth offers some flexibility in operational management. The addition of water, supplied from existing water abstraction licences, is undertaken to supplement water levels in the pond as required.

To effectively access the ore body, the water levels in the dredge ponds must be maintained within specific target ranges. If the water is too shallow, it could lead to cavitation in the dredge pump, while excessively deep water would hinder the dredge's ability to reach the full depth of the ore. The inflow and outflow of water and solids (such as tails, bore water, and return water) will be carefully managed to sustain the necessary pond depth for mining. For a significant portion of the Proposal lifespan, this target depth will be within the natural seasonal variation of the water table level.

Groundwater (sourced from existing superficial and Yarragadee groundwater bores at the Cooljarloo Mine) will be utilised to compensate for evaporation from the pits, facilitate dredge movement between ore bodies, and adjust the water level in the dredge pond to access ore at varying depths and thicknesses.

Dredge mining for the Proposal will take place within the superficial aquifer (Figure 6.1). This activity does not require pit dewatering but has the potential to impact the surrounding water table due to the difference in levels between the dredge pond and the water table. Recent groundwater modelling for the Cooljarloo Mine has been undertaken for dredge mining within the DE. Figure 6.3 shows the modelled 90th percentile cumulative drawdown from changes in groundwater levels to dredge mine within the existing operations and the DE. Modelling predicts that dredge mining within the DE will not increase groundwater drawdown, with drawdown of 1 m or greater not expected to extend beyond the existing mining lease areas or the DE. In addition, with the proposed control measures (Table 6.2) that will be implemented, drawdown impacts on surrounding vegetation, and GDEs are unlikely to be impacted by the Proposal

It should be noted that the modelled drawdown cone intersecting Mount Jetty Creek is not associated with the Proposal but rather is associated with the proposed Lone South deposit which is not part of this referral.

Mount Jetty Creek
Wongonderah Swamp
M 70/1398
M 70/1413
0.5
5
10
2
1

Legend

- Minor Road
- Hydrography
- Mining Tenement
- MS1158 Disturbance Footprint
- Proposed Osprey Development Envelope

Contour

- 0.5 m
- 1 m
- 2 m
- 5 m
- 10 m

SLIP POWERED BY LANDGATE

Paper Size ISO A3
at Scale: 1:27,000

0 300 600 900 1,200
Meters

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

Tronox Management Pty Ltd
Environmental Approval Support for Osprey Expansion

Modelled Maximum Drawdown Extent for the Revised Project

Project No. **12649786**
Revision No. **1**
Date **01/03/2025**

FIGURE 6-3

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6.3.2 Disruption of existing surface and/or sub-surface drainage systems

Excavation and dredge mining could potentially disrupt surface water and subsurface drainage to wetlands and/or surface watercourses (i.e., Mullering Brook) and impact water dependent ecosystems. Approximately 17 ha of the DE is classified as an important wetland (Figure 6.2) that will be impacted from project clearing and excavation activities.

Topographically, the DE is primarily situated between Mullering Brook and Mount Jetty Creek. This area is characterised by a series of dunes and interdunal depressions (Syrinx, 2013). Rainfall in these dune regions typically infiltrates the soil until it reaches the clay layers of the Guildford Formation (Figure 6.1). At this point, water may begin to flow toward the local low areas within the interdunal depressions, which can become seasonally waterlogged or flooded (Syrinx, 2013). These depressions are regarded as 'trapped low points' and are not part of the catchment areas for either Mullering or the Mount Jetty Creek; instead, they create distinct, seasonally wet zones (Syrinx, 2013). Therefore, changes in surface levels and hydrology within the DE are not expected to affect the catchments or flows of either watercourse.

6.3.3 Disturbance and exposure of ASS/PASS

The processes of excavation of the open-pit and stockpiling of material may result in the direct disturbance and exposure of ASS/PASS to air, resulting in oxidation of the predominantly iron sulfide (pyrite) materials. This in turn may impact groundwater quality from acidification of groundwater and mobilisation of metals, which also could impact GDEs. No indirect disturbance is anticipated as the dredge mining method used in the Proposal does not involve dewatering operations to lower groundwater levels that could increase exposure and oxidation of ASS/PASS present.

The ASS/PASS risk for the Proposal site is not mapped as having ASS/PASS present, although this does not guarantee that ASS/PASS do not pose a risk. Tronox will implement specific management procedures (refer to Acid Sulfate Soil Management Plan in attached EMP (Appendix A) currently applied to existing Cooljarloo Mine operations to minimise the ASS/PASS risk as much as possible (Table 6.1).

Given the management measures that will be implemented in addition to the ASS controls required to be implemented under the Part V Licence (L5319/1988/12), it is unlikely that there will be significant acidification due to the exposure of PASS material. Any acidification that does occur will likely remain contained within the pond, as the pond will likely be in a net deficit, receiving inflow from the surrounding groundwater. During operations, the water level in the pond will be adjusted to match seasonal water table fluctuations and is unlikely to exceed the surrounding water table level. Consequently, if there is any acidification in the groundwater, it is unlikely to interact with environmental receptors, further reducing the potential for environmental impacts. Nearby surface water bodies are unlikely to be impacted due to the likely low connectivity between the groundwater within the DE and nearby surface water bodies.

6.3.4 Unplanned events – spills, ruptures, loss of containment, incorrect disposal

Any unplanned event from spills, ruptures, loss of containment, or incorrect disposal of waste and hazardous materials could potentially impact groundwater quality, and GDEs.

Tronox will implement their Cooljarloo Mine Waste Management Plan (WMP) and Hydrocarbons and Hazardous Materials Management Plan (HHMMP) outlined in the attached Environmental Management Plan (EMP) (Appendix A) for the Proposal, with key control measures summarised in Table 6.2.

6.4 Mitigation

Proposed control measures to minimise identified potential impacts to inland waters are presented in Table 6.2.

Table 6.2 Proposed management actions to minimise identified impacts to inland waters

Potential impact	Avoid	Minimise	Rehabilitate	Residual impact
Changes to groundwater levels impacting vegetation and GDEs	Avoid dry mining, preference for dredge mining	– Groundwater levels will be monitored before, during, and after mining to confirm changes reflect modelled drawdown and to minimise impacts on vegetation and GDEs. – Monitoring will be completed in accordance with the groundwater licence for the Cooljarloo Mine.	Pit backfill achieved within 1 year from cessation of mining to allow groundwater levels to recover	Residual impact is not considered significant
Loss of listed important wetland habitat	Minimise the proposed land-clearing to only what is critically necessary for the Project	– Clearing activities are controlled and monitored to minimise the risk of unauthorised clearing	Rehabilitation will include re-vegetation with locally present flora species, consistent with the pre-mining hydrological regime.	Residual impact is not considered significant
Impacts on subsurface and surface water flows impacting drainage patterns to nearby wetlands, surface water courses, and water dependent ecosystems	No control measures proposed due to likely low connectivity between DE and nearest surface water bodies (Mullering Brook and Mount Jetty Creek)			Residual impact is not considered significant
Disturbance and exposure of ASS/PASS resulting in acidification and mobilisation of metals in groundwater and can impact GDEs	Avoid dry mining and pit dewatering, preference for dredge mining	**Identification and minimisation of disturbance:** Prior to commencement of mining, PASS will be mapped in three dimensions to confirm location of PASS materials. **Overburden management:** Management of PASS material involves limiting the likelihood of it drying out and being exposed to air. – Overburden containing PASS will be identified prior to excavation and will be disposed of below the water table within the previously mined area as soon as practicable. – Stockpiling of overburden containing PASS may be required where there is insufficient available volume in the mine void. In this case, PASS material will be stored as follows: • On a bunded treatment pad or 'guard layer' of crushed limestone or other suitable neutralising material that prevents leachate entering groundwater • In a manner that limits the surface area of the stockpile to reduce exposure to atmospheric oxygen, such as capping or lining the stockpile • Keeping the surface of the material moist but not wet enough to allow leachate formation • Erosion and sediment control structures will be installed to prevent movement of soils from the stockpile onto any adjacent sensitive receptors. **Heavy mineral concentrate (HMC) management:** HMC will be considered to contain PASS and stockpiling for greater than two weeks will be avoided. Should a longer stockpiling period be required, this will occur on a hardstand area or an area that has an underdrainage system to capture any potential seepage and runoff for treatment prior to discharge. Runoff will be collected and returned to the ore processing circuit (e.g. returned to the dredge pond for reuse) **Clay fines material management:** All clay fines generated from areas within the Proposal deposit have the potential to contain appreciable sulphides. This material will be: – Identified in three-dimensional PASS mapping – Amount of clay fines within the dredge pond will be kept to a practical minimum – TTA, TPA and TAlk of clay fines within solar drying dams will be monitored at least fortnightly whilst pumping to solar drying dams – TTA, TPA and TAlk of dried clay fines will be determined prior to landform reconstruction – Actual and potentially acidic clay fines will be: (i) placed as a homogenous layer at least ≥1 m above the water table in solar drying dams (ii) treated at the calculated liming rate for adequate neutralisation (PASS/ASS) **Monitoring:**	-	ASS management managed under Part V Licence. Residual impact is not considered significant

Potential impact	Avoid	Minimise	Rehabilitate	Residual impact
		– Groundwater quality will be monitored during the mining process and in rehabilitation areas – Groundwater quality monitoring will include monitoring of pH, alkalinity, electrical conductivity, iron, aluminium, sulphate and chloride concentrations		
Unplanned events – spills, ruptures, loss of containment, incorrect disposal impacting groundwater quality and GDEs	Avoid storing waste, hydrocarbon, hazardous materials storage facilities within 200 m of a GDE	**Waste management:** – All domestic and non-process waste (except for inert materials) will be removed off-site to licensed landfill facilities – Implementation of an ongoing waste monitoring program including spills and leaks, litter/rubbish, chemicals and effluent – Implementing spill response procedures in the event of observed spills – Reporting all contaminated sites to the Department of Water and Environmental Regulation (DWER) in accordance with the Contaminated Sites Act (2003)	-	Waste and hydrocarbon management managed under Part V Licence. Residual impact is not considered significant
		Hydrocarbons and hazardous materials management: – Designing and constructing hydrocarbon and hazardous material storages to protect storage and containment areas from stormwater ingress – Providing secondary containment of minor storages (<500 L) in bunded areas or chemical storage cabinet – Providing full bunding of bulk liquid transfer points – Fitting all bulk fuel tanks and mobile refuelling vehicles with auto-shut-off valves or other appropriate devices to prevent overfilling – Implementing spill response procedures in the event of observed spills	-	

6.5 Predicted environmental outcomes

Following the implementation of the proposed mitigation measures, the Proposal is anticipated to yield the following outcomes regarding the environmental quality of inland waters:

– The expected drawdown and its potential effects on surrounding vegetation and Groundwater Dependent Ecosystems (GDEs) are projected to be minimal.
– Cleared wetland areas will be rehabilitated at completion of mining activities
– Surface water flow and quality are unlikely to be impacted, as there is limited interaction between the proposed mine and nearby surface water bodies.
– Groundwater quality is expected to remain unaffected by ASS or PASS disturbances, given that the Proposal DE likely poses a low risk for these soil conditions.
– The Proposal is not located in a Public Drinking Water Source Area. The environmental and social values of the groundwater is not anticipated to be affected.

Based on this evaluation and the proposed management strategies, it is expected that the EPA's objectives for inland waters environmental quality will be achieved.

7. Greenhouse gas emissions

The EPA's environmental objective for the factor Greenhouse Gas (GHG) Emissions is *"To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable"* (EPA, 2024c).

7.1.1 Relevant policy and guidance

The following policy and guidance documents have been considered throughout this section:

– Environmental Factor Guideline – Greenhouse Gas Emissions (EPA, 2024c)

7.1.2 Receiving environment

Greenhouse gas (GHG) emissions (Scope 1 & 2) from the existing Cooljarloo Mine operations are estimated at around 45,000 t CO_2-e per year, based on NGER report estimates provided in Table 7.1, which is significantly less than the current threshold (100,000 t CO_2-e /year) specified in the Environmental Factor Guideline for GHG (EPA, 2024c). These emissions are primarily (80%) scope 2 emissions from electricity soured from the grid used to power the existing dredge. Other minor GHG emissions are also from heavy vehicle movements, pumps and the clearing of native vegetation. As the operations within the Osprey pit will not include an increase to current production rates, there will be no increase to GHG emissions (Scope 1 & 2) as a result of Proposal implementation.

Table 7.1 Scope 1 & 2 GHG emissions from existing Cooljarloo Mine operations reported to the NGER scheme (source: Tronox)

Reporting period	GHG emission (scope 1 and 2) estimate (t CO_2-e)
2021/2022	57,570
2022/2023	46,160
2023/2024	44,502

7.1.3 Potential impacts

7.1.3.1 Greenhouse gas emissions

GHG emissions from the Osprey Proposal will not increase the annual emissions from Cooljarloo, currently approx. 45,000 t CO_2e / annum. There are no changes to GHG sources. The Proposal will increase the mine life by 12 months.

7.1.3.2 Cumulative impacts

Projected GHG emissions from the Osprey Project Proposal are expected to be minor and will not result in an increase to the current annual GHG emissions (approx. 45, 000 t CO_2-e /year) from Cooljarloo Mine operations. Given this, there will be no cumulative impact to GHG emission as a result of the Proposal.

7.1.4 Mitigation

Proposed control measures to minimise identified potential impacts GHG emissions are presented in Table 7.2.

Table 7.2 Proposed management actions to minimise identified impacts from Greenhouse gas emissions

Potential impact	Avoid	Minimise	Rehabilitate	Residual impact
Greenhouse gas emissions	– Avoid Scope 1 Emission by adopting a dredge mining technique powered by scheme electricity – Avoid Scope 1 Emission by adopting electric pumps instead of diesel where possible.	– Minimise Scope 2 emissions by reducing transport routes for materials handling, for example placing topsoils and OB stockpiles as close to the pit as practicable. – Maintain a system to identify and evaluate energy efficiency and carbon pollution reduction opportunities – Optimise energy efficiency and minimise carbon pollution Report as per the requirements of the National Greenhouse and Energy Reporting (NGERS) legislation	– Rehabilitation of cleared vegetation to self-sustaining ecosystems comprising of local species present pre-mining	The residual impact is expected to be not significant, as the GHG emissions from the Osprey Project will unlikely increase the cumulative GHG emissions from the existing Cooljarloo Mine operations.

7.1.5 Predicted environmental outcomes

Following the implementation of the proposed mitigation measures, the Proposal is anticipated to yield the following outcomes for GHG emissions:

– No increase in GHG emissions from the Cooljarloo Mine and the current emissions do not exceed the EPA GHG threshold of 100,000 t CO_2-eq/year.

Based on this evaluation and the proposed management strategies, it is expected that the EPA's objectives for GHG Emissions will be achieved.

8. Other environmental factors

In addition to the key environmental factors discussed in previous sections, the Proposal has the potential to interact with several other environmental factors considered by the EPA:

– Landforms
– Subterranean fauna
– Terrestrial environmental quality
– Air quality
– Social surrounds
– Human Health

Discussion on these factors, including the receiving environment and the potential significance to the Proposal is provided in Table 8.1. Given the Proposal's location, the marine environmental factors are not considered relevant to this Proposal.

Table 8.1 Other environmental factors relevant to the Proposal

Environmental factor	EPA environmental objective	Receiving environment	Significance to proposal
Landforms	The EPA's environmental objective for the factor Landforms is: *"To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected"* (EPA, 2018b).	The DE is situated in the Swan Coastal Plain geomorphological region of Western Australia, specifically on the Bassendean sand complex. This area features a gently rolling landscape made up of sand dunes, inter-dune basins, and swales (Blandford, 2004). To the east, the Cooljarloo Mine is bordered by dissected remnant hills.	At the completion of mining activities, the disturbed DE will be contoured corresponding to surrounding landforms and drainage patterns to re-establish safe and stable landforms capable of supporting a sustainable native ecosystem to that which occurs in adjacent areas. Prior to landform reconstruction, materials will be characterised to ensure they are suitable for their intended final position within the landform and soil profile. The Proposal is expected to meet the EPA objective for Landforms.
Subterranean Fauna	The EPA's environmental objective for the factor Subterranean Fauna is: *"To protect subterranean fauna so that biological diversity and ecological integrity are maintained"* (EPA, 2016d).	An updated study for subterranean fauna (stygofauna and troglofaunal species) within the Proposal DE is still being finalised. However, two previous studies (Bennelongia, 2013b, 2013c) undertaken for the nearby Cooljarloo West Project (Tronox, 2017) did not identify any stygofauna species. Troglofauna sampling was not deemed necessary within the project area as a lack of interstitial spaces within recent deposits were deemed as unsuitable as troglofaunal habitat (Bennelongia 2013b). It is expected that the conclusions from these two studies will also apply to the Proposal DE.	There will be no likely impacts to subterranean fauna from the Proposal. The Proposal is expected to meet the EPA objective for Subterranean Fauna.
Terrestrial Environmental Quality	The EPA's environmental objective for the factor Terrestrial Environmental Quality is: *"To maintain the quality of land and soils so that environmental values are protected"* (EPA, 2016e).	There are no mapped contaminated sites within the Project Footprint (DWER, 2024b), although ASS/PASS could still be present.	Due to the ASS/PASS control measures (Table 6.2) that will be employed during the project, land and soil disturbance activities from the Proposal are unlikely to result in degradation of soils and land due to soil acidification from potential ASS/PASS disturbance. The Proposal is expected to meet the EPA objective for Terrestrial Environmental Quality.
Air Quality	The EPA's environmental objective for the factor Air Quality is: *"To maintain air quality and minimise emissions so that environmental values are protected"* (EPA, 2020c).	Air quality/fugitive dust emissions at the existing Cooljarloo Mine operations are administered under Part V Licence (L5319/1988/12) that mandates implementation of fugitive dust control and dust deposition monitoring at the site boundary. The nearest residential receptors are located in the Billinue community > 5 km from existing mining operations.	The Proposal will use dredge mining which will generate less dust than the existing dry mining operations. In addition, dust emissions from the project will be regulated under the Part V Prescribed Premises Licence (L5319/199/12) where required management controls and monitoring in licence conditions will be implemented to minimise dust emissions. The Proposal is expected to meet the EPA objective for Air Quality.
Social Surrounds	The EPA's environmental objective for the factor Social Surrounds is: *"To protect social surroundings from significant harm"* (EPA, 2023b).	The Project Footprint does not intersect any mapped or occurrences of Aboriginal cultural heritage (Department of Planning, Lands and Heritage, 2024). A recent archaeological field survey (Dortch & Cuthbert, 2024) of the Proposal DE did not identify any archaeological objects or places definable as Aboriginal sites under Section 5 of the *Aboriginal Heritage Act* 1972. The nearest community to site is the Billinue Community, located approx. 5 km southeast of the DE, which is not currently inhabited.	No Aboriginal cultural heritage is expected to be impacted. Noise levels generated and visual impacts are unlikely to significantly differ from current levels or impacts from the existing Cooljarloo Mine operations. The Proposal is expected to meet the EPA objective for Social Surrounds.
Human Health	The EPA's environmental objective for the factor Human Health is: *"To protect human health from significant harm"* (EPA, 2016f)	Naturally occurring radioactive materials (NORM) occur in mineral sands deposits throughout Western Australia. The sources, risks and controls for the low-level radioactive materials are well understood and implemented in the industry. Current NORM on the existing Cooljarloo Mining operations include the coarse sand containing monazite and HMC mining product. These NORM are also applicable to the Proposal.	The potential radiation exposure risk to human receptors at the Osprey Project Proposal will be managed in accordance with procedures outlined in the Radiation Management Plan (refer to EMP in Appendix A) used for current Cooljarloo Mine operations. The Proposal is expected to meet the EPA objective for Human Health.

9. Holistic impact assessment

Holistic impact assessment considers the connections and interactions between impacts, and the overall impact of the proposal on the environment as a whole.

For each relevant Key Environmental Factor, the ERD provides a detailed assessment of the potential impacts associated with the Proposal, application of the mitigation hierarchy and the management strategies proposed. The Key Environmental Factors relevant to the Proposal include:

– Flora and Vegetation
– Terrestrial Fauna
– Inland Waters.

Each relevant Key Environmental Factor has been assessed separately in Sections 4 to 6. Linkages of varying strengths exist between the relevant Key Environmental Factors. The potential impacts of the Proposal have been considered in a holistic context and a conceptual model demonstrating links between key environmental factors is provided in Figure 9.1. A linkage is considered to be present if any two Key Environmental Factors share the same impact.

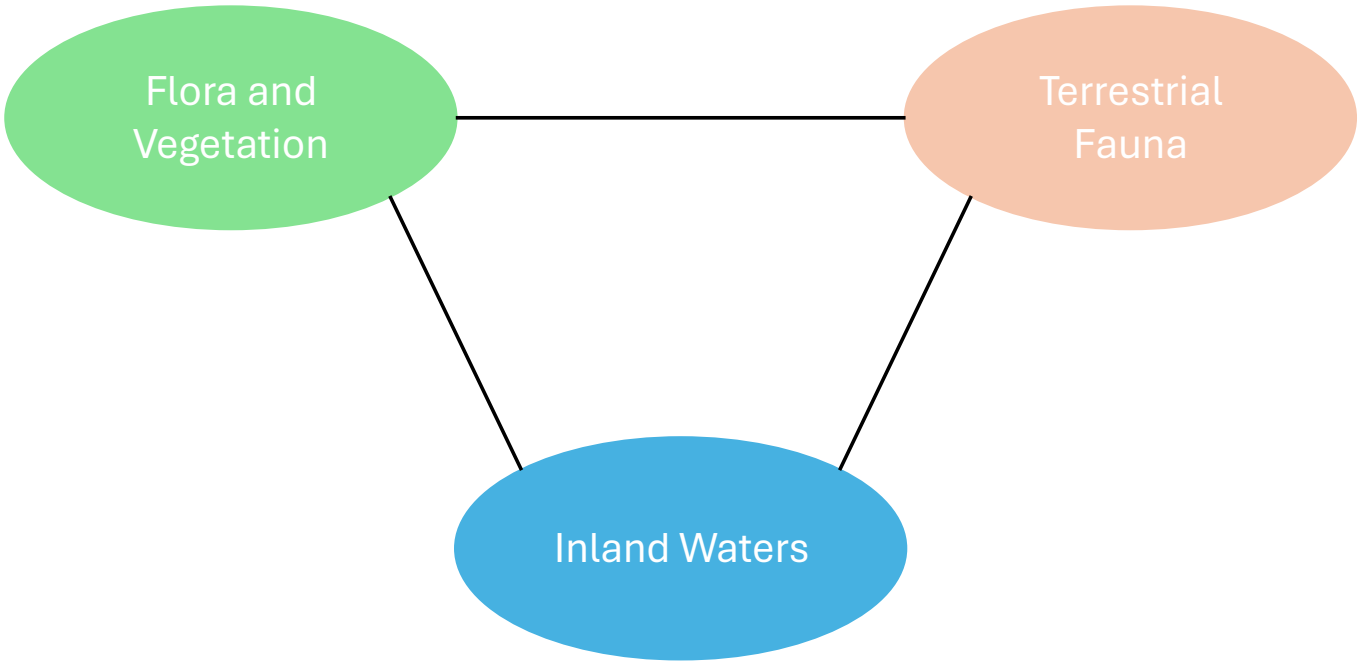

Figure 9.1 Conceptual model of interactions between Key Environmental Factors

Potential overarching impacts relevant to each Key Environmental Factor have been summarised in Table 9.1. While many potential impacts are shared between multiple factors, key impacts (those which have been identified as creating a strong linkage) have been identified with highlighted cells.

Table 9.1 Potential impacts shared by Key Environmental Factors

KEF	Potential Impacts				
	Clearing	Dieback / Weeds	Changes to Groundwater	Contamination	Dust Emissions
Flora and Vegetation	**Yes**	**Yes**	**Yes**	-	Yes
Terrestrial Fauna	**Yes**	**Yes**	**Yes**	Yes	Yes
Inland Waters	Yes	-	Yes	**Yes**	-

10. Offsets

The EPA's goal regarding environmental offsets is to balance any significant residual environmental impacts or uncertainties using offsets. Residual impacts are those that persist after implementing on-site management strategies like avoidance, mitigation, and rehabilitation. Environmental offsets aim to counteract these significant and unavoidable adverse impacts by taking actions that lead to environmental benefits. These offset actions are supplementary to any on-site management or rehabilitation efforts.

When a significant residual environmental impact is identified, both the WA Government and the Australian Government mandate the implementation of offsets as part of the development process. This is intended to preserve the environmental values affected, ultimately striving for a net environmental benefit from the development.

There are two recognised categories of environmental offsets by both governments:

– **Direct offsets**: These actions focus on restoring or improving habitats beyond the project area.
– **Indirect offsets**: Also known as "other compensatory measures," these actions aim to enhance the affected environmental asset by improving scientific knowledge or community awareness. This may involve research, management planning, or educational initiatives that foster a better understanding of environmental management
– Of the two offset options, direct offsets are preferred and should account for at least 90% of the offset value

Relevant WA Government documents concerning environmental offsets include:

– WA Environmental Offsets Policy (EPA, 2011)
– WA Offsets Guidelines (EPA, 2014b)
– Environmental Offsets Metric: Quantifying Environmental Offsets in Western Australia (DWER, 2021a)
– DWER WA Environmental Offsets Calculator (DWER, 2021b)

10.1 Application of the EPA’s Mitigation Hierarchy

Tronox has committed to protect (where feasible) key values and areas identified by environmental studies and/or stakeholder consultation through use of the mitigation hierarchy: avoid, mitigate or minimise, rehabilitate, offset Proposed management measures will aid to minimise impacts to priority flora, vegetation communities and/ or fauna species. Following mining, Tronox rehabilitates mine pits to a high ecological standard.

Avoidance and mitigation measures have been detailed in the relevant impact assessment chapters (Section 4.5 and Section 5.5). Figure 10.1 illustrates how the mitigation hierarchy is applied to reduce the residual impact before its significance is assessed in order to determine whether an offset is required.

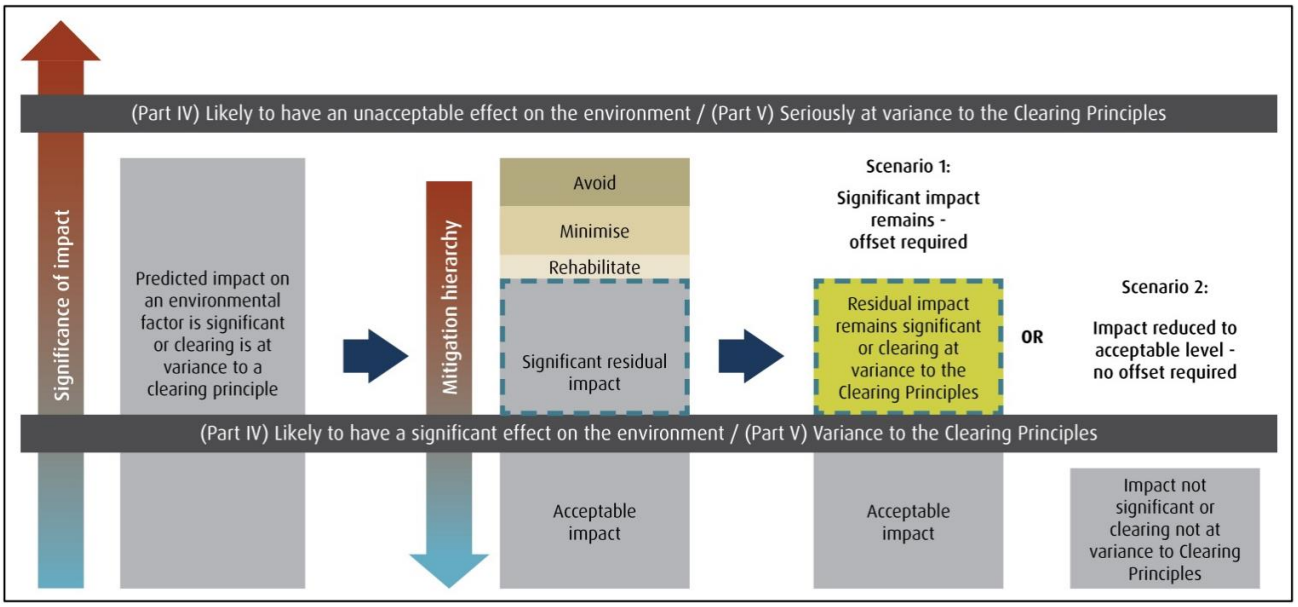

Figure 10.1 Mitigation hierarchy (EPA, 2014b)

10.2 Significant residual impacts

There are several activities associated with the Proposal that have the potential to impact the environment, including impacts to BC Act listed species. Potential impacts from these activities include:

- Loss or reduced health of flora and/or terrestrial fauna habitat through land disturbance or direct loss of native vegetation
- Exacerbation of vegetation and habitat fragmentation
- Displacement, injury, or death of fauna individuals during operation activities including clearing of vegetation
- Increased potential exposure (via clearing and mobilisation of vehicles and equipment) to native species predation and habitat disturbance from feral and invasive species
- Indirect impacts on fauna and habitats from dust, noise and vibration during operation activities
- Further spread weeds already present within the Proposal and surrounding areas .

10.2.1 Mitigation Measures

The WA Offsets Policy states that environmental offsets will only be considered after the EPA's mitigation hierarchy has been considered. The ERD details the application of the Proposal's mitigation measures, including avoidance, minimisation, and rehabilitation measures, with the key measures summarized below:

Avoid

- Preference for clearing lower conservation significance areas
- Avoiding clearance of vegetation that provides linkages between remnants
- Clearing within authorised areas only
- Restricting the importation of soil and vegetation matter to low-risk material
- Mulching of vegetation for rehabilitation use rather than burning of material onsite
- Restricting vehicle access to designated areas around the mining lease
- Avoid excessive lightshed
- Prohibition of feeding and hunting fauna
- Preference dredge mining to avoid indirect impacts from groundwater drawdown

Minimise

– Restrict clearing to the authorised extent and minimising impact where possible
– Progressive clearing and backfilling to minimise clearing footprint
– Regular monitoring of vegetation health within high-risk areas against reference sites and reliable data sources
– Minimise impact to significant Flora and Fauna through restriction of vehicle access to designated areas and speed limits
– Clear vegetation in a front towards remnants (not clearing towards existing mine)
– Implementation of food waste controls to minimise attraction of feral species
– Implementation of fire management controls
– Minimisation of dust emissions through operational controls including transport, topsoil and process waste procedures
– Minimise loss/reduction of habitat due to introduction or weeds and pathogens with appropriate hygiene controls (implemented through EMP)
– Minimise impacts to wetlands and ground water dependent vegetation through water management procedures

Manage

– Implement EMP
– Photographic evidence of proposed clearing area before and after clearing
– Inspect demarcated boundaries for damage or signs of clearing encroachment.

10.2.2 Flora and Vegetation

Following application of the mitigation hierarchy, including rehabilitation, the Proposal is likely to cause a significant residual impact (SRI) to vegetation, specifically, Banksia Woodlands PEC. Rehabilitation methods are well established within the Cooljarloo Operations though Tronox acknowledges the complexity involved in achieving outcomes to establish a functional and self-sustaining ecological community. Given this uncertainty, the residual impacts are considered to be significant given the cumulative loss of the ecological community across the SCP.

Up to 33.37 ha of the proposed disturbance to the Banksia Woodlands PEC will be rehabilitated as part of the ongoing Cooljarloo mining operations and rehabilitation plan. The Proposal will therefore result in a loss of 33.37 ha of this ecological community for up to an estimated 12 years, until rehabilitated areas have qualities that align with this PEC (i.e. up to two years of construction and operations, and an estimated ten years of rehabilitation). After this period the community will not be of the same quality, however the quality is predicted to improve gradually over time.

The calculated SRI to vegetation is summarised in Table 10.1 with details provided in Appendix C. The offset is proposed to counterbalance the SRI of the Proposal and is consistent with the principles of the WA Environmental Offset Policy. The Residual Impact Significance Model (RISM) for the Proposal, prepared as per Figure 3 in the WA Environmental Offsets Guidelines, is in Table 10.3.

Table 10.1 Significant Residual Impacts to be Offset

Community	Proposal raw impact (ha)	Proposal SRI (ha) after EPBC Act calculator	Total SRI (ha)
Banksia Woodlands PEC	33.37 ha (Excellent condition)	16.78 ha	16.78 ha

10.2.3 Terrestrial Fauna

Following application of the mitigation hierarchy, including rehabilitation, the Proposal is likely to cause a significant residual impact (SRI) fauna species, specifically, Carnaby's Cockatoo. Rehabilitation methods are well

established within the Cooljarloo Operations and rehabilitation planning targets the return of plant species suitable to support Carnaby's Cockatoo foraging. Given the temporary loss of foraging resources, and the cumulative loss of Carnaby's Cockatoo foraging habitat across the SCP, the residual impacts are considered to be significant.

Up to 53.94 ha of the proposed disturbance to Carnaby's Cockatoo foraging habitat will be rehabilitated as part of the ongoing Cooljarloo mining operations and rehabilitation plan. The Proposal will therefore result in a loss of 53.94 ha of foraging resources for up to an estimated 12 years, until rehabilitated areas have developed to support Carnaby's Cockatoo foraging (i.e. up to two years of construction and operations, and an estimated ten years of rehabilitation). After this period the habitat will not be of the same quality, however the quality is predicted to improve gradually over time.

The calculated SRI to terrestrial fauna is summarised in Table 10.2 with details provided in Appendix C. The offset is proposed to counterbalance the SRI of the Proposal and is consistent with the principles of the WA Environmental Offset Policy. The Residual Impact Significance Model (RISM) for the Proposal, prepared as per Figure 3 in the WA Environmental Offsets Guidelines, is in Table 10.3.

Table 10.2 Significant Residual Impacts to be Offset

Species	Proposal raw impact (ha)	Proposal SRI (ha) after EPBC Act calculator	Total SRI (ha)
Carnaby's Cockatoo	53.94 (moderate to high)	25.99 ha	25.99 ha

Table 10.3 Preliminary offset triggers – Residual Impact Significance Model

Part IV Environmental Factors	Vegetation and Flora						
						Subterranean Fauna	
				Terrestrial Fauna			
	Rare flora	**Threatened ecological communities**	**Remnant vegetation**	**Wetlands & waterways**	**Conservation areas**	**High biological diversity**	**Habitat for fauna**
Residual impact that is environmentally unacceptable or cannot be offset	No residual impacts are considered to meet these criteria	No residual impacts are considered to meet these criteria	No residual impacts are considered to meet these criteria	No residual impacts are considered to meet these criteria	No clearing will occur in conservation areas	None identified	Overall, the clearing will not significantly reduce the extent of any fauna habitat type.
Significant residual impacts that will require an offset – All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level	No residual impacts are considered to meet these criteria: – No Threatened Flora records are located within the DE – Impacts to Priority flora are not considered significant	Significant residual impacts following clearing of 33.37 ha of vegetation representative of the Banksia Woodlands PEC in Excellent condition, can be offset. The significant residual impacts are 16.78 ha for Banksia Woodlands PEC.	No residual impacts are considered to meet these criteria – all vegetation associations have over 65% per cent of pre-European extent remaining.	No residual impacts are considered to meet these criteria as no wetlands or waterways that are protected by statute lie within the DE or would be indirectly impacted by the Proposal.	No clearing will occur in conservation areas	No residual impacts are considered to meet these criteria. Locally significant vegetation is known to have high diversity, however the residual impacts on these areas are not considered significant given the area of intact habitat that will remain outside the DE.	Significant residual impacts following clearing of 53.94 ha of vegetation that provides habitat for Black Cockatoos, can be offset. The significant residual impacts are 25.99 ha for Carnaby's Cockatoo.
Significant residual impacts that may require an offset – Any significant residual impact to potentially threatened species and ecosystems, areas of high environmental value or where the cumulative impact may reach critical levels if not managed	No residual impacts are considered to meet these criteria – refer above	No other residual impacts are considered to meet these criteria – refer above	No residual impacts are considered to meet these criteria – refer above	No residual impacts are considered to meet these criteria – refer above	No residual impacts are considered to meet these criteria – refer above	No residual impacts are considered to meet these criteria – refer above	No residual impacts are considered to meet these criteria – refer above
Residual impacts that are not significant	No Threatened Flora listed under the EPBC Act or BC Act were recorded in the DE. Twelve Priority flora species were recorded with the DE. Eight of the species have a large proportion of their local records located outside the DE and therefore impacts are not considered significant: – *Chordifex reseminans* (P2) – 2.75% – *Babingtonia urbana* (P3) – 1.12% – *Comesperma rhadinocarpum* (P3) – 9.97% – *Hensmania stoniella* (P3) – 3.47% – *Hypocalymma quadrangulare* (P3) – 9.97% – I*sopogon panduratus* subsp. *palustris* (P3) - 0.47% – *Schoenus pennisetis* (P3) - 9.70%	No other residual impacts are considered to meet these criteria – refer above	Clearing of 59.14 ha of remnant vegetation is not considered to be a significant residual impact (noting other associated values are discussed separately in this table)	Indirect impacts to wetland and waterways are not considered to be a significant residual impact	No residual impacts are considered to meet these criteria or any other criteria above	Residual impacts on vegetated areas are not considered significant given the area of intact habitat that will remain outside the development envelope	Fauna habitats in the DE are well represented locally and regionally and do not support species that are considered restricted to the area.

	– *Schoenus griffinianus* (P4) – 7.03% Four Priority Flora species had larger proportion of total records within the DE: – *Levenhookia preissii* (P1) – *Poranthera asybosca* (P1) – *Poranthera moorokatta* (P2) – *Anigozanthos humilis* subsp. *chrysanthus* (P4) Based on the individual assessments of these species in Section 5.5.2 the Proposal is unlikely to significantly impact the regional extent of these species. Impacts to the local extent will occur but are not expected to be significant.						
Assessment: Does this project meet the EPA's objective for this factor?	Through implementation of the mitigation hierarchy, application of the management actions, Tronox consider the Flora and Vegetation environmental factor can be managed to meet the EPA's objective to protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Through implementation of the mitigation hierarchy, application of the management actions, and implementation of offsets to compensate for significant residual impacts, Tronox consider the Flora and Vegetation environmental factor can be managed to meet the EPA's objective to protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Through implementation of the mitigation hierarchy, application of the management actions, Tronox consider the Flora and Vegetation environmental factor can be managed to meet the EPA's objective to protect flora and vegetation so that biological diversity and ecological integrity are maintained.	The Proposal is expected to have a negligible impact to water quality. Tronox considers the EPA objective for inland waters will be met.	No clearing will occur in conservation areas. Tronox considers the EPA objective for Conservation Areas will be met.	None identified. Tronox considers the EPA objective for flora, vegetation and fauna will be met.	Through implementation of the mitigation hierarchy, application of the management actions, and implementation of offsets to compensate for significant residual impacts, Tronox consider the Terrestrial Fauna environmental factor can be managed to meet the EPA's objective to protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

10.3 Proposed offsets

Tronox proposes to offset the significant residual impacts identified in section 10.2 with a combination of land acquisition, habitat improvement through on ground management and creation of ecological linkages. The proposed offsets package is yet to be finalised but will be consistent with relevant police and guidance, including:

– *Environmental Protection Act 1986*
– *Biodiversity Conservation Act 2016*
– WA Government's Environmental Offset Policy (EPA, 2011)– outlines the principles for the use of offsets
– WA Environmental Offsets Register (2013) – Central public record of all offset agreements in WA, providing transparency and accountability
– WA Environmental Offsets Guidelines (EPA, 2014b) – complements the policy by clarifying how environmental offsets will be determined and applied
– Better offsets for Western Australia's black cockatoos. (Maron, 2021)
– Environmental offsets metric: Quantifying environmental offsets in Western Australia (DWER, 2021a)
– Considering offsets at a regional scale (EPA, 2024d).

Land acquisition of properties with remnant vegetation that provide environmental values similar to those in the impact area, i.e. like-for-like offset and can integrate with the existing conservation estate have been shown to achieve offset requirements. These areas have the potential to increase the value existing of conservation areas by:

– Increasing the areas of secured habitat within the conservation estate
– Securing larger areas of contiguous vegetation preventing fragmentation from future development activities
– Including the additional land in conservation and management programs, reducing the impacts of threatening processes.

In addition to direct land acquisition and management to maintain condition and quality, the acquisition of freehold land and rehabilitation of native vegetation in a disturbed condition or rehabilitation of cleared land can also achieve offset requirements. The rehabilitation and or creation of values for the key communities, habitats and species align with the principles of additionality and can provide an environmental gain.

10.4 Stakeholder Consultation

The scope, objectives and quantum of the Offset Proposal will be prepared in consultation with relevant Government departments and stakeholders as part of the Part IV EP Act assessment processes.

Tronox will present and seek engagement of the proposed approach to fund environmental offset projects with key government agencies, including EPA Services and DBCA. Further engagement will be sought on the governance and financial arrangements to ensure the offset quantum of the current Proposal can be defined as clear and measurable on-ground projects consistent with the offset objectives.

Furthermore, as part of the assessment process key government, community stakeholders, Traditional Owners and other proponents operating in the region will be consulted to identify the most appropriate offset approaches that leverage synergies with existing projects and significant regional knowledge gaps.

10.5 Finalisation and implementation of offsets

The finalised Offset Proposal is expected to be delivered as a package of offset actions, prepared in consultation with State departments. Coordination of offset elements creates an opportunity to deliver more value.

Offset Management Plans and Environmental Offset Project Plans will be developed as part of the assessment process.

11. Consultation

Table 11.1 provides a summary of stakeholder engagement related to the Proposal. Engagement is ongoing. Tronox will continue to engage with relevant stakeholders throughout the environmental approval process to ensure that all concerns are addressed. This includes decision making authorities, other relevant government authorities, the local community, and environmental non-government organisations. Future consultation related to the Proposal will be undertaken as part of the schedule for future consultation that is currently being implemented for the Cooljarloo Mine (Table 11.2).

Table 11.1 Summary of stakeholder consultation undertaken for the Proposal

Stakeholder/s	Date	Role and key comments
Environmental Protection Authority (EPA)	December 2023	Pre-referral meeting held with EPA Services to present the original Proposal.
Environmental Protection Authority (EPA)	27 November 2024	Pre-referral meeting held with EPA Services to present revised (current) Proposal.

Table 11.2 Stakeholder consultation schedule for the Cooljarloo Mine

Organisation	Main interest	Task	Frequency
Government agencies			
Dept. of Energy, Mines, Industry Regulation and Safety (DEMIRS)	– Mining Approvals (Mining Proposal) – Mine Closure – Radiation – Mine Safety – Minerals Resources – (Production)	Revision and approval of Mining Proposal (MP) and Mine Closure Plan (MCP)	Prior to commencement of the Proposal
		Annual Environmental performance reporting regarding compliance with MP and MCP	Annually during operations
		Review of MCP	Every 3-5 years
		Revision and approval of Radiation Management Plan.	Prior to commencement
		Annual Radiation Reporting	Annually during operations
Environmental Protection Authority (EPA)	Compliance with Part IV approvals/ Ministerial Conditions as they relate to preliminary key Environmental factors e.g. – Flora and Vegetation – Fauna – Hydrological processes – Mine Closure – Offsets	Consult in relation to Ministerial Statement compliance	Annually
		Annual/Triennial Environmental Report submission and review	Annually
		Review of MCP for Cooljarloo Consult regarding research plans and potential changes to operations or criteria	Every 3-5 years
Dept. of water and Environmental Regulation (DWER)	Compliance with Part V licence and in relation to contaminated sites management	Annual/Triennial Environmental Report submission and review	Annually
		Management of contaminated sites	Annually and as required
	Compliance in relation to Annual Water Entitlement (groundwater abstraction licences and associated Operating Strategy)	Annual/ Environmental Report submission and review	Annually
		Revision of the Op strategy	
		Establishment and maintenance of groundwater abstraction licences	As required

Organisation	Main interest	Task	Frequency
Radiological Council	Management of naturally occurring radiological materials	Submit annual report on surface radiation levels.	Annually
		Obtain sign-off on management of rehabilitated sites	As required
		Revision and approval of management plans	As required
Department of Biodiversity, Conservation and Attractions (DBCA)	Management of protected flora and fauna.	Consult regarding rehabilitation and mine closure	Annually
		Feral animal control and fauna monitoring	As required
Dept. of Planning, Lands and Heritage (DPLH)	Identification and protection of Aboriginal heritage	Consult regarding Aboriginal Heritage Sites	As required
	Landowner of UCL	Consult regarding land access	As required
Main Roads WA	State Road network	Consult regarding road intersection and usage	As required
Shire of Dandaragan	Local governance	Liaise with Shire regarding mining activities, interactions with local communities and road networks (e.g. Cooljarloo Road and Woolka Road)	As required
Local landholders /neighbours		Keep informed regarding mining activities, interactions with local landholder's road networks (e.g. Cooljarloo Road and Woolka Road)	As required
Traditional owners	Protection of heritage matters, environmental management and protection of other Native Title interests	Consult regarding Aboriginal Heritage Sites as per existing Heritage agreements	Annually during operations within affected areas
Suppliers		Keep suppliers informed of mining schedule and project activities	As required
Supported organisations and groups		Maintain current liaison with the surrounding residents and keep community aware of all relevant aspects of the mining operation.	As required

12. Existing compliance and environmental performance

12.1 Compliance

Table 12.1 provides the environmental compliance history for the existing Cooljarloo Mine for the past five years sourced from Compliance Assessment Reports (CARs) from 2019 to 2023. The Cooljarloo Mine has a good track record in environmental compliance with Ministerial Statements, notwithstanding the minor non-compliance for exceeding (+35 ha) the authorised pasture disturbance footprint, which is from an administrative error by Tronox who under-estimated the existing disturbance footprint (under-estimated by 35 ha) at the Cooljarloo Mine for the MS1158 application. This will be corrected from a pending submission of a revised S45C to amend the authorised pasture disturbance footprint from 795 to 837 ha.

Table 12.1 Summary of Ministerial Statement 1158 compliance reports for the Cooljarloo Mine

Year	Title	Compliance status		
		Key characteristics	Ministerial conditions audit	EMP implementation under Ministerial Statement
2024	Ministerial Statement Compliance Assessment Report: Cooljarloo MS1158	Under preparation – due 31 March 2025	Under preparation – due 31 March 2025	Under preparation – due 31 March 2025
2023	Ministerial Statement Compliance Assessment Report: Cooljarloo MS1158	No change from previous reporting period.	MS1158 - One non-compliance (Audit Code MS1158: M1-1) due to technical error by Tronox during original submission of pasture disturbance data for the MS1158 application. Implementation of the Proposal regarding authorised extent not in accordance with Schedule 1 of MS1158	Full compliance
2022	Ministerial Statement Compliance Assessment Report: Cooljarloo MS1158	No change from previous reporting period.	MS1158 - CAR states full compliance but Audit Code MS1158:M1-1 still appears to be a non-compliance due non-compliance of Implementation of the Proposal regarding the authorised extent (pasture disturbance) being not in accordance with Schedule 1 of MS1158	Full compliance
2021	Ministerial Statement Compliance Assessment Report: Cooljarloo MS1158	*Pasture disturbance footprint* - Non-compliance for exceeding authorised pasture disturbance footprint (795 ha) for pastural land use Current pasture disturbance footprint is 829.99 ha	MS1158 - One non-compliance (Audit Code MS1158: M1-1) due to technical error by Tronox during original submission of pasture disturbance data for the MS1158 application. Implementation of the Proposal regarding authorised extent not in	Full compliance

Year	Title	Compliance status		
		Key characteristics	Ministerial conditions audit	EMP implementation under Ministerial Statement
			accordance with Schedule 1 of MS1158	
2020	Ministerial Statement Annual Environmental Report: Cooljarloo MS037 & MS557	MS037 - Full compliance MS557 - Full compliance	MS037 - Full compliance MS557 - Full compliance	MS037 - Full compliance MS557 - Full compliance
2019	Annual Environmental Report: Cooljarloo Mine	MS037 - Full compliance MS557 - Full compliance	MS037 - Full compliance MS557 - Full compliance	MS037 - Full compliance MS557 - Full compliance

12.2 Environmental performance

Current environmental performance of the existing Cooljarloo Mine for key EPA environmental factors relevant to this Proposal are summarised in Table 12.2, which indicates that the Cooljarloo Mine is currently meeting environmental performance expectations.

Table 12.2 EPA environmental factors and objectives relevant to the to the Proposal and current environmental performance

Theme	Factor	Objective	Relevance to proposal	Key environmental factor	Current environmental performance
Sea	Benthic Communities and Habitats	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	N/A	No	N/A
	Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	N/A	No	N/A
	Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	N/A	No	N/A
	Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	N/A	No	N/A
Land	Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	The Proposal will require the clearing of native vegetation across the development footprint	Yes	Objective is currently being met by Cooljarloo Mine operations – The authorised (MS1158) overall disturbance footprint and native vegetation disturbance footprint are up to 7,000 ha and up to 6,905 ha respectively. Cooljarloo Mine is complying with MS1158 as the current overall disturbance footprint is 4,443.32 ha and the current native vegetation disturbance footprint is 3,613.33 ha. Management measures employed and/or evidence of compliance include: – Implementation of Rehabilitation Management Plan – Implementation of Offset Strategy to compensate for residual impacts to significant flora and vegetation, and ecological communities for the Cooljarloo West development – 2021 Cooljarloo Vegetation Monitoring Report – Spatial dataset maintained – Clearing and stripping shapefiles and register maintained – Annual reconciliations and reviews – Pre-disturbance reports – Completed applications to clear native vegetation forms and clearing inspection checklists. – Annual Environmental Management Program – conservation significant flora management summary – Internal (Cooljarloo Mine) audits and cross-site audits – Herbarium maintained at Cooljarloo Mine offices
	Landforms	To maintain the variety and integrity of significant physical landforms so that environmental values are protected.	No significant impact expected.	No	N/A
	Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	HOLD - Desktop assessment indicated that impacts to subterranean fauna are unlikely	No	N/A
	Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	The Proposal is not expected to result in any substantial changes to terrestrial environmental quality.	No	N/A
	Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	The Proposal will impact on habitat for conservation significant fauna	Yes	Objective is currently being met by Cooljarloo Mine operations Management measures employed and/or evidence of compliance include: – Implementation of Fauna Management Plan – Implementation of Rehabilitation Management Plan – Implementation of Offset Strategy to compensate for residual impacts from loss of Carnaby's Black-Cockatoo foraging habitat for the Cooljarloo West development
Water	Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	DE intersects a listed important wetland	Yes	Objective is currently being met by Cooljarloo Mine operations Management measures employed and/or evidence of compliance include: – Annual Environmental Management Program Summary- Annual Water Management – Annual aquifer review

Theme	Factor	Objective	Relevance to proposal	Key environmental factor	Current environmental performance
					– Groundwater Drawdown Management Plan
Air	Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	Dust and pollutants are unlikely to lead to exceedances at sensitive receptors given their distance from the project	No	N/A
	Greenhouse Gas (GHG) Emissions	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change	The Proposal is NOT anticipated to generate additional greenhouse gas (GHG) emissions during both the construction and operational phases, which may lead to the Cooljarloo Mine surpassing the EPA threshold of 100,000 tons of CO_2 equivalent per year for GHG emissions.	Possible	Objective is currently being met by Cooljarloo Mine operations. Management measures employed and/or evidence of compliance include: – Monitor GHG emissions – Progressive revegetation of cleared areas of unallocated Crown Land after mining activities – Reporting of GHG emissions (scope 1 & 2) to the Clean Energy Regulator in accordance with the *National Greenhouse and Energy Reporting Act 2007* (NGER Act)
People	Social Surroundings	To protect social surroundings from significant harm.	Noise levels are unlikely to significantly differ from current noise levels generated at the Cooljarloo mine. The Osprey expansion is not likely to increase visual impacts from the existing mine. No Aboriginal heritage is expected to be impacted.	No	N/A
	Human Health	To protect human health from significant harm.	No radiological impacts are associated with the Project.	No	N/A

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Appendices

Appendix A

Environmental Management Plan

Appendix B

Studies and Surveys

Appendix C

DWER Environmental Offsets Calculations

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