2. Legislative context

2.1 Environmental impact assessment process

2.1.1 Environmental Protection Act 1986 (WA)

The EP Act is the primary legislation governing environmental impact assessment (EIA) in WA. Part IV of the EP Act relates to Environmental Impact Assessment, which is carried out in accordance with the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual* (EPA 2021a).

In accordance with section 3.1.3 of the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual*, the ERD has been prepared with the intent to provide the EPA sufficient information regarding the potential environmental impacts to enable assessment of the Proposal. The ERD has been prepared in accordance with the EPA (2021b) *Instructions on how to prepare an Environmental Review Document*, including assessment against the EPA's key environmental factors. The EIA is based on conformance with the ESD and its addendum, and various relevant EPA policy position statements and guidance documents.

Alcoa will release the ERD for a public review period of ten weeks. The EPA will provide a summary of the submissions on the ERD for Alcoa to respond to. The EPA will then review the response to the submissions and may publish Alcoa's response to the submissions on the EPA website if appropriate. The EPA then prepares and submits its assessment report and recommendations to the WA Minister for Environment for consideration.

2.1.1.1 Assessment of the approved proposal

the Pinjarra Refinery and Huntly Mine were established before the introduction of environmental legislation in WA (and had existing approvals under State Agreements as detailed in Section 2.2.1), these operations were not originally subject to Ministerial conditions pursuant to Part IV of the EP Act. In 2003, the exemption of State Agreements from the operation of the EP Act was repealed.

Alcoa referred the Pinjarra Refinery Efficiency Upgrade (PREU) proposal to the EPA in 2003 as a significant proposal. The PREU proposal sought to increase the production of alumina at the Pinjarra Refinery from 3.5 Mtpa to 4.2 Mtpa, and included the mining of bauxite at the Huntly Mine (see Section 1.10). The PREU was approved in 2004 under Ministerial Statement (MS) 646 and subsequently amended in 2015 under s45C of the EP Act to upgrade the Refinery from 4.2 Mtpa to 5.0 Mtpa. The Proposal is a significant amendment to the PREU approved under MS 646, and if approved will result in changes to MS 646.

Under s40AA of the EP Act, assessment of significant amendments must be in the context of the approved proposal and have regard to the combined effect that the implementation of the approved proposal and the significant amendment might have on the environment.

The EPA (2003) assessed the PREU with regard to four environmental factors:

- Air quality
- GHG emissions
- Noise and
- Water supply.

In accordance with s40AA of the EP Act, this ERD assesses the potential impacts of the Proposal in the context of the PREU, including the combined effects on the above four environmental factors. The context and combined effects are addressed in the ERD as

presented in Table 2.1. For each of the four factors, the environmental effects of the Refinery are assessed at 5.25 Mtpa production, including the 0.25 Mtpa increase (the significant amendment) and approved 5.00 Mtpa production (the approved proposal).

Table 2.1 Assessment of the Proposal as a significant amendment to the PREU

Key environmental factor	Context described in ERD section	Combined effects described in ERD section
Inland waters (water supply)	Section 8.4.12	Section 8.4.12
Air quality	Section 9.3.3.4 Section 9.3.3.5	Section 9.4.4
GHG emissions	Section 10	Section 10
Social surrounds (noise)	Section 12.3.3.3	Section 12.4.2.2

Before the PREU, the extent of the Huntly Mine within ML1SA was not defined. The 2003 referral supporting documentation under Part IV of the EP Act to initiate approvals for the PREU (Environmental Protection Statement (EPS) (Environ 2003)) set out the change to the Refinery, which was to increase alumina production from 3.5 Mtpa to 4.2 Mtpa. The referral supporting documentation did not explicitly define the area within the Huntly Mine from which bauxite would be mined to feed the refinery. Likewise, MS 646 did not define a development envelope (DE) for the Huntly Mine, though it referenced a Bauxite Mine Rate of 22.6 Mtpa in its Schedule 1. This rate was subsequently removed following an approved change to proposal under section 45C in 2015.

When considering the third party Part IV referral of Alcoa's 2022-2026 and 2023-2027 MMPs, (see section 2.1.1.3) the EPA determined that the DE of the Huntly Mine that was included in the consideration of the PREU covers an area of 27,574 ha (Figure 1-3, Section 1.4). The EPA reasoning is set out in their Section 38(G)7 Public Advice regarding the *Bauxite mining on the Darling Range in the southwest of WA for the years 2023 to 2027* proposal (Assessment 2385).

The EPA does not define in the Public Advice a corresponding disturbance footprint or limit within the Huntly Mine DE. Therefore, although disturbance is subject to prior authorisation, any future disturbance within the DE remains subject to the disturbance approvals process required by Alcoa's Alumina Refinery (Wagerup) Agreement and Acts Amendment Act 1978, namely the annual approval by the Minister for State Development on advice from the Minister for Environment of a Mining and Management Program (MMP).

2.1.1.2 Implementation conditions

Alcoa has reviewed the implementation conditions under MS 646, which include the following:

1. Implementation and Changes
2. Proponent Commitments
3. Proponent Nomination and Contact Details
4. Commencement and Time Limit of Approval
5. Compliance Audit and Performance Review
6. Air Quality and Emissions Source Monitoring
7. Emissions Reduction Program
8. Model Validation
9. GHG Emissions.

Alcoa considers that the implementation conditions under MS 646 do not warrant an inquiry under Section 46 of the EP Act.

Alcoa requests consideration of removing conditions 2, 6, 7 and 8 from MS 646 and these requirements being incorporated into the Refinery environmental licence L5271/1983/14. This would remove the current overlap in regulation of air quality at the refinery, improving management and regulatory efficiency, and is considered appropriate given Alcoa's demonstrated compliance in air quality under both MS 646 and L5271/1983/14

Alcoa also requests a modification of condition 9 to reflect the EPA's 2024 environmental factor guidance on greenhouse gas emissions, and the regulation for Scope 1 emissions from refinery by the Australian Government's Safeguard Mechanism.

2.1.1.3 Third Party Referrals

On 28 February 2023, a third party made two referrals to the EPA under Part IV of the EP Act. The two referrals referenced Alcoa's 2022 to 2026 MMP and 2023 to 2027 MMP. In December 2023, the EPA determined to assess both referrals (Assessments 2384 and 2385), and that, like this Proposal, they are significant amendments to MS 646. An Environmental Scoping Document for Assessments 2384 and 2385 was published in August 2024.

On 14 December 2023, the *Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023* (Exemption Order) was issued, permitting Alcoa to continue its bauxite mining operations for the periods covered by the 2022 to 2026 and 2023 to 2027 MMPs, under specified conditions. The Exemption Order permits Alcoa to undertake clearing endorsed under the currently approved 2023-2027 MMP, while the EPA completes Assessments 2384 and 2385. The exemption remains in force until 31 December 2027, or until the WA Environment Minister makes a decision on the outcome of the EPA's assessments if earlier.

The Proposal detailed in this ERD (Assessment 2253) is not seeking to implement any of the mining activities detailed in Assessments 2384 and 2385 and being undertaken in accordance with the Exemption Order. The DEs for these three assessments do overlap, most notably within the Myara North Infrastructure Corridor (ICDE) (see Figure 1-4b, Section 1.4) and the O'Neil DE (see Figure 1-6b, Section 1.4), however the activities that are the subject of this Proposal are distinct, namely the Kisler facility and haul road in the ICDE, and planned disturbance in the O'Neil DE that is not included in the approved 2023-2027 MMP.

The cumulative impacts of these three Proposals (Assessments 2253, 2384 and 2385) are considered in Chapter 17 of this ERD.

2.1.2 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) covers the assessment of proposals which may have a significant impact on Matters of National Environmental Significance (MNES).

Section 67 of the EPBC Act defines a 'controlled action' as one that is likely to cause a significant impact to a MNES and which must be approved under the EPBC Act. Parts 7 and 8 of the EPBC Act provide for the referral and assessment of controlled actions.

Pinjarra Refinery and Huntly Mine commenced operation in the 1970s, well before the establishment of the EPBC Act. Activities associated with Pinjarra Refinery and Huntly Mine are a continuation of the use taking place at the time the EPBC Act came into force on 16 July 2000 and continue to be covered by section 43B of the EPBC Act, which enables such uses to continue unchanged without an EPBC Act approval.

The Proposal was initially referred under the EPBC Act on 30 July 2020, for both Refinery and Mine components. The Proposal was determined a controlled action (EPBC 2020/8743) requiring assessment and approval under the EPBC Act. On 18 March 2022, Alcoa withdrew

the proposed action and in mid-April 2022 submitted split referrals for the Refinery and Mine components:

- Pinjarra Alumina Refinery – Development of water storage ponds and associated borrow pits (EPBC 2022/09213)
- Huntly Mine Bauxite Mine Transition (EPBC 2022/09204)

On 18 August 2022 a delegate of the Commonwealth Minister for the Environment determined that EPBC 2022/09204 and EPBC 2022/09213 are controlled actions and require assessment and approval under the EPBC Act. The controlling provisions for both actions are:

- Listed threatened species and communities (sections 18 & 18A)
- Ramsar wetlands (sections 16 & 17B)
- Listed migratory species (sections 20 & 20A).

The assessment approach for EPBC 2022/09204 and EPBC 2022/09213 was determined to be accredited assessment under the WA EP Act.

On 21 October 2024, Alcoa submitted a request to DCCEEW to withdraw EPBC 2022/09213, which was approved in November 2024. The reason being that the proposed water storage ponds and associated borrow pits within the Pinjarra Alumina Refinery DE are no longer being assessed as part of the Proposal. The approval pathway for these items will be reconsidered following the outcome of a codesign process with the Traditional Owners (Gnaala Karla Booja).

Following consultation with the EPA and DCCEEW, it was determined that EPBC 2022/09204 cannot be varied to incorporate the O'Neil DE. As such, on 23 October 2024, Alcoa referred the O'Neil DE to DCCEEW under the EPBC Act (EPBC 2024/10009)[1]. DCCEEW is currently considering the Proposed Action to determine if it is a controlled action requiring assessment and approval under the EPBC Act.

Accordingly, this ERD assesses under the EPBC Act the Huntly Mine transition to the Myara North DE and Holyoake DE, which comprises EPBC 2022/09204, but does not assess under the EPBC Act the Huntly Mine re-entry into the O'Neil DE, which is subject to the determination of EPBC 2024/10009. This is reflected in Chapter 15, which assesses the Huntly Mine in the Myara North and Holyoake DEs only, whereas other ERD chapters assess the Huntly Mine in the Myara North, Holyoake and O'Neil DEs.

2.1.2.1 Accredited Assessment

Section 87(4) of the EPBC Act enables the Commonwealth Minister for the Environment to accredit the WA EPA's assessment process as suitable for assessing the impacts of a Proposal on MNES, and in doing so DCCEEW will consider the EPA's assessment report when advising their Minister on the acceptability of a Proposal's impacts on MNES.

Prior to amending the Proposal to include the O'Neil DE and remove the proposed run-off water storage (ROWS) ponds at the refinery, DCCEEW was assessing the Proposal only via the accredited assessment pathway. The removal of the ROWS ponds meant that there will no longer be any potentially significant impacts to MNES at the Pinjarra Refinery. Therefore, Alcoa withdrew EPBC 2022/09213 in October 2024.

The assessment of the Myara North and Holyoake DEs will continue under the accredited assessment pathway, with the impacts to MNES documented in Chapter 15 of this ERD. The EPA is considering potential impacts to MNES species within the O'Neil DE as part of the

[1] The scope of the Proposed Action forms part of the scope of two proposals that are being assessed under Part IV of the EP Act: *Pinjarra Alumina Refinery Revised Proposal* (Assessment No. 2253) and *Bauxite mining on the Darling Range in the southwest of WA for the years 2023 to 2027* (Assessment No. 2385).

assessment of this Proposal and its assessment of the 2023-2027 MMP. As a result of this overlap, for the O'Neil DE component of this Proposal, should DCCEEW determine that (EPBC 2024/10009) is a controlled action, it will not accredit the EPA's assessment, instead carry out its own.

2.2 Other approvals and regulation

2.2.1 State Agreements

A State Agreement is a legal agreement between the State of Western Australia and a proponent of a major project within the boundaries of Western Australia. The Proposal is subject to two State Agreements; the *Alumina Refinery Agreement Act 1961* and the *Alumina Refinery (Pinjarra) Agreement Act 1969*. These detail the rights, obligations, terms and conditions in relation to the operation of the Pinjarra Refinery and the Huntly Mine. Alcoa's State Agreements, read together, and in conjunction with a range of Ministerial Statements issued under the EP Act, create the current regulatory framework for Alcoa's operations in Western Australia.

Alcoa commenced its operations in Western Australia (WA) in 1963 under the *Alumina Refinery Agreement Act 1961* to build and operate the Kwinana Alumina Refinery. The same agreement also granted Alcoa a right to mine for bauxite in Mining Lease 1SA (ML1SA). Alcoa's operations expanded under subsequent State Agreements, which supported the construction and operation of two additional alumina refineries in Pinjarra and Wagerup, with the corresponding bauxite mining continuing in ML1SA focused on the Huntly and Willowdale Mines. The historical growth of Alcoa's WA operations has occurred against a backdrop of the State Agreements and evolving environmental legislation and management policies. Alcoa's operations have been progressively authorised by successive Ministerial Statements (MS) under Part IV of the EP Act and environmental licences under Part V of the EP Act, tailored to each operation.

2.2.1.1 Alumina Refinery Agreement Act 1961

Alcoa was granted the right to mine bauxite within ML1SA under the *Alumina Refinery Agreement Act 1961*. ML1SA covers 7,129 square kilometres across the Darling Plateau and extends from east of Perth in the north, to east of Bunbury in the south. The western boundary of ML1SA comprises the Swan Coastal Plain and the eastern boundary adjoins the Worsley mining lease ML258SA, Mundaring and Youraling State Forests and Wandoo National Park (Figure 1-1). ML1SA includes several mining areas, comprising:

- Jarrahdale Mine (1963 to 1998) to the north of the Huntly Mine, now closed and formerly supplying the Kwinana Alumina Refinery
- Huntly Mine (1976 to present), supplying the Kwinana and Pinjarra Alumina Refineries and
- Willowdale Mine (1984 to present) to the south of Huntly, supplying the Wagerup Alumina Refinery.

Under clause 13(3) of the *Alumina Refinery Agreement Act 1961*, Alcoa pays compensation to the State Government (Conservator of Forests) (now DBCA) for forest *"impacted by or in connection with the Company's mining activities"*. The amount of compensation paid is based on the planned clearing for the calendar year, with a reconciliation of the actual clearing from the previous year. Over the past five years, Alcoa has paid between $2.3 million to $6.4 million in compensation per year.

The *Alumina Refinery Agreement Act 1961* further links Alcoa's mining activities to the State Government's management of the Northern Jarrah Forest through clause 13(2), which requires Alcoa to give the Forest Products Commission (FPC) six months prior notice of its intention to clear an area for mining. The FPC then has the opportunity to enter the area to cut and remove merchantable timber or other forest produce.

Since 1961, a series of reviews of conservation reserves have been undertaken to improve biodiversity protection across the Northern Jarrah Forest region. As a result of the reviews, Alcoa has agreed not to mine in conservation areas with ML1SA. This was formalised in 1986 by amendments to the *Alumina Refinery Agreement 1961*. Additional reserves have been established under the Regional Forest Agreement between the State and Commonwealth and the Forest Management Plan review process.

2.2.1.2 Alumina Refinery (Pinjarra) Agreement Act 1969

Alcoa was granted approval to develop the Pinjarra Alumina Refinery under the *Alumina Refinery (Pinjarra) Agreement Act 1969*. The refinery was commissioned in 1972, before the introduction of environmental protection legislation in WA. The refinery is now subject to approvals under environmental legislation including MS 646 under Part IV of the EP Act, an environmental licence under Part V of the EP Act, in addition to water abstraction licences under the WA *Rights in Water and Irrigation Act 1914* (RIWI Act).

2.2.1.3 State Agreement – Environmental approvals and assessment

Approval decision making

As of July 2024, the Bauxite Strategic Executive Committee (BSEC) replaced and now fulfills the existing advisory functions of the Mining and Management Plan Liaison Group as they are described in Ministerial Statement 728 and *Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004*. The BSEC is chaired by the Department of Jobs, Tourism, Science and Innovation (DJTSI) and consist of representatives of the Department of Water and Environmental Regulation (DWER), Department of Health (DoH), Department of Planning, Lands and Heritage (DPLH), Forest Product Commission (FPC), Department of Biodiversity, Conservation and Attractions (DBCA), Department of Energy, Mines, Industry Regulation and Safety (DEMIRS), and the independent Chair of the Alcoa Independent Technical Advisory Group (ITAG).

BSEC provides advice and recommendations to the Minister for State Development with regards to approval decisions on the annual Mining and Management Program (MMP) that Alcoa is required by its State Agreement to submit and have approved.

The conditions accompanying the Minister for State Development's approval of Alcoa's 2023-2027 MMP included the requirement for Alcoa to provide adequate resourcing to ensure the ITAG was reconstituted by 30 June 2024. ITAG provides technical input to assist BSEC fulfill its functions (ITAG function 1) as well as providing advice to Alcoa in co-designing and implementing a range of technical studies and reports (ITAG function 2). Membership for ITAG function 1 consists of officer-level representatives from BSEC member agencies, plus Water Corporation. ITAG function 2 requires additional membership that will be determined by BSEC upon advice from the ITAG Chair, as informed by function 1 members; it is expected this will consist of relevant academic and research institutions, catchment councils and Alcoa.

Mining and Management Programs

Each year, Alcoa submits a rolling five-year MMP to BSEC for review, which is approved by the Minister for State Development in whole or with conditions. The MMP sets out Alcoa's mining and rehabilitation schedule for the Huntly and Willowdale Mines and includes priority land uses and management plans agreed through the ITAG.

The MMP for 2024-2028 has received approval to mine at rate of up to 24.1 Mtpa (dry tonnes) of bauxite per year at Huntly Mine. Alcoa had committed to limiting the clearing associated with this period to 800 ha per year over the five-year period, which includes allocations for infrastructure in the mine regions, and allows unused annual clearing allocations to roll over to the following years.

2.2.2 Land tenure and zoning

The Myara North, Holyoake and O'Neil DEs (Figure 2-1, Figure 2-2 and Figure 2-3) lie predominantly in State Forest, within ML1SA granted under the *Alumina Refinery Agreement Act 1961*. The Refinery DE lies on freehold land owned by Alcoa and designated for the refinery under the *Alumina Refinery (Pinjarra) Agreement Act 1969*. The State Agreements typically override the provisions of the regional and local planning schemes prepared in accordance with the *Planning and Development Act 1985*; hence the following analysis is presented for context only.

The Myara North DE is predominantly located within the Metropolitan Region Scheme (MRS) and the Shire of Serpentine-Jarrahdale local planning Scheme (LPS) No. 2. The far eastern edge of the Myara North DE is located in the Shire of Wandering LPS No. 3. The Myara North DE is predominantly zoned as State Forest, with small areas zoned as Rural and Parks and Recreation. In addition, the Myara North DE is zoned as Water Catchment Area under the MRS, as it lies within the drinking water catchment of Serpentine Dam. The regional and local planning areas relevant to the Myara North DE are summarised in Table 2.2.

The Holyoake DE is predominantly located within the Peel Region Scheme (PRS) and the Shire of Murray LPS No. 4. An eastern portion of the Holyoake DE is located within the Shire of Boddington LPS No. 2. The Holyoake DE is predominantly zoned as State Forest with small areas zoned as Rural or Railways. In addition, the majority of the Holyoake DE falls under a Water Catchment Special Control Area as it lies within the drinking water catchment of the South Dandalup Dam (Lake Banksiadale). The regional and local planning areas relevant to the Holyoake DE are summarised in Table 2.2.

The O'Neil DE is predominantly located within the Shire of Boddington, with the north-eastern portion located within the Shire of Wandering and western portion within the Shire of Murray. A western portion of the O'Neil DE is located within the Peel Region Scheme (PRS). The O'Neil DE is predominately zoned as State Forest. In addition, the O'Neil DE is zoned as Water Catchment Area as it lies within the drinking water catchment of Serpentine Dam. The regional and local planning areas relevant to the O'Neil DE are summarised in Table 2.2.

The Refinery DE (Figure 2-4) is located within the PRS and the Shire of Murray LPS No. 4. The majority of the refinery is zoned as Industrial and Rural. The refinery also includes an area zoned for Public Purposes – public utilities, that relates to land used for refinery water storage, incidental infrastructure and equipment. The regional and local planning areas relevant to the Refinery DE are summarised in Table 2.2.

Table 2.2 Proposal regional and local planning areas

Development Envelope	Zone / Reservation	Region Scheme (RS) Zone / Reservation[1]	RS Special Control Area[2]	Local Planning Scheme (LPS) Zone / Reservation	LPS Special Control Area	LPS Zoning Permitted Land Use[3]
Myara North	Zone	Rural	Water Catchments	Rural	-	Commercial Vehicle Parking, Recreation Public, Single House Residential, Rural Use, Stable
				Conservation		Single House, Public Utility
		Urban		Residential		Recreation Public, Single House Residential
	Reservation	State Forests		State Forest		-
		Waterways		-		-
		Parks and Recreation		Public Open Space		-
		Primary Regional Roads		-		-
Holyoake / O'Neil	Zone	Rural	Special Control Area No. 1 – Water Catchments	-	-	Single House, Public Utility, Agriculture Extensive, Hobby Farm, Home Office, Horse Stables, Rural Pursuit
	Reservation	State Forests		State Forest		-
		Railways		-		-
		Primary Regional Roads		-		-
		Waterways		-		-
O'Neil	Reservation	State Forest	Special Control Area No. 1 – Water Catchments	State Forest	-	-
Pinjarra Alumina Refinery	Zone	Rural	-		Conservation/Protection: L1 – Places of Landscape Value Water: Floodprone Areas (100 Year Flood)	Home Office, Single House, Public Utility, Rural Pursuit
		Industrial		Industry		Car Park, Light Industry, General Industry, Public Utility

Development Envelope	Zone / Reservation	Region Scheme (RS) Zone / Reservation[1]	RS Special Control Area[2]	Local Planning Scheme (LPS) Zone / Reservation	LPS Special Control Area	LPS Zoning Permitted Land Use[3]
				Special Use		Refinery water storage and incidental infrastructure and equipment with the exclusion of residue storage areas
	Reservation	Public Purposes - Public Utilities		-		-
		Primary Regional Roads				

Notes:

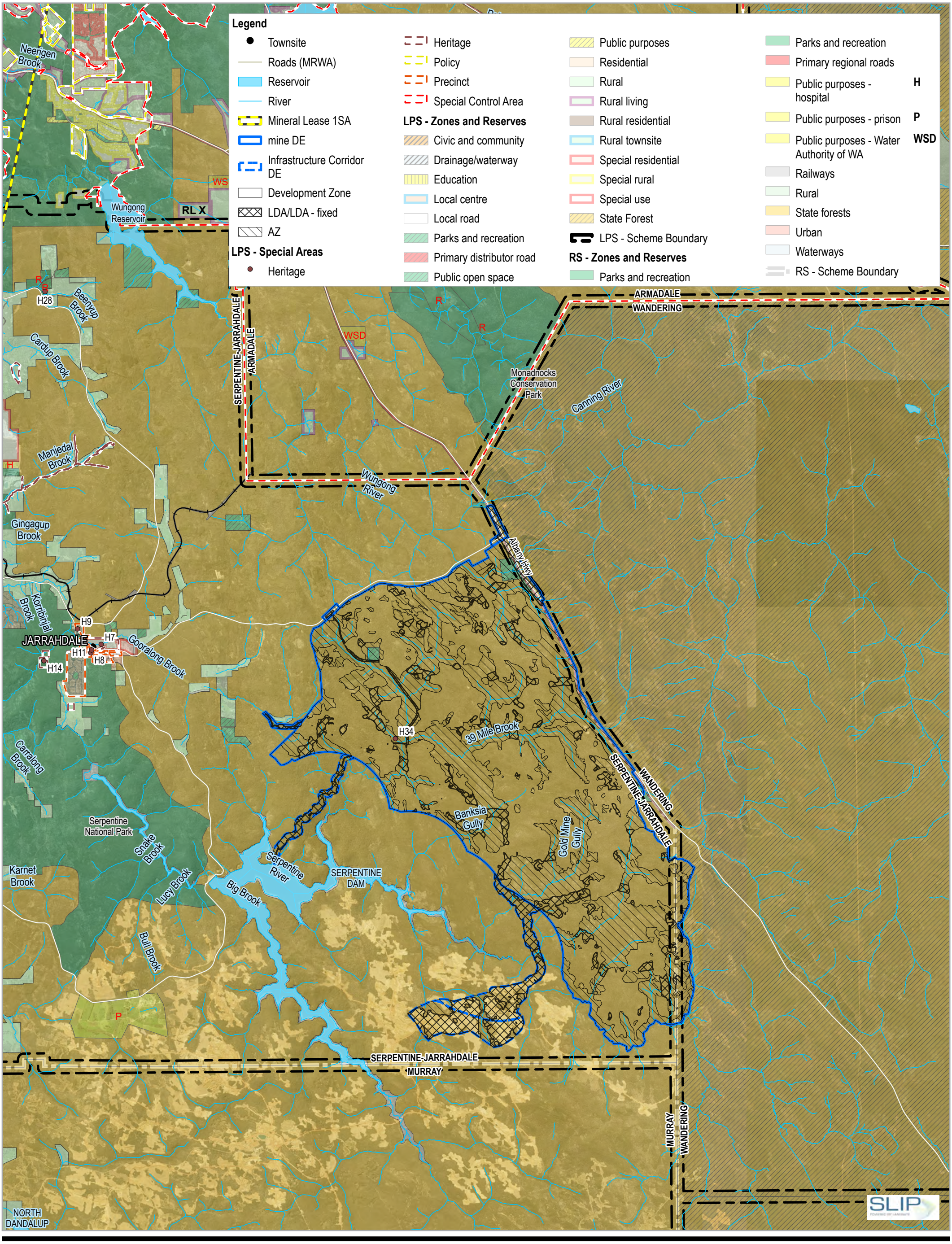
[1] **Region Scheme Zone/Reservation Descriptions**:

- Rural - Land in which a range of agricultural, extractive and conservation uses are undertaken.
- Urban - Areas in which a range of activities are undertaken, including residential, commercial recreational and light industry.
- State Forests - Areas of woodland located on Crown land managed under the Conservation and Land Management Act 1984.
- Waterways - Permanent inland and coastal waters including many rivers and reservoirs.
- Parks and Recreation - Areas of significance to the region's recreation resource, which are, or are proposed to be managed by the private sector.
- Primary Regional Roads - These are the most important of the roads of regional significance in the planned road network and are currently or proposed to be declared under the Main Roads Act 1930.
- Industrial - Land in which manufacture, processing, warehousing and related activities are undertaken.
- Public Purposes - Land for public facilities such as hospitals, schools, universities, utilities for electricity and water treatment of wastewater, Commonwealth government and other special uses.

[2] **Special Control Areas** are mechanisms that deal with specific issues, which may overlap zone and reserve boundaries. Special control areas can place requirements on the development of land that apply in addition to the requirements of the underlying zones and/or reserves. The Special Control Areas listed in this table are present at various locations within the Development Envelopes.

- Water Catchments - Water sources protected for high quality public water supply. These areas have strict controls on land use to avoid harm to the water resource.

[3] The land uses presented in this table are those presented in the relevant LPS text's zoning table and only include those which are permitted (denoted as 'P' in the scheme text zoning table).



Scale: 1:110,000 at ISO A3

0 1 2 3 4

Kilometres

N

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

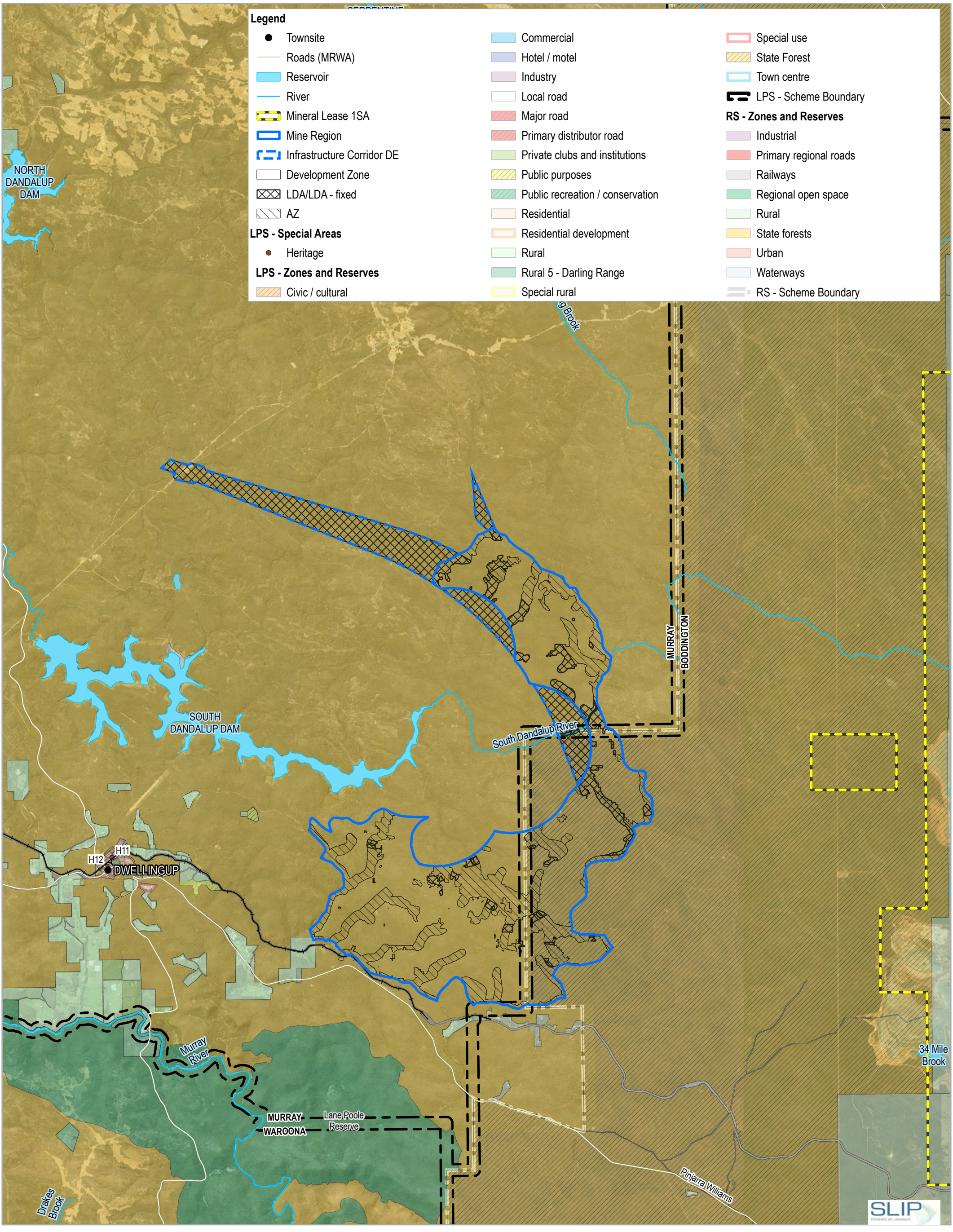
Alcoa of Australia Limited
Pinjarra Refinery Revised Proposal - Environmental Review Document

Regional and Local Planning - Myara North DE

Project No. **12633192**
Revision No. **3**
Date **07/03/2025**

FIGURE 2-1

Data source: WANow: Landgate / SLIP



Scale: 1:110,000 at ISO A3

0 1 2 3 4

Kilometres

N

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

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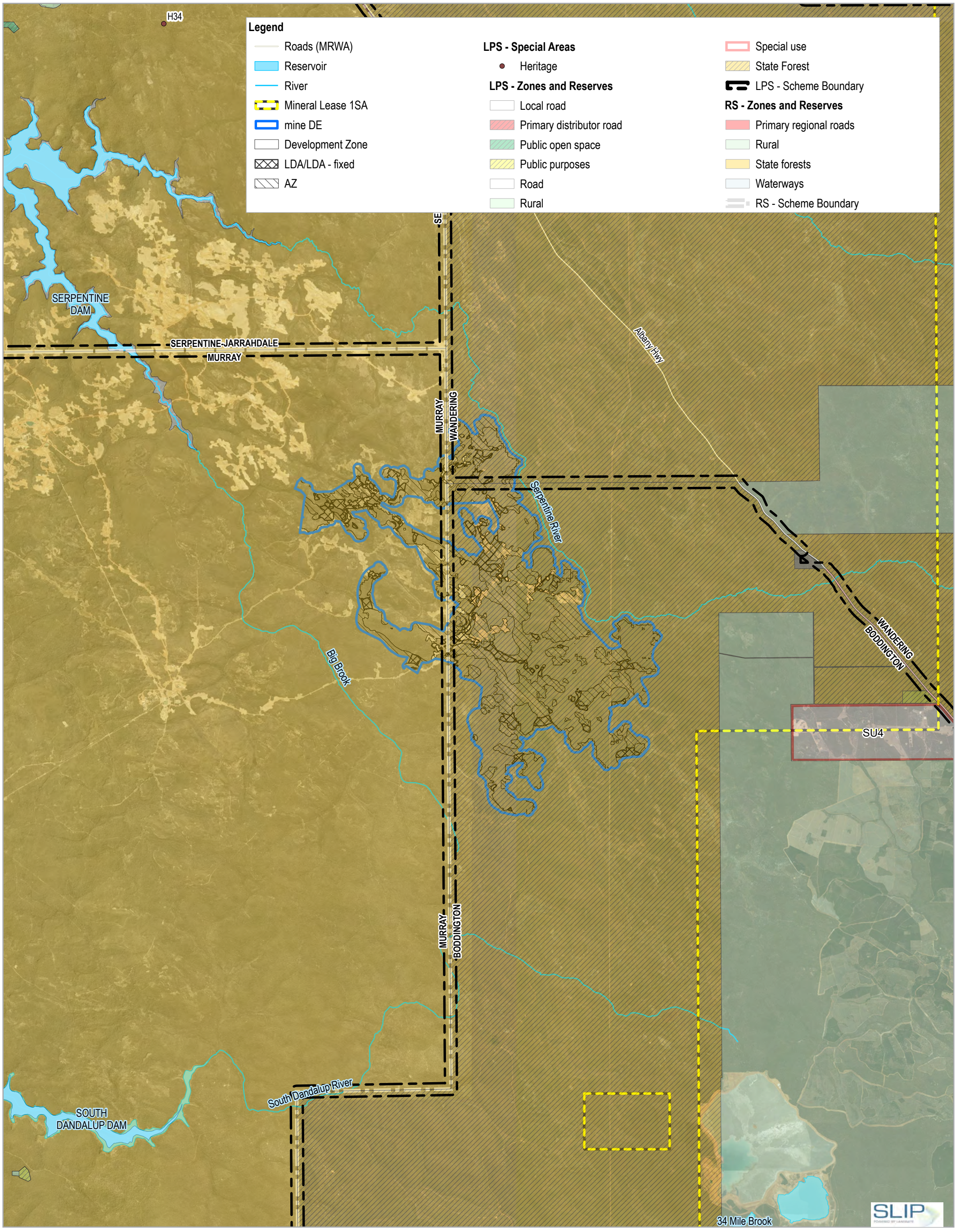
Pinjarra Refinery Revised Proposal - Environmental Review Document

Regional and Local Planning - Holyoake DE

Project No. **12633192**
Revision No. **3**
Date **07/03/2025**

FIGURE 2-2

Data source: WANow: Landgate / SLIP



Scale: 1:110,000 at ISO A3

0 1 2 3 4

Kilometres

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

N

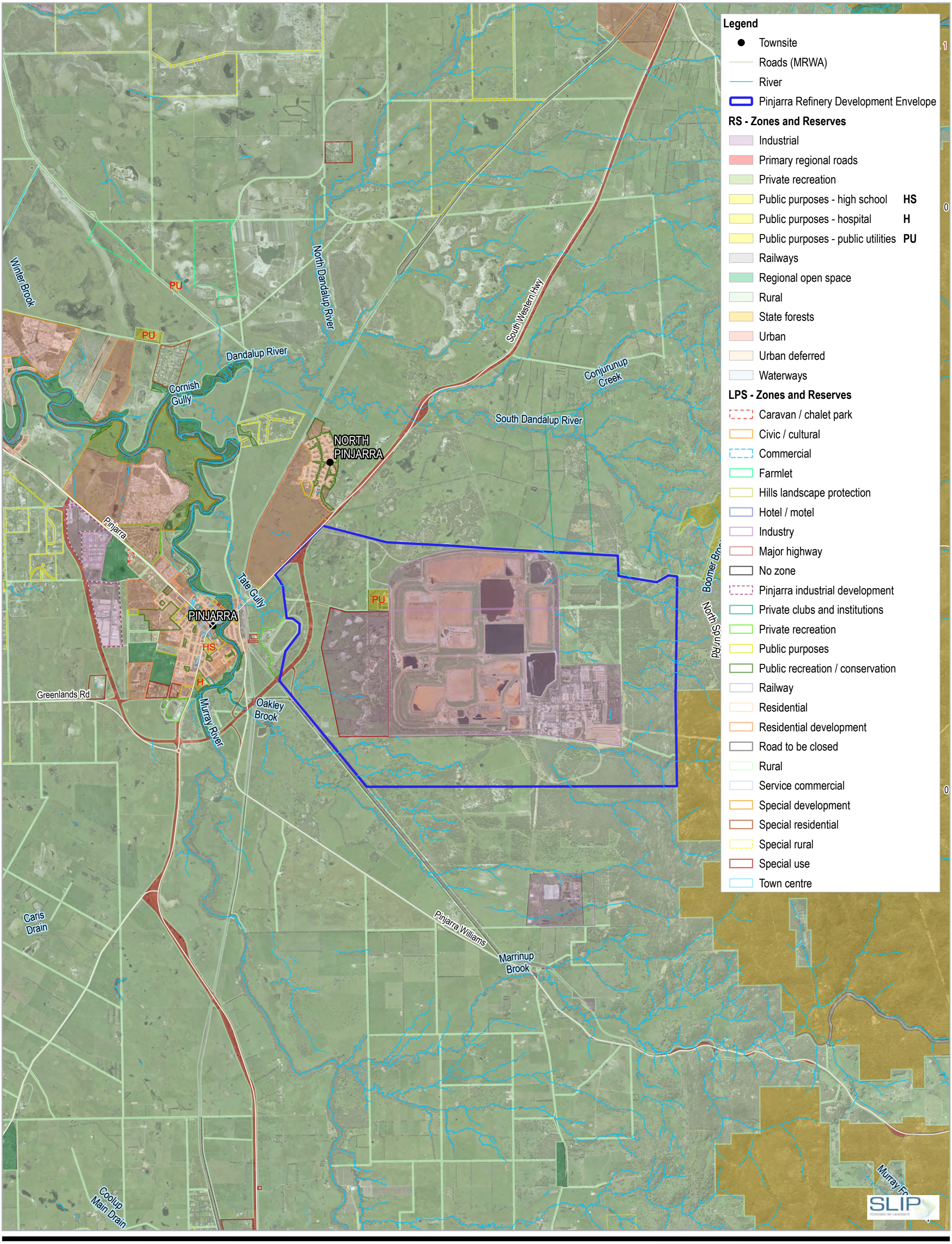
Alcoa of Australia Limited
Pinjarra Refinery Revised Proposal - Environmental Review Document

Regional and Local Planning - O'Neil DE

Project No. **12633192**
Revision No. **3**
Date **07/03/2025**

FIGURE 2-3

Data source: WANow: Landgate / SLIP



Scale: 1:65,000 at ISO A3

0 0.5 1 1.5 2

Kilometres

N

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

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Pinjarra Refinery Revised Proposal - Environmental Review Document

Regional and Local Planning - Pinjarra Refinery

Project No. **12633192**
Revision No. **3**
Date **07/03/2025**

FIGURE 2-4

Data source: WANow: Landgate / SLIP

2.2.3 Other approvals and decision-making authorities

Provisions in the EP Act (Section 44 (2AA)) allow the EPA and the Minister for Environment to consider other statutory decision-making processes that may mitigate environmental impacts and ensure that environmental factor objectives are met.

Interim EPA guidance (EPA 2021e) outlines aspects that the EPA will consider when assessing whether an alternative Decision Making Authority (DMA) can effectively mitigate the environmental impacts of a proposal. These are:

- The ability of the DMA to consider the impact of the proposal.
- The process that the DMA uses to assess the potential impacts of the activity on the environment.
- The relevant considerations which the DMA can take into account in decision making.
- The conditions that may be applied as a result of the decision-making process.
- Likely outcomes and
- Overall conclusion

Table 2.3 presents the relevant approvals and Decision Making Authorities (DMAs) for the Proposal and explains the applicability of each, where relevant, to mitigating impacts on the environment.

2.2.3.1 Environmental Protection (Noise) Regulations 1997

The Regulations define Assigned Levels which are the levels of noise allowed to be received at a premises at a particular time of the day or night. The Assigned Levels form prescribed standards under the *Environmental Protection Act 1986*. Noise monitoring has shown that noise emissions from the Pinjarra refinery currently exceed the Assigned Levels at noise sensitive premises surrounding the refinery. Noise modelling of mitigation options in 2021 showed that it is neither feasible nor reasonably practicable to reduce noise to below the Assigned Levels at all affected premises under all prevailing weather conditions, see Chapter 12 of this ERD.

In response to this situation, Alcoa sought a variation to the prescribed noise standard in accordance with Regulation 17 (Reg 17). An application for a variation was submitted to the Minister for Environment in June 2021, but has yet to be determined.

Under certain circumstances as described in the Regulations, instead of the DWER CEO being responsible for considering a Reg 17 application and making a recommendation to the Minister, this responsibility transfers to EPA and it makes a recommendation to the Minister. Although the refinery's exceedance of the Assigned Levels relates to existing approved operations under MS 646, the EPA and DWER have determined that Alcoa's Reg 17 application will be considered as a part of Assessment 2253 and corresponding recommendations included in the EPA's assessment report to the Minister.

It is Alcoa's expectation that the EPA will make joint recommendations to the Minister on whether to approve the Reg 17 application and whether this Proposal can be implemented via a Ministerial Statement.

2.2.3.2 Australian Government's Safeguard Mechanism

The Safeguard Mechanism is a legislative requirement that will ensure scope 1 emissions from the Pinjarra refinery and Huntly Mine are reduced to meet Australia's emissions reduction targets. The Safeguard Mechanism sets emission limits (baselines) for facilities with scope 1 emissions over 100,000 tonnes of carbon dioxide equivalent (t CO2e) and then requires a trajectory to achieve net zero Scope 1 emissions by 2050, which aligns with the EPA's expectations for its Greenhouse Gas Environmental Factor.

In October 2024, the WA Government amended its *Greenhouse Gas Emissions Policy for Major Projects.* The policy document states that

> *"where proposals with significant greenhouse gas emissions are adequately dealt with by other regulatory measures such as the strengthened Safeguard Mechanism, those emissions should not be regulated by the State".*

It goes on to state that:

> *"Where the greenhouse gas emissions of a major proposal assessed under Part IV of the Environmental Protection Act 1986 (WA) (EP Act) will be subjected to alternative regulatory measures, the State will no longer apply conditions to reduce net greenhouse gas emissions."*

In response to this change in government policy, the EPA revised its Environmental Factor Guideline for Greenhouse Gas Emissions in November 2024. The guideline states that:

> *"Given the maturing of the Commonwealth Safeguard Mechanism and the State's Greenhouse Gas Emissions Policy for Major Projects 2024, the EPA expects that emissions reductions required under the Safeguard Mechanism are now likely to represent an "as far as practicable" reduction of, and in most cases meet its factor expectation for, covered emissions."*

The guideline also states that the EPA no longer requires a Proposal to have a Greenhouse Gas environmental management plan.

The Pinjarra refinery and the Huntly Mine are Safeguard Facilities and thus required to comply with the requirements of the Safeguard Mechanism. Therefore, in line with WA Government policy and the EPA's guidance, Alcoa anticipates that to avoid duplication, the EPA's assessment of this Proposal will not consider Scope 1 emission covered by the Safeguard Mechanism e.g. those from alumina production and the extraction and transport of bauxite.

2.2.3.3 RIWI Act Bed and Banks Permits

In accordance with section 11, 17, or 21A of the RIWI Act, a permit issued by the Minister for Water is required to interfere with the waters, bed or banks of a watercourse on Crown Land. Further details are provided in Table 2.3 below.

Alcoa has had in place longstanding "Working Arrangements" with DWER and the Water Corporation, the most recent spanning the period 2018-2023[2]. Under these arrangements Alcoa is exempt from obtaining Bed and Banks Permits when proposed work is to be undertaken on Crown Land contained in ML1SA. Assessment of works that interfere with the water, bed or banks of a watercourse was delegated to the MMPLG, the government body responsible for assessing Alcoa's MMPs prior to approval by the Minister for State Development.

A revised version of the Working Arrangement has yet to be developed, and the MMPLG has been replaced by the ITAG, which in turn advises BSEC. Therefore, the ongoing arrangements for Bed and Banks Permits are to be confirmed.

Alcoa's current operations are still adhering to the 2018-2023 Working Arrangements, and there is no expectation that Bed and Banks Permits are required for planned stream or river crossings. Although, as detailed in Table 2.3, Alcoa recognises that permits could remove the need to regulate relevant works under Part IV of the EP Act.

[2] https://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4110497c6d4ca0549f439f1f4825874300066087/$file/tp-497.pdf

Table 2.3 Summary of other Proposal regulatory approvals with reference to the EPA's Interim Guidance

Decision making authority	Legislation or Agreement regulating activity	Approval required / Existing Approval	Proposal element	Does statutory decision making process mitigate impacts on the environment?	Whether/how statutory decision-making process can mitigate impacts on the environment?
Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972*	Section 18 Consent	Disturbance of an Aboriginal heritage site (if unavoidable)	Partially mitigates potential impacts to Social Surroundings (heritage).	Under section 17 of the AH Act 1972, it is an offence to knowingly disturb an Aboriginal heritage site without the consent of the Minister of Aboriginal Affairs under section 18. Whilst there is no statutory requirement to consult nor is there provision for public comment, best practice in Western Australia requires proponents to have identified whether or not their activity is likely to harm Aboriginal heritage. Consequently, archaeological and ethnographic heritage surveys of the land subject to development are undertaken in order to determine whether Aboriginal heritage places as defined under section 5 of the AH Act exist on the Land. These heritage surveys can overlap with parts of the social surroundings factor.
Minister for State Development, DJTSI	*Alumina Refinery (Pinjarra) State Agreement Act 1969* (WA)	Ministerial approval of proposed modification or expansion or production capacity	Increase in Refinery production	No	The statutory decision-making process under the State Agreement that relates to mitigation of impacts on the environment has been replaced by decision-making under Part IV of the EP Act, pursuant to the EPA assessment of the Proposal.
Minister for State Development, DJTSI	*Alumina Refinery Agreement Act 1961*	n/a	Transition of mining into the Myara North, Holyoake and O'Neil mine regions	No	The statutory decision-making process under the State Agreement that relates to mitigation of impacts on the environment has been replaced by decision-making under Part IV of the EP Act, pursuant to the EPA assessment of the Proposal.
Federal Minister for the Environment, DCCEEW	EPBC Act	Approval to develop Proposal EPBC referral of the Huntly Mine Transition EPBC referral of the O'Neil mining region (still subject to a controlled action determination, but assumed to be one for the analysis in this table)	Impacts to Matters of National Environmental Significance Transition to Myara North and Holyoake mine regions Re-entering the O'Neil mining region	Yes – mitigates potential impacts to MNES as they relate to: • Flora and Vegetation (listed species / communities) • Terrestrial Fauna (listed species) • Inland Waters (Ramsar wetlands)	**The ability of the DMA to consider the impact of the proposal:** The statutory decision-making process under the EPBC Act mitigates impacts to the environment with respect to threatened species and communities, migratory species and wetlands of international importance, which are the relevant matters of national environmental significance (MNES) or controlling provisions for the controlled action EPBC 2022/09204. **The process that the DMA uses to assess the potential impacts of the activity on the environment:** The EPBC Act protects MNES across Australia. The Mine components of the Proposal were referred to DCCEEW under the EPBC Act as the proposed actions EPBC 2022/09204 and 2024/10009. EPBC 2022/09204 was determined to be controlled action requiring assessment and approval under the EPBC Act. EPBC 2024/1009 is yet to be determined. The controlling provisions (i.e. relevant MNES) to EPBC 2022/09204 are threatened species and ecological communities, migratory species and wetlands of international importance. The assessment of EPBC 2022/09204 will be under the Part IV EP Act assessment process, via an accredited assessment with the WA Government. **In determining approvals and conditions to be applied, the Federal Minister considers:** • matters relevant to the controlling provisions (e.g. conservation advice, recovery plans) • principles of ecologically sustainable development, which include the precautionary principle and principles of intergenerational equity, conservation of biological diversity and ecological integrity, and improved valuation, pricing and incentive mechanisms • the WA EPA assessment report, under the accredited assessment (EPBC 2022/09204 only) • economic and social matters • Alcoa's history in relation to environmental matters. There are no specific merits-based appeal provisions under the EPBC Act, but the Minister's decision can be subject to Judicial Review proceedings under Common Law in accordance with the *Administrative Decisions (Judicial Review) Act 1977* (Cth). **The conditions that may be applied as a result of the decision-making process:** The EPBC Act assessment of threatened species and ecological communities, migratory species and wetlands of international importance is expected to address the EPA's factor objectives for flora and vegetation and terrestrial fauna. The EPBC Act approvals conditions may include standard and/or special conditions relating to the environment. The Minister and DCCEEW have sufficiently broad powers to impose conditions including compliance monitoring and reporting of outcomes. The conditions can include requirements for offsets. **Likely outcomes:** The EPA's objectives for flora and vegetation and terrestrial fauna are expected to be met through the EPBC Act decision-making process. Other elements of flora and vegetation (e.g. priority flora and ecological communities, Old Growth Forest, restricted range vegetation communities) and terrestrial fauna (e.g. priority and short-range invertebrate fauna) and other environmental factors relevant to the Proposal are not protected under the EPBC Act. **Conclusion:** Regulation by DCCEEW will ensure that environmental factor objectives that relate to MNES are met.

Decision making authority	Legislation or Agreement regulating activity	Approval required / Existing Approval	Proposal element	Does statutory decision making process mitigate impacts on the environment?	Whether/how statutory decision-making process can mitigate impacts on the environment?
Department of Health	Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974	Approval to install onsite wastewater system	On-site sewage treatment and disposal system Transition to Myara North and Holyoake regions	No	No The *Public Health Act 2016* is an Act 'to protect, promote and improve the health and wellbeing of the public of Western Australia and to reduce the incidence of preventable illness, and for related purposes'. The *Public Health Act 2016*, in some respects, aligns with the inland waters and social surroundings factors, however it does not consider environmental impacts associated with sewage treatment and disposal. Applications for on-site sewage treatment and disposal are lodged with Local Government, who assess applications for systems treating less than 540 L/day and forward applications for larger systems to the Department of Health. Applications are not subject to public comment and there are no third party appeal rights over approval decisions.
DWER	Part V of the EP Act	Licence amendment to L5271/1983/14	Increase in Refinery production	Yes – mitigates potential impacts that relate to: • Air Quality • Social Surroundings (noise)	**The ability of the DMA to consider the impact of the proposal:** The Refinery is a prescribed premises under Part V of the EP Act and the decision-making process will mitigate impacts on the environment relating to emissions to land, water, air and noise. The Refinery is prescribed under Part V of the EP Act with respect to the following categories: • Category 46 - Bauxite refining • Category 52 - Electric power generation • Category 64 - Class II or III putrescible landfill site • Category 67 - Fuel burning **The process that the DMA uses to assess the potential impacts of the activity on the environment:** DWER assesses licence amendments on an activity category basis using a risk framework and consideration of State and policy and relevant standards (e.g. National Environmental Protection Measures) to protect the environment, public health and amenity. The licence amendment application is subject to public review (with at least 21 day public comment period) and there is a right of appeal for third parties on the licence decision and conditions. The licence conditions may include standard and/or special conditions relating to environmental protection, compliance monitoring and reporting. The licence conditions do not include provision for environmental offsets. **The relevant considerations which the DMA can take into account in decision making:** DWER takes a risk-based approach to assessing approval applications and setting conditions. DWER's risk assessment is formally captured in a decision document appended to the Works Approval or Licence. DWER will consider each discharge and its potential impact on the receiving environment. For example, DWER will consider the quality and quantity of particulates to be discharged to the local airshed and set conditions to ensure that risks are mitigated. The decision document addresses each identified risk associated with emissions from the Project and justifies the conditions set or if no condition is required for that emission. **The conditions that may be applied as a result of the decision-making process:** DWER has the authority to set enforceable conditions on Works Approvals and Licences. These will set: • The volumes of wastes that can be discharged. • Limits and targets for the levels of pollutants in discharges. • Monitoring requirements. • Mandatory cleaning up of spills. • Requirements for storing hydrocarbons and chemicals. • Bunding requirements for wet processing units. • Commissioning requirements. Standard conditions will also set regular compliance reporting and annual environmental reporting requirements. DWER has the authority to enter Prescribed Premises and assesses compliance via annual reporting; incident reporting; and site inspections. In the event of non-compliance or environmental harm, DWER has the authority to issue Environmental Protection Notices or Closure Notices to proponents that contain conditions to rectify environmental harm. DWER may also levy financial penalties or, in the case of serious environmental harm, prosecute offenders. **Likely outcomes:** The DWER assessment of a licence amendment is expected to address the EPA's objectives for terrestrial environmental quality, partly for inland waters (i.e. maintain quality of groundwater and surface water), partly for air quality (i.e. maintain air quality) and partly for social surroundings (i.e. protect with respect to noise). Other elements of inland waters (i.e. hydrological processes), air quality (i.e. minimise

Decision making authority	Legislation or Agreement regulating activity	Approval required / Existing Approval	Proposal element	Does statutory decision making process mitigate impacts on the environment?	Whether/how statutory decision-making process can mitigate impacts on the environment?
					emissions) and social surroundings (i.e. heritage, visual and other amenity), as well as other environmental factors are not addressed by environmental licencing under Part V of the EP Act. **Conclusion:** Regulation by DWER will ensure that environmental factor objectives are not compromised due to emissions and discharges from the Proposal.
DWER	Part V of the EP Act	Licence amendment to L6210/1991/10	Transition to Myara North and Holyoake regions Development of new mine facilities Re-entry to O'Neil region	Yes – mitigates potential impacts that relate to: • Terrestrial Environmental Quality • Inland Waters • Air Quality • Social Surroundings (noise)	**The ability of the DMA to consider the impact of the proposal:** Yes, the mine is a prescribed premises under Part V of the EP Act and the decision-making process can mitigate impacts on the environment relating to emissions to land, water, air and noise. The mine is prescribed under Part V of the EP Act with respect to Category 5 for the processing or beneficiation of metallic and non-metallic ore, including crushing, grinding, milling and processing. **The process that the DMA uses to assess the potential impacts of the activity on the environment:** DWER assesses licence amendments on an activity category basis using a risk framework and consideration of State and policy and relevant standards to protect the environment, public health and amenity. The licence amendment application is subject to public review (with at least 21 day public comment period) and there is a right of appeal for third parties on the licence decision and conditions. The licence conditions may include standard and/or special conditions relating to environmental protection, compliance monitoring and reporting. The licence conditions do not include provision for environmental offsets. **The relevant considerations which the DMA can take into account in decision making:** DWER takes a risk-based approach to assessing approval applications and setting conditions. DWER's risk assessment is formally captured in a decision document appended to the Works Approval or Licence. DWER will consider each discharge and its potential impact on the receiving environment. For example, DWER will consider the quality and quantity of particulates to be discharged to the local airshed and set conditions to ensure that risks are mitigated. The decision document addresses each identified risk associated with emissions from the Project and justifies the conditions set or if no condition is required for that emission. **The conditions that may be applied as a result of the decision-making process:** DWER has the authority to set enforceable conditions on Works Approvals and Licences. These will set: • The volumes of wastes that can be discharged. • Limits and targets for the levels of pollutants in discharges. • Monitoring requirements. • Mandatory cleaning up of spills. • Requirements for storing hydrocarbons and chemicals. • Bunding requirements for wet processing units. • Commissioning requirements. Standard conditions will also set regular compliance reporting and annual environmental reporting requirements. DWER has the authority to enter Prescribed Premises and assesses compliance via annual reporting; incident reporting; and site inspections. In the event of non-compliance or environmental harm DWER has the authority to issue Environmental Protection Notices or Closure Notices to proponents that contain conditions to rectify environmental harm. DWER may also levy financial penalties or, in the case of serious environmental harm, prosecute offenders. **Likely outcomes:** The DWER assessment of a licence amendment is expected to address the EPA's objectives for terrestrial environmental quality, partly for inland waters (i.e. maintain quality of groundwater and surface water), partly for air quality (i.e. maintain air quality) and partly for social surroundings (i.e. protect with respect to noise). Other elements of inland waters (i.e. hydrological processes), air quality (i.e. minimise emissions) and social surroundings (i.e. heritage, visual and other amenity), as well as other environmental factors are not addressed by environmental licencing under Part V of the EP Act. **Conclusion**: Regulation by DWER will ensure that environmental factor objectives are not compromised due to emissions and discharges from the Proposal.
DWER	*Rights in Water and Irrigation Act*	Section 5C Licence to Take Water	Water abstraction for mining (surface water)	Yes – mitigates potential impacts to: • Inland Waters	**The ability of the DMA to consider the impact of the proposal:**

Decision making authority	Legislation or Agreement regulating activity	Approval required / Existing Approval	Proposal element	Does statutory decision making process mitigate impacts on the environment?	Whether/how statutory decision-making process can mitigate impacts on the environment?
	1914 (RIWI Act)	SWL 83356 SWL 153635	Transition to Myara North and Holyoake regions Re-entry to O'Neil region	Partially mitigates impacts to: • Terrestrial Environmental Quality • Social Surrounds	The mine water abstraction is licensed under the RIWI Act and the decision-making process can mitigate impacts on the environment relating to water abstraction, however there are limitations with regard to public appeals. **The process that the DMA uses to assess the potential impacts of the activity on the environment:** DWER assesses water abstraction licences for water abstraction in proclaimed areas, which includes most of the Darling Plateau, encompassing the Serpentine Dam and South Dandalup Dam catchments. Licence applications are assessed on a case-by-case basis with assessment of the effects on hydrological processes and other environmental and human uses of water. DWER has discretion to seek public comment (28 day period) for licence applications over 100,000 kL/year. Proponents can appeal the licence approval decision under the State Administrative Tribunal, however there are generally no third party appeal rights. **The Minister, in approving an application, is to have regard to the following:** • Public interest • Ecological sustainability and environmental acceptability • Detrimental effects of the abstraction on other persons • Alternative water sources • Consistency with local practices and laws, water resource and land use planning, Government policies and intergovernmental agreements. **Licence conditions can relate to the following:** • Taking, use or disposal of water • Use, management, protection and enhancement of a water resource, its ecosystem and the environment in which it is situated • Construction, alteration, maintenance, operation or removal of works • Monitoring of a water resource, its ecosystem and the environment in which it is situated • Reporting to the Minister or DWER. **Likely outcomes:** The DWER assessment of a water abstraction licence application is expected to address the EPA's objectives for inland waters, partly for terrestrial environmental quality (i.e. maintain quality with respect to acid sulfate soils) and partly for social surroundings (i.e. protect with respect to beneficial uses of water). Other elements of terrestrial environmental quality (i.e. not related to acid sulfate soils), social surroundings (i.e. non-water related), as well as other environmental factors are not addressed by water abstraction licencing under the RIWI Act. **Conclusion:** Regulation by DWER will ensure that environmental factor objectives for Inland Waters are met, and additionally decrease the likelihood of compromising the objectives for Terrestrial Environmental Quality and Social Surrounds.
DWER	*Rights in Water and Irrigation Act 1914* (RIWI Act)	Section 5C Licence to Take Water GWL 98936 GWL 167867 GWL 150586 SWL 98937 SWL 98940 SWL 98939	Increase in Refinery production	Yes – mitigates potential impacts to: • Inland Waters (hydrological regimes) Mitigates partial impacts to: • Terrestrial Environmental Quality • Social Surrounds	**The ability of the DMA to consider the impact of the proposal:** The Refinery water abstraction is licensed and the RIWI Act and the decision-making process can mitigate impacts on the environment relating to water abstraction, however there are limitations with regard to public appeals. **The process that the DMA uses to assess the potential impacts of the activity on the environment:** DWER assesses water abstraction licences for water abstraction in proclaimed areas, which include the Swan Coastal Plain aquifers, encompassing those utilised for water abstraction by the Refinery. Licence applications are assessed on a case-by-case basis with assessment of the effects on hydrological processes and other environmental and human uses of water. DWER has discretion to seek public comment (28 day period) for licence applications over 100,000 kL/year. Proponents can appeal the licence approval decision under the State Administrative Tribunal, however there are generally no third party appeal rights. **The Minister, in approving an application, is to have regard to the following:** • Public interest • Ecological sustainability and environmental acceptability • Detrimental effects of the abstraction on other persons • Alternative water sources • Consistency with local practices and laws, water resource and land use planning, Government policies and intergovernmental agreements. **Licence conditions can relate to the following:**

Decision making authority	Legislation or Agreement regulating activity	Approval required / Existing Approval	Proposal element	Does statutory decision making process mitigate impacts on the environment?	Whether/how statutory decision-making process can mitigate impacts on the environment?
					• Taking, use or disposal of water • Use, management, protection and enhancement of a water resource, its ecosystem and the environment in which it is situated • Construction, alteration, maintenance, operation or removal of works • Monitoring of a water resource, its ecosystem and the environment in which it is situated • Reporting to the Minister or DWER. **Likely outcomes:** The Refinery water abstraction licences are managed under a mature Operating Strategy, which includes comprehensive monitoring and reporting of groundwater levels and quality in the superficial and confined aquifers beneath the Refinery. The DWER assessment of a water abstraction licence application is expected to address the EPA's objectives for inland waters, partly for terrestrial environmental quality (i.e. maintain quality with respect to acid sulfate soils) and partly for social surroundings (i.e. protect with respect to beneficial uses of water). Other elements of terrestrial environmental quality (i.e. not related to acid sulfate soils), social surroundings (i.e. non-water related), as well as other environmental factors are not addressed by water abstraction licencing under the RIWI Act. **Conclusion:** Regulation by DWER will ensure that environmental factor objectives for Inland Waters are met, and additionally decrease the likelihood of compromising the objectives for Terrestrial Environmental Quality and Social Surrounds.
DWER	*Rights in Water and Irrigation Act 1914* (RIWI Act)	Sections 11, 17 and 21A Permit to take, store or divert water	Disturbance to bed and banks of a watercourse or wetland	Yes – mitigates potential impacts to: • Inland Waters Partially mitigates impacts to: • Terrestrial Environmental Quality • Social Surrounds	**The ability of the DMA to consider the impact of the proposal:** The decision-making process can mitigate impacts on the environment relating to disturbance to bed and banks of a watercourse or wetland, however there are limitations regarding public comment and appeals. **The process that the DMA uses to assess the potential impacts of the activity on the environment:** Under the RIWI Act, a permit is required for works on the bed and banks of a watercourse or wetland. On a mining tenement, a permit is only required where the works involve taking, storing or diverting water. Permit applications may be advertised where the works are likely to have a significant impact on a water resource. Proponents can appeal the permit approval decision under the State Administrative Tribunal, however there are generally no third party appeal rights. The Minister, in approving an application, is to have regard to the following: • Public interest • Ecological sustainability and environmental acceptability • Detrimental effects of the abstraction on other persons • Alternative water sources • Consistency with local practices and laws, water resource and land use planning, Government policies and intergovernmental agreements. **The relevant considerations which the DMA can take into account in decision making:** Permit applications are assessed on a case-by-case basis and require applicants to demonstrate consideration of key principles as per the Rights in Water and Irrigation Regulations 2000, as follows: Site selection (principles 1-5) 1. Avoid interference or obstruction of the water, bed or banks of watercourses, wherever practicable. 2. Dams on watercourses are discouraged, where there are viable off-stream alternatives. 3. Reduce watercourse crossings to a minimum and consolidate watercourse crossings with other infrastructure, where practicable. 4. Avoid permanent pools, bends or high velocity sections of watercourses. 5. Minimise disturbance to riparian vegetation, riparian zones and flood plains. Work schedule (principles 6-8) 6. Mitigate the risks or impacts from site disturbance, including erosion, sedimentation, weed introduction, vegetation clearing, loss of habitat and changes to ecological values. 7. Prevent the discharge of pollutants and materials into watercourses. 8. Rehabilitate or revegetate the site following construction to maintain or improve riparian zone function. **The Minister, in approving a permit, is to have regard to and may make conditions with respect to the following:**

Decision making authority	Legislation or Agreement regulating activity	Approval required / Existing Approval	Proposal element	Does statutory decision making process mitigate impacts on the environment?	Whether/how statutory decision-making process can mitigate impacts on the environment?
					• Public interest • Ecological sustainability and environmental acceptability • Detrimental effects of the works on other persons • Alternatives to the works • Consistency with local practices and laws, water resource and land use planning, Government policies and intergovernmental agreements • Safety of the design, construction or operation of works. The licence conditions do not include provision for environmental offsets. **Likely outcomes:** The DWER assessment of a bed and banks permit is expected to address the EPA's objectives for inland waters, partly for terrestrial environmental quality (i.e. prevent bed and banks erosion) and partly for social surroundings (i.e. protect with respect to beneficial uses of water). Other elements of terrestrial environmental quality (i.e. not related to bed and banks erosion), social surroundings (i.e. non-water related), as well as other environmental factors are not addressed by water abstraction licencing under the RIWI Act. **Conclusion:** Regulation by DWER will ensure that environmental factor objectives for Inland Waters are met, and additionally decrease the likelihood of compromising the objectives for Terrestrial Environmental Quality and Social Surrounds.
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	*Dangerous Goods Safety Act 2004*	Dangerous Goods Storage Licences (DGS004240 and DGS008201)	Storage, handling and transport of dangerous goods	No	No DEMIRS assess dangerous goods licence applications primarily with respect to human safety, however licence applications require risk assessments demonstrating the facilities can be operated with minimal risk to people, property and the environment. DEMIRS will notify DWER of all new licence applications or amendments to existing licences, which may trigger environmental approvals under the EP Act (e.g. for a prescribed premises).
Department of Biodiversity, Conservations and Attractions (DBCA)	*Conservation and Land Management Act 1984*	Section 4 - Lawful authority Section 101 - Licences etc. for use etc. of land	Transition of mining into the Myara North and Holyoake mine regions Re-entry to O'Neil region	No	Licences received under s4 and s11 of the CALM Act enable Alcoa to undertake various activities in DBCA managed lands associated with mining operations and investigations. The need for them is determined in consultation with DBCA.
Department of Biodiversity, Conservations and Attractions (DBCA)	*Biodiversity and Conservation Act 2016*	Section 40	Taking or disturbance of threatened flora or fauna	Yes – mitigates potential impacts to: • Flora and Vegetation (threatened species) • Terrestrial Fauna (threatened species)	**The ability of the DMA to consider the impact of the proposal:** The decision-making process can mitigate impacts on the environment relating to taking or disturbance of threatened flora and fauna, including clearing of flora and translocation of fauna if this is required, however there are limitations regarding public comment and appeals. **The process that the DMA uses to assess the potential impacts of the activity on the environment:** Under the BC Act, a Section 40 licence is required for taking or disturbance of threatened flora or threatened fauna. Licence applications are not advertised. Proponents can appeal the licence decision under the State Administrative Tribunal, however there are generally no third party appeal rights. **The relevant considerations which the DMA can take into account in decision making:** The Minister in approving a licence, is to have regard to the following: • the proper conservation, protection and management of fauna and flora • the public interest • the experience, skills or qualifications of the applicant to perform the activities. **The conditions that may be applied as a result of the decision-making process:** Section 41 of the BC Act allows the Minister to impose conditions on a licence, which may include measures to mitigate or offset the impact on a known population of the relevant species or relevant habitat. **Likely outcomes:**

Decision making authority	Legislation or Agreement regulating activity	Approval required / Existing Approval	Proposal element	Does statutory decision making process mitigate impacts on the environment?	Whether/how statutory decision-making process can mitigate impacts on the environment?
					The DBCA assessment of a Section 40 licence is expected to partly address the EPA's objectives for Flora and Vegetation and Terrestrial Fauna (i.e. mitigate impacts if clearing of threatened flora or translocation of fauna are required). Other elements of Flora and Vegetation and Terrestrial Fauna (e.g. impacts to priority or common species, priority ecological communities, biodiversity) are not addressed by Section 40 licensing under the BC Act. **Conclusion:** Regulation by DBCA will decrease the likelihood of compromising the objectives for Flora and Vegetation and Terrestrial Fauna.

2.3 Environmental management framework

2.3.1 Corporate standards

Sustainability is at the heart of Alcoa's strategic agenda. In 2021, Alcoa announced a vision to 'reinvent the aluminium industry for a sustainable future'. Sustainable operations support key business drivers and deliver better outcomes for the environment and the communities where Alcoa operates; these are articulated in Alcoa's most recent (2023) Sustainability Report[3]. Alcoa has dedicated environment, health and safety, biodiversity, sustainability and social policies available on their public website (Alcoa.com).

In 2021, Alcoa announced its ambition to achieve net-zero greenhouse gas (GHG) emissions across its global operations by 2050. This ambition complements existing GHG targets which included reducing direct and indirect GHG emissions from aluminium smelting and alumina refining from 2015 baselines by 30 per cent by 2025 and 50 per cent by 2030. Alcoa's global technology roadmap was launched in 2021, with next-generation solutions to significantly reduce emissions.

In 2019, Alcoa became a member of the International Council on Mining and Metals (ICMM). The ICMM's Mining Principles serve as a best practice framework on sustainable development for the mining and metals industry. In 2020, Alcoa received certification by the Aluminium Stewardship Initiative (ASI) for its Western Australian operations. This certification recognises, in part, the strength of Alcoa's environmental policies and management systems including compliance and certification with international standards (ISO 14001).

2.3.2 Mine environmental management

The Huntly Mine has a mature environmental management system developed over five decades and subject to established working arrangements with the State Government.

Alcoa has undertaken pre-clearing flora and vegetation surveys within the Huntly Mine since the late 1980s, using the same vegetation mapping methodology used for the Mine DE. The pre-clearing surveys have guided mine planning and informed the clearing approval process under the State Agreement.

Alcoa's *Phytophthora* dieback management system operates in accordance with arrangements agreed with DBCA and has been demonstrated to effectively mitigate against *Phytophthora* dieback being spread during mining (Section 5.4.4.2).

In 2005, Alcoa developed an Environmental Improvement Plan (EIP) in conjunction with members of the community, non-government organisations, universities, state government representatives and environmental regulators. The EIP set clear targets and actions for improvement in all areas of Alcoa's operations. One of the EIP commitments is to minimise impacts on fauna species which inhabit areas surrounding mining operations and to maximise recolonisation of fauna into areas rehabilitated following mining. This includes managing rare and threatened species that occur within Alcoa's mining region.

Alcoa's Long Term Fauna Monitoring Program commenced in 1992. This has involved monitoring every three years at twenty plots located in rehabilitation and nearby forest at Jarrahdale, Huntly and Karnet (remote from mining).

Alcoa has contributed funding to feral animal control in the NJF since 1994, commencing with Operation Foxglove, the first broadscale baiting program in the NJF. The success of Operation Foxglove led to the implementation of DBCA's flagship wildlife recovery program, Western Shield. Western Shield has resulted in the recovery of several critical weight range mammals including Woylie, Chuditch and Quokka. Alcoa's ongoing contribution to Western Shield through

[3] https://www.alcoa.com/sustainability/pdf/2023-Sustainability-Report.pdf

its Forest Enhancement payments under the State Agreement, supports feral animal control over approximately 0.69 million ha (approximately 62 per cent) of native fauna habitat in the NJF.

In response to the conditions attached to the 2023-2027 MMP and Section 6 Exception Order, Alcoa has recently revised and/or established the following environmental management plans for its mining operation in the Huntly and Willowdale Mines. These plans are published on Alcoa's website and are adaptive being revised to reflect anticipated and future approval conditions or updated Alcoa standards. The current plans are included in Appendix C. This ERD references these plans and future revisions in relation to mitigation measures that minimise impacts to the relevant environmental factors.

- Fauna Management Plan, June 2024
- Flora and Vegetation Management Plan, December 2024
- Rehabilitation Management Plan and Schedule, June 2024
- Water Resources Management Plan, February 2025

Alcoa manages dust emissions and contaminant discharges through established strategies and procedures and through continual improvement. Alcoa has a two-stage noise management process that is detailed in an internal Noise Management Plan that is available to employees via the Controlled Document System (AUA-CDS-4124). The first stage is predictive noise modelling to guide mine planning to determine compliance with the *Environmental Protection (Noise) Regulations 1997*. The second stage uses operational noise modelling of actual mining activities, equipment location and live weather data, and guides mine operations to minimise the risk of noise impacts on nearby sensitive receptors. Alcoa also has an established noise complaints resolution process. Where a complaint is made, Alcoa gathers the relevant information from the complainant and logs the complaint in Alcoa's Community Consultation System. This is followed up by an investigation with Alcoa responding to the complaint as requested and as appropriate.

2.3.3 Preventative risk management of drinking water

The Huntly Mine has included substantial operations within the South Dandalup Dam, North Dandalup Dam, Serpentine Dam and Wungong Dam Public Drinking Water Source Areas (PDWSAs). To date, there has not been a substantial rise in salinity, a major sediment release or a major diesel spill from Alcoa's operations that has required remedial actions in these PDWSAs or for a drinking water reservoir to be taken off-line.

Alcoa implements preventative risk management at the Huntly Mine, which incorporates multiple preventative mitigation measures or 'barriers' to prevent hazards to downstream drinking water reservoirs from occurring, or reduce risks to acceptable levels. Multiple barriers are established that control hazards relating to pathogens, sediment discharge and hydrocarbons and other chemicals from being discharged into downstream reservoirs.

Details of the preventative risk management at the Huntly Mine are presented in Section 8.4.11 with a detailed Drinking Water Risk Assessment (including Quantitative Microbial Risk Assessment) presented in Appendix B8.6. Additional barriers and improvements to existing barriers are proposed to be implemented as part of the Proposal. This will improve the robustness of the multiple barriers at the Mine and enhance the protection of drinking water quality.

Alcoa is committed to working with the Water Corporation and DWER to ensure Huntly Mine operations continue to protect public drinking water supply and recreational values and to protect water dependent ecosystems that contribute to maintaining the ecological integrity of the NJF.

2.3.4 Refinery environmental management

The Pinjarra Alumina Refinery is operated in accordance with an Environmental Management system (EMS) accredited to the international standard ISO14001:2015. The refinery has operated under an EP Act Part V environmental licence since 1983 and Ministerial Statement 646 since 2004.

The refinery has operated in accordance with a Long Term Residue Management Strategy (LTRMS)[4] since 1997. The LTRMS is a voluntary initiative by Alcoa and is endorsed by State Government. In 2006, Alcoa released an Environmental Improvement Plan (EIP) for the Refinery, the first such plan for an industry in WA, and revised the EIP in 2008, 2011, 2014 and 2018. The current EIP (2023-2027) is published on Alcoa's website[5].

Alcoa has developed the Refinery LTRMS and EIP in a consultative fashion, with key contributions by the Pinjarra Community Consultative Network (CCN). The CCN was formed in 1994 and provides input on a range of issues relating to the Refinery and Mine, local community matters and issues relevant to the Peel region. The CCN has smaller working groups as needed, including the EIP working group and LTRMS stakeholder reference group.

Refinery air emissions are managed under an existing Air Quality Management Plan (AQMP), Dust Management Plan, and air pollution control conditions under the Part V environmental licence (L5271/1983/14), including ambient dust monitoring and stack emission testing and reporting. The current plans are included in Appendix C.

Refinery GHG emissions are managed under an existing GHG management plan[6]. Since 2008, Alcoa and Alinta have partnered to operate two cogeneration power units at the refinery, delivering energy efficiencies and significant GHG benefits. The refinery has one of the lowest GHG intensities of alumina refineries globally, with a combined Scope 1 and 2 emission intensity of less than 0.7 tonnes of carbon dioxide equivalent (CO_2-e) per tonne of alumina, compared to a global industry average of 1.2 t CO_2-e/t alumina[7].

The refinery operates on a closed water circuit which is supplemented for water losses. Water abstraction is rigorously managed through water licensing and an operating strategy under the RIWI Act. Alcoa undertakes comprehensive monitoring of water quality in the superficial and confined aquifers under the operating strategy and water pollution control conditions in the Part V environment licence. Alcoa has undertaken continual improvement at the Refinery to improve protection for inland waters, including water efficiency initiatives (Section 8.4.12.2).

[4] https://www.alcoa.com/australia/en/pdf/ltrms-pinjarra-refinery.pdf
[5] https://www.alcoa.com/australia/en/pdf/eip_pinjarra.pdf
[6] https://www.alcoa.com/australia/en/pdf/Greenhouse_Management_Plan_Final_Feb_07.pdf
[7] https://aluminium.org.au/wp-content/uploads/2022/07/220719-PATHWAY-FACT-SHEET-03-ALUMINA.pdf

2.4 Rehabilitation program

Alcoa's rehabilitation program aims to rehabilitate areas affected by mining activities in ML1SA. Since the early 1980s, Alcoa has undertaken extensive research and improvement in rehabilitation practice. The program focusses on re-establishing native vegetation and ensuring the sustainability of rehabilitated areas.

2.4.1 Legislative context

References to the need for Alcoa to rehabilitate and ultimately hand back to the State areas of ML1SA in which it has undertaken mining operations are contained within the three State Agreements that regulate Alcoa's operations at the Huntly Mine and Pinjarra Refinery.

Alumina Refinery Agreement Act 1961, First Schedule

Clause 13 (b)

The Company will ensure after its operations on any area that that area is rendered and left tidy but not necessarily restored to its original contour.

Alumina Refinery (Pinjarra) Agreement Act 1969. First Schedule

Forests

(8) as may be reasonably required by the Conservator from time to time, take adequate measures at the Company's expense for the progressive restoration and re-afforestation of the forest destroyed, the prevention of soil erosion and formation of deep water pools, and such safety measures;

Alumina Refinery Agreements (Alcoa) Amendment Act 1987

This Act added the following subclause to Clause 9 of the 1961 Act:

(20) (a) Notwithstanding the provisions of the Mining Act 1978 but subject to the provisions of this subclause the Company may from time to time surrender to the State all or any portion or portions (of reasonable size and shape) of the land for the time being the subject of the mineral lease subject, in the case of any areas thereof which have been mined by the Company, to the Company first obtaining the consent in writing of the Minister to the surrender of those areas.

The most contemporaneous rehabilitation requirement is set out in Condition 15(a) iii. attached to the approval for the 2023-2027 MMP:

15. Alcoa must prepare the management plans referred to below…

(a) Rehabilitation Schedule and Management Plan that:

> *iii. includes a detailed rolling 5 yearly stabilisation/rehabilitation schedule that meets completion criteria and demonstrates an increase each consecutive year in the area (ha) in which stabilisation and rehabilitation activities are being undertaken over the next 4 years, achieving a minimum of 3,159 ha of rehabilitation (cumulative) over this period (2024-2027);*

The current version of this management plan is available on Alcoa's website and provided in Appendix C to this ERD.

Condition 23 of the same MMP approval requires Alcoa to consult with DBCA on the drafting of a revised set of Rehabilitation Completion Criteria and once agreed, provide these to the State Development Minister for endorsement. At the time of writing, a revised set of criteria has yet to be endorsed.

2.4.2 Rehabilitation of the Huntly Mine

As part of this Proposal, Alcoa commits to manage the rehabilitation of cleared areas across the Huntly Mine as follows:

- Ensure that in any three (3) rehabilitation season period (May-April) commencing after the date of approval that the hectares of rehabilitation of active areas within the Huntly Mine is equal to or greater than the hectares of disturbance of native vegetation for active areas.
- Ensure that the commencement of decommissioning of areas cleared for long-term infrastructure occurs within 18 months of these areas no longer being required by either Alcoa or the landowner.

Active areas and long-term infrastructure are as defined in Chapter 1.

2.4.3 Rehabilitation principles

Alcoa's rehabilitation objective under the current Rehabilitation Completion Criteria (endorsed in 2015 and applied from 2016) is to:

'*Restore a self-sustaining Jarrah Forest ecosystem planned to enhance or maintain water, timber, recreation, conservation and/or nominated forest values.*'[8]

The Rehabilitation Completion Criteria and associated standards were developed based on a set of principles that were considered appropriate for mine rehabilitation in the NJF. The agreed principles were that rehabilitated areas:

- Meet land use objectives.
- Are integrated into the surround landscape.
- Support vegetation that exhibits sustained growth and development.
- Support vegetation that is as resilient as jarrah forest.
- Can be integrated with the surrounding forest management.

2.4.4 Rehabilitation goals

An overview of key goals from rehabilitation includes:

- Water values: to ensure that mined areas provide acceptable water quality and quantity.
- Recreation: to maintain existing recreational values where possible and to provide increased opportunities for forest-based recreational activities in accordance with DBCA district and regional recreation plans.
- Protection: to conserve the residual soils, to control *Phytophthora* dieback spread and to manage potential fire hazards.
- Landscape: to create a rehabilitated landscape visually compatible with the adjoining unmined forest.
- Conservation: to encourage the development of floral, faunal and soil characteristics of the indigenous Jarrah forest ecosystem.
- Long-term Management: to produce a rehabilitation system that can flourish (in the short-term) and become self-sustaining (in the long-term) without continual applications of management resources greater than those needed by the un-mined forest (e.g. fertiliser applications).

From 2024, the only timber to be removed from the forest will be limited to forest management activities that improve forest health (e.g. ecological thinning) and clearing for approved mining

[8] It is noted that the revised Rehabilitation Completion Criteria propose to amend this objective to '*Establish and return a self-sustaining Jarrah Forest ecosystem that meets the agreed forest values, and that will support similar management practices employed in the surrounding Jarrah Forest.*'

operations under the 2024-2033 Forest Management Plan (FMP). Alcoa's objective is consistent with the multiple uses of State Forest under the current FMP.

2.4.5 Evolution of Alcoa's rehabilitation

Alcoa's rehabilitation standards and techniques have evolved over time, being informed by interactions in research and practice (Grant and Koch 2007). Table 2-4 provides an overview of progressive development of rehabilitation characteristics and areas over Alcoa's three mines in the NJF. As presented, approximately 83 per cent of Alcoa's rehabilitation has occurred after 1988, comprising a native species overstorey, deep ripped substrate and a rich native species understorey.

Alcoa's WA operations commenced at Jarrahdale in 1966, with early rehabilitation seeking to restore mined areas to productive land use, primarily timber production (Koch 2007). Early rehabilitation practices involved planting exotic pine trees with little site preparation. Topsoil return and direct seeding technologies were in their infancy. Understorey vegetation, which comprises the majority of floristic diversity, was not considered until 1975 (Koch 2007).

Later rehabilitation prioritised Marri (*Corymbia calophylla*) plus non-native eucalypt tree species, due to the uncertainty in impact of *Phytophthora* dieback on Jarrah *(Eucalyptus marginata*), the predominant overstorey species (Grant and Koch 2007). Research in the 1980s indicated that Jarrah could survive in rehabilitated areas even if infected with *Phytophthora*, and since 1988, rehabilitation prescribed only native over-storey species. Deep ripping of compacted pit floors was introduced in 1971 to break soil compaction, with introduction of the winged tine in 1984 (Grant and Koch 2007). Deep ripping substantially breaks up the underlying regolith to support root penetration and plant water availability, sustaining vegetation structure and ecological integrity.

Standish et al. (2021) reviewed long-term rehabilitation data and their assessment noted the shift in focus to emphasise the re-establishment of a functioning jarrah forest ecosystem. These efforts have included reductions in fertiliser amounts and seed application rates of large understorey legumes. Both these reductions reduce overall productivity and result in greater species richness, including that of under-represented resprouter species, resulting in assemblages that are similar to reference jarrah forest (Daws and Koch 2015).

Alcoa has undertaken extensive research and development in rehabilitation for over 50 years, with the publication of findings in peer reviewed journals. This has enabled the distribution of Alcoa's accumulated knowledge to the learning and applied practice in other mining operations, improving the wider benefits to biodiversity and ecological integrity of the Jarrah forest and elsewhere.

A summary of Alcoa's research findings with respect to the flora and vegetation and terrestrial fauna factors is presented in Section 5.5.3 and Section 6.5.3, respectively, with regard to the EPA's objective of maintaining biodiversity and ecological integrity.

Table 2.4 Alcoa mine rehabilitation overview

Period	Key characteristics	Huntly (ha)	Jarrahdale (ha)	Willowdale (ha)	Total (ha)	Proportion (%)
1966-1975	Exotic overstorey, rudimentary understorey	73	428	-	501	2
1976-1987	Exotic overstorey, native understorey (mostly legumes)	1,695	1,278	102	3,075	15
1988-1999	Native overstorey ~3000 stems/ha, flora species richness > 60% of un-mined forest	1,909	1,601	894	4,404	21
2000-2015	Native overstorey ~1400 stems/ha, flora species richness > 80% of un-mined forest	6,878	723	2,908	10,509	50
2016-present	Native overstorey ~1000 stems/ha, flora species richness > 80% of un-mined forest	1,854	-	654	2,508	12
Total		**12,408**	**4,030**	**4,559**	**20,997**	**100**

2.4.6 Rehabilitation process

Alcoa's rehabilitation process includes a range of components. Key components of the rehabilitation process are:

- Rehabilitation prescriptions for each mined area.
- Research programmes to improve rehabilitation procedures.
- Rehabilitation monitoring to determine capacity to meet objectives and
- Remedial treatments where monitoring indicates that rehabilitation objectives were not achieved.

Rehabilitation planning occurs as a part of mine planning, to schedule mining to maximise direct soil return, plan soil stockpiles, minimise non-ore clearing, undertake efficient seed collection, nursery plant production and plan *Phytophthora* dieback hygiene. Detailed rehabilitation planning occurs on a pit-by-pit basis, to schedule rehabilitation for the optimum time of the year; plan soil movements, access and *Phytophthora* dieback hygiene.

Alcoa's rehabilitation methodology has been documented in published journals and is set out in DBCA Working Arrangements, along with Alcoa's Rehabilitation Management Plan and Schedule; and Rehabilitation Design Manual. Table 2.5 provides a summary of current Huntly Mine rehabilitation, which is subject to on-going development and refinement and may be subject to change during the proposal. All rehabilitation is undertaken in accordance with *Phytophthora* dieback hygiene requirements.

Alcoa has integrated adaptive management practices within its rehabilitation monitoring program to ensure that the rehabilitation quality is on an appropriate trajectory towards achieving the completion criteria. Following monitoring, areas that fail to meet completion criteria are risk assessed and scheduled for remediation based on risk and appropriate timeframes to address quality issues.

Remediation works may include:

- Seeding of additional legumes
- Planting of additional eucalypt tube stock
- Planting of additional species
- Re-work (such as re-establishing soil profile, contour ripping, seeding and planting).

Table 2.5 Overview of rehabilitation – Huntly Mine (based on current prescription)

Rehabilitation component	Elements
Landscaping	• Topsoil and overburden are mechanically stripped to either be used directly in rehabilitation or stored for future use. Topsoil contains native seed, nutrients and beneficial organisms that support successful revegetation, providing approximately 60% of species diversity in the 'recipient' rehabilitation area. Overburden and topsoil greater than 3 months old are used to reconstruct the soil profile. • Pre-ripping of compacted pit floors with a winged tine to at least 1.2 m, excluding batters and waste islands. • Vertical faces re-shaped to achieve acceptable grades that blend in with the surrounding natural forest landscape (< 18º slope). • Long-term forest access tracks reinstated as agreed with DBCA and located as low in the profile as possible with surface water runoff directed into the rehabilitated area. • Pits are landscaped to retain surface water runoff and sediment.
Soil return	• Topsoil and overburden returned from stockpiles to an area of the same *Phytophthora* dieback category. • Fresh topsoil is sourced from an area (donor site), cleared nominally from late-spring to mid-summer of the commencing rehabilitation season. • Where practicable, topsoil and overburden depth is applied to replace topsoil stripped from the area. Reduced depth may be applied subject to limited soil availability across the mine. • Topsoil handling is scheduled to avoid damage to the structure during high moisture.
Fauna habitats	• Constructed fauna habitats established at a target rate of one per hectare. • Habitats constructed with woody material, rocks and soil to support re establishment of fauna populations within rehabilitated areas. • If pits are designed to retain water, habitat structures should not be placed at the base of the pit to avoid being surrounded by water.
Contour ripping	• Ripping carried out on contour with a multi-tine. • Some batters and banks need not be deep ripped, but must be scarified or shallow ripped, to avoid bringing up rocks. • Interceptor banks constructed during contour ripping on steeper areas to assist in erosion control. • Cleared, un-mined areas scarified on contour to avoid bringing up rocks.
Seeding	• Seed collection from approved Huntly Mine provenance zone, which have been informed by genetic analysis. • Apply seed mix including understorey and overstorey species. • Standard prescription for Upland Forest is to establish 80 per cent *Eucalyptus marginata* and 20 per cent *Corymbia calophylla*.

Rehabilitation component	Elements	
	• For stream crossings or low areas within pits, *Eucalyptus patens*, *Eucalyptus megacarpa* and *Eucalyptus rudis* used in proportions relating to density in surrounding areas, calculated from permanent monitoring plots in streamzones. • Mixed understorey seed sown at the rate of 1-2 kg/ha. Seeding soon after contour ripping operations (preferably within seven days). • Seed applied mechanically at time of contour ripping or by hand.	
Planting	• Planting recalcitrant seedlings, following significant autumn/winter rains. • Use of *Phytophthora* dieback free nursery stock.	
Fertilising	• Fertilizer generally spread in early spring.	
Monitoring	• Rehabilitation monitoring program evaluates rehabilitated areas against approved rehabilitation completion criteria (RCC) which incorporates performance criterion for: ○ plant densities, plant species richness, erosion and weeds in the early establishment phase. • longer term ecosystem development and integration with standard forest management. Monitoring of rehabilitation completed post 2016 (inclusive of disturbance and rehabilitation undertaken as part of this proposal) is undertaken at the following intervals:	
	9 Months:	Monitoring at nine months evaluates rehabilitated areas for tree and legume densities as well as the presence of erosion and the presence of weeds against completion criteria standards.
	15 Months:	Monitoring at 15 months assesses the species richness of the rehabilitated area in comparison to the surrounding remnant (i.e., unmined) forest. The RCC stipulates that all rehabilitated areas achieve a minimum of 60% species richness.
	24 Months:	Monitoring at 24 months is undertaken using an unmanned aerial vehicle (UAV) to assess rehabilitated areas for erosion and measure specific metrics for comparison against completion criteria.
	Five Years	Monitoring through aerial imagery and GIS tools is undertaken to ensure that the completed rehabilitation remains on trajectory to achieve RCC, with a focus on areas that have insufficient tree density.
	>12 years:	Final assessment of rehabilitation can be undertaken once rehabilitation >12 years of age to assess the area and confirm resilience criterion has been met and is on trajectory to a self-sustaining jarrah forest ecosystem.

2.4.7 Rehabilitation Completion Criteria

Alcoa's rehabilitation has been subject to completion criteria developed with and approved by the BSEC (formerly known as the MMPLG) to meet the agreed objective of a self-sustaining jarrah forest ecosystem that meets multiple forest uses. The completion criteria have evolved over time, being informed by interactions in research and practice.

Rehabilitated areas established up to 1987 reflect the agreed Post Mining Land Use (PMLU), which at that time was to support the establishment of a non-jarrah forest ecosystem, with species chosen for their resilience to the soil borne pathogen *Phytophthora cinnamomi*. These are collectively termed *Early Era rehabilitation*.

Since the introduction of a fully native species overstorey in 1988, Alcoa has undertaken rehabilitation with respect to three successions of completion criteria:

- 1988 – 2004
- 2005 – 2015
- 2016 to present.

Each completion criterion has an associated standard, including quantitative targets, against which Alcoa monitors and reports the rehabilitation performance. Alcoa's current rehabilitation completion criteria (2016 to present) are published on Alcoa's website[9].

Over these three successions, key completion criteria have related to the establishment of a native species overstorey, which is the primary indicator of vegetation cover and primary productivity in a forest ecosystem, and understorey species, which are the predominant floristic diversity in the Jarrah forest.

Improved rehabilitation outcomes have been achieved through improved rehabilitation methods, such as enhanced site preparation; improved topsoil management (direct-return); direct seeding of native species; propagation and planting of nursery-grown recalcitrant species; seed germination treatments; reduction in tree and legume densities and optimisation of fertiliser application.

Alcoa acknowledges the WA Government's banning of timber harvesting from 2024 onwards and the update of the FMP in 2024, which has changed the future land use of objectives for State Forest. This may affect Alcoa's rehabilitation objectives and the completion criteria relating to overstorey establishment.

2.4.7.1 Rehabilitation Monitoring

Alcoa's rehabilitation quality monitoring program evaluates rehabilitated areas against the Alcoa WA Mining RCC, developed in consultation with the PMLU manager, the DBCA and other key stakeholders and endorsed by the MMPLG in 2016.

As well as long term rehabilitation monitoring, Alcoa conducts monitoring in rehabilitation areas at nine and 15 months after establishment to provide early feedback on performance and allow for timely remediation and procedural improvements. At nine months, Alcoa monitors the density of Jarrah, Marri, total Eucalypts, and legumes. At 15 months, Alcoa assess species richness over 80 m² in each area and monitors the density of 'recalcitrant' species (Stantec, 2023).

The monitoring methodology employs a combination of traverses along transects and floristic sampling within quadrats, utilising both temporary transects and a combination of temporary and permanent plots. Temporary plots are used during 9-month monitoring and consist of 4 m x 4 m quadrats positioned along transects to record legumes, with a sampling intensity targeting

[9] https://www.alcoa.com/

covering ≥ 5% of rehabilitated areas. Permanent plots are established during the 15-month botanical monitoring at an intensity of one plot for every five hectares.

Alcoa has established 151 permanent vegetation monitoring plots in unmined forest areas around its Huntly and Willowdale operations, serving as reference sites for comparison.

At 24 months, erosion monitoring is undertaken after the second wet season following the establishment of rehabilitation using an external company which provides photogrammetric services. This company conducts the UAV photography across Alcoa's rehabilitation estate and derives secondary products including Digital Elevation Models and Orthomosaics of the rehabilitated landscape. Careful interpretation of these products by the supplier helps identify erosion using specific metrics, including depth, length, and width, ensuring they meet the completion criteria.

Additional vegetation monitoring is undertaken at five years using aerial imagery and Geographical Information Systems (GIS) tools to identify rehabilitated areas with insufficient tree density. Rehabilitation > 12 years of age is monitored utilising a combination of LiDAR, Real Time Kinematic (RTK) enabled UAV imagery, aerial photography, permanent plot monitoring and research trials are utilised to assess rehabilitation performance against resilience completion criteria.

Alcoa has also established 12 long-term vertebrate fauna monitoring sites consisting of unmined habitats and areas rehabilitated five, 10 and 15 years ago. Vertebrate fauna at these sites are periodically monitored to ensure rehabilitated areas are progressing on a restoration trajectory towards unmined forests.

An Environment and Rehabilitation checklist has been developed to record the status of rehabilitation in the field. Historic rehabilitation records and aerial photographs are also used to assist with the assessment. The assessments indicate whether the site is exhibiting sustained growth and development. If a site is recorded as not meeting one of the criteria, it is recorded within Alcoa's corrective action management system to inform rework planning.

2.4.7.2 Reference ecosystem

A reference ecosystem is defined as a suite of conditions that inform the performance level for developing and assessing RCC. Alcoa utilises analogue reference ecosystems, which are adjacent or nearby sites from which the necessary ecological attributes can be quantified to develop RCC (Young et al. 2019).

These analogue sites, termed 'permanent forest plots' by Alcoa, are 20m × 20m plots or equivalent coverage (containing quadrats) which have been established in unmined forest adjacent to mining areas in the same Havel SVTs.

Alcoa has defined two separate analogue reference ecosystems based on the Havel complexes, Upland Forest (SVTs: P, S, T) and the Stream Zone (SVTs: A, C, W, D). Targeted RCC have been developed for both ecosystems to ensure restored areas reflect conditions similar to those before mining activities.

Reference communities are dynamic due to the varied nature of ecosystems (i.e. some flora, like trees, possess long life spans, while others, such as fire ephemerals, are short-lived). This means species richness will fluctuate over time, particularly following disturbances. For example, fire can initially diminish richness, density, and cover before these attributes initially increase, as fire promotes seedling recruitment during post fire recovery, then eventually decrease as short-lived species senesce.

Recognising this temporal and spatial variation is important for setting appropriate RCC, especially as new plots are added with the progression of mining activities and permanent plots

are re-monitored over time. Alcoa has utilised the full range of reference data, using means and quartiles to develop the RCC for rehabilitation to account for the extent of this variability.

2.4.7.3 Rehabilitation establishment

The ecological succession stages and notable characteristics during rehabilitation phases are illustrated in Table 1-9 (Section 1.9.2.13).

The methodology implemented by Alcoa involves a multi-faceted strategy for returning plant species to the rehabilitation sites, which is described further below.

Topsoil management

Topsoil management is critical for native forest re-establishment, including seedbank survival, Phytophthora dieback hygiene and sediment control. Reducing the time period from stripping to re-spreading offers clear benefits for rehabilitation, due primarily to higher levels of soil-stored seed, and also to the presence of beneficial soil microbial populations (Daws et al. 2022).

Recent research also highlights the importance of not only direct return but also the combined benefits of direct return and depth of soil returned on soil seed bank viability (Daws et al. 2022). Re-spreading direct return topsoil over stockpiled topsoil has been shown to produce a vegetation composition most similar to unmined forest in the long term (45 years) (Daws et al. 2022).

Approximately 60% of the species present in the Jarrah Forest are returned to rehabilitation through the topsoil seed bank. This is preserved by stripping and returning the topsoil annually during the optimal months of October to April. This practice helps to maintain valuable seed banks and nutrients essential for successful rehabilitation.

Broadcast seeding

Broadcasting or sowing seed helps to support vegetation establishment in rehabilitation. Application of seed supplements the plant establishment achieved from the return of fresh topsoil. Jarrah and Marri eucalypt emergence predominantly comes from applied seed, although there is also a significant but highly variable contribution from the forest edge as windblown seed (Stantec 2023).

An additional 30% of species are incorporated through broadcast seeding, which is employed to increase the density of species returning from the topsoil and of species which store their seed in the canopy rather than the soil. Two seed mixes are developed; one for the Upland Forest and one for the Stream Zones, with species selected from those found in the reference plots.

Alcoa have formulated different seed mixes using research data to calculate the targeted grams of each species required to achieve germination rates that meet completion criteria. Seed used in rehabilitation is of the correct provenance zone, i.e. collected from vegetation within the locality of the mine (Stantec 2023).

Seed is ordered from various suppliers, stored as inventory on or off-site, and either delivered as specific mixes to the mine, as requested, or delivered to suppliers for growing of seedlings. Managing the supply, treatment, testing and delivery of seed to the mine is a critical process in quality and cost control for rehabilitation (Stantec 2023).

The composition and treatment of the broadcast seed mix varies from year to year; however, most plant species establish from the topsoil seed bank (i.e. up to 70% understorey species; Koch 2007) and so topsoil handling, rather than seed mix, drives seedling establishment (Standish et al. 2015).

Planted tubestock

The remaining 10% of species, categorised as recalcitrant, are more challenging to re-establish from topsoil or broadcast seeding. These species are propagated from seed (when available), cuttings, or tissue culture, which are then planted into the rehabilitation areas by hand (Koch 2007).

2.4.8 Rehabilitation performance

As of June 2024, Alcoa had rehabilitated approximately 79.6% of its operational footprint. Rehabilitation has been identified as a primary mitigation measure across the potentially impacted environmental factors.

Alcoa's rehabilitation is subject to completion criteria developed with and approved by the BSEC (previously approved by the MMPLG). The completion criteria have evolved over time, being informed by interactions in research and practice. The assessment of rehabilitation against the completion criteria occurs at various stages of the rehabilitation execution and establishment.

This section has been compiled to demonstrate Alcoa's rehabilitation performance utilising quantitative and qualitative data gathered from Alcoa's internal monitoring program and conclusions drawn from the peer review completed by Stantec (2023).

2.4.8.1 Native overstorey establishment and density

The establishment of a native species overstorey provides the predominant vegetation cover and primary productivity of the forest ecosystem, which is key to the ecological integrity of the NJF.

In rehabilitation, the return of flora and vegetation is the foundation for many other ecological processes. Indeed, within the Jarrah Forest, at least 300–400 plant species assemble to constitute the vegetation typically mined (Koch 2007). This vegetation attracts herbivores (and other fauna), like the emu, which benefit from the food vegetation provides and, in turn, contribute to seed dispersal and nutrient cycling. At the same time, soil is one of the critical ingredients supporting vegetation; however, biotic processes within vegetation also influence the soil. For example, plant roots stabilise against erosion (Hubble, Docker and Mickovski 2012), detritus from plant decomposition reduces water runoff and increases infiltration (Doerr, Shakesby and Walsh 2000), and plant microbial activity assists in replenishing soil nutrients (Jasper 2007).

Alcoa has botanical monitoring data, dating from 1990 onwards, demonstrating vegetation establishment in rehabilitation. Alcoa measures the success of rehabilitation using several indices and their associated thresholds established within four discrete rehabilitation eras. For example, species richness is one commonly applied index of success which has appeared in the Completion Criteria of the three most recent rehabilitation eras and has generally been met for most rehabilitated areas. The species richness recorded within rehabilitation is at a level which is considered acceptable according to the conditions agreed upon by the government in the corresponding Completion Criteria. Species richness and other measures related to density and recalcitrant species are discussed in the following sections.

Between 1988–2004, rehabilitation focused on returning high tree density, supported by legumes and fertilisers to support forest productivity. Apart from providing redundancy to ensure sufficient tree survival, a key driver for the higher stocking rates was to satisfy timber production values. Research indicated that moderation of fertiliser and large understorey legumes assists to maximise understorey cover, tree growth and understorey species richness (Daws et al. 2019). This has led to decreases in the amounts of fertiliser used, from 500 kg/ha between 1988–2004, to 280 kg/ha between 2005–2015, with fertiliser use around 140 kg/ha currently. The stocking rates at establishment are based on the demonstrated natural attribution of trees

over time, with the acceptable range of 600-1,400 trees/ha declining to about 400-1,100 trees after 32 years (Chart 2-1).

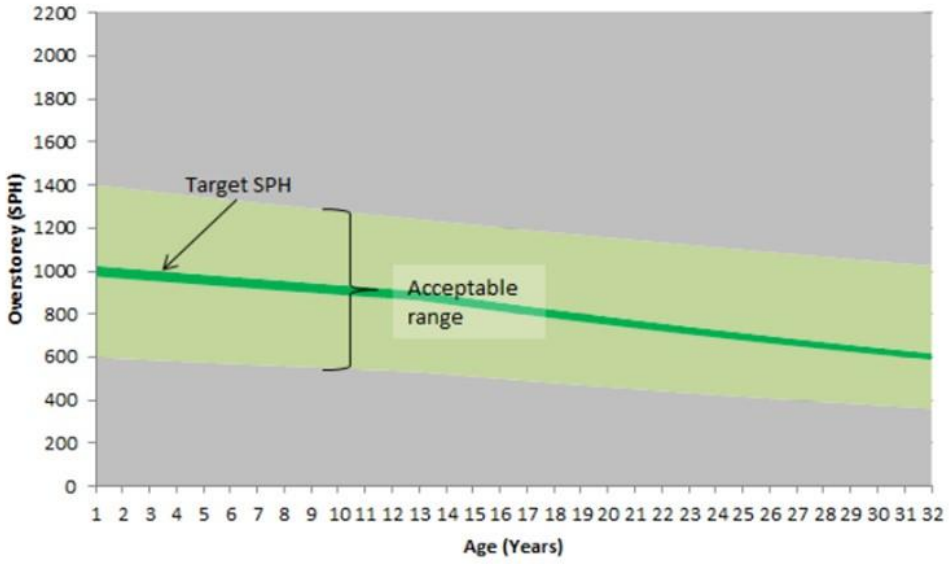

Chart 2-1 Target stocking rate for overstorey (stems/ha) in rehabilitation

As presented in Chart 2-2 and 2-3, Alcoa has successfully met completion criteria targets relating to establishment of a native species overstorey, with the targets and achieved establishment of eucalypts (predominantly Jarrah) progressively reducing from 1991 to 2021 in line with Alcoa and DBCA's increasing confidence in seedling survival and the more recent recognition of the need to reduce tree stocking rates to improve resilience to declining rainfall.

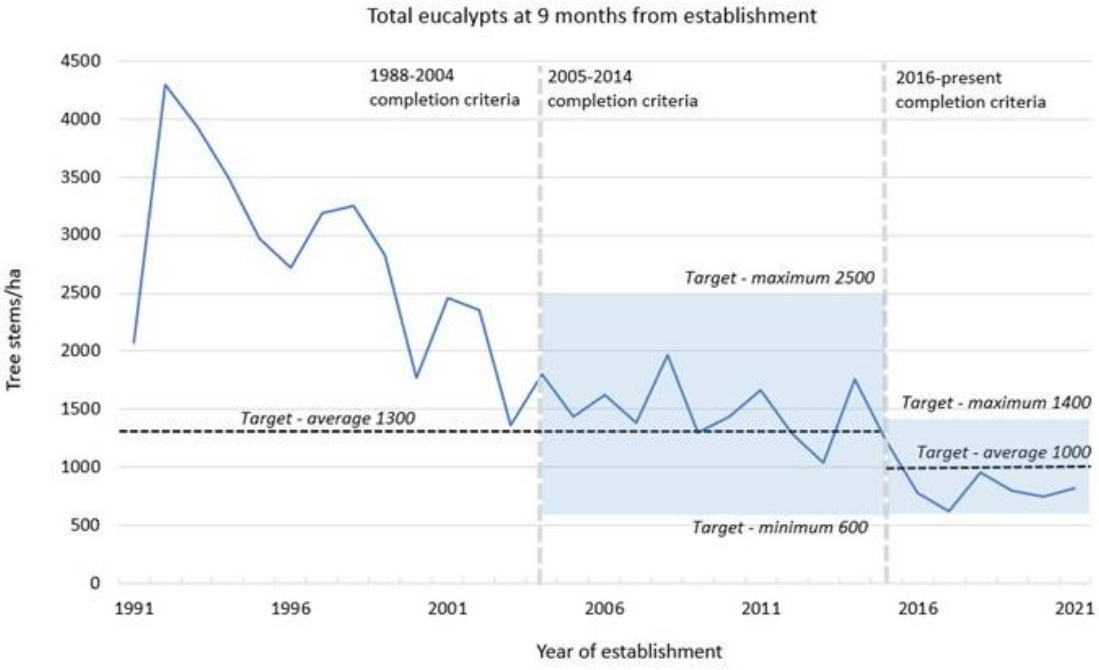

Chart 2-2 Alcoa's rehabilitation performance against completion criteria for the Huntly Mine – establishment of eucalypts

As presented in Chart 2-3, Alcoa has achieved the minimum stocking rates for Marri in 29 out of the 30 years of rehabilitation. Marri is the co-dominant tree species of the NJF and is not susceptible to *Phytophthora* dieback (see Section 5.3.4.7), as well as being an important species for Black Cockatoos (see Section 6.3.3.5). The establishment of a native species

overstorey provides the predominant vegetation cover and primary productivity of the forest ecosystem, which is key to the ecological integrity of the NJF.

In lieu of the progressive nature of the Completion Criteria and striving to keep up with best research practices, Alcoa continue to develop rehabilitation and monitoring practices. For example, Alcoa's rehabilitation seeding program returns 78 – 113 native Jarrah Forest species from local provenance collected within approximately 20 km of the mine (Koch 2007). Using local provenance seeds is supposed to ensure that the genetic diversity of the restored areas is maintained and matched to surrounding native vegetation (McKay et al. 2005).

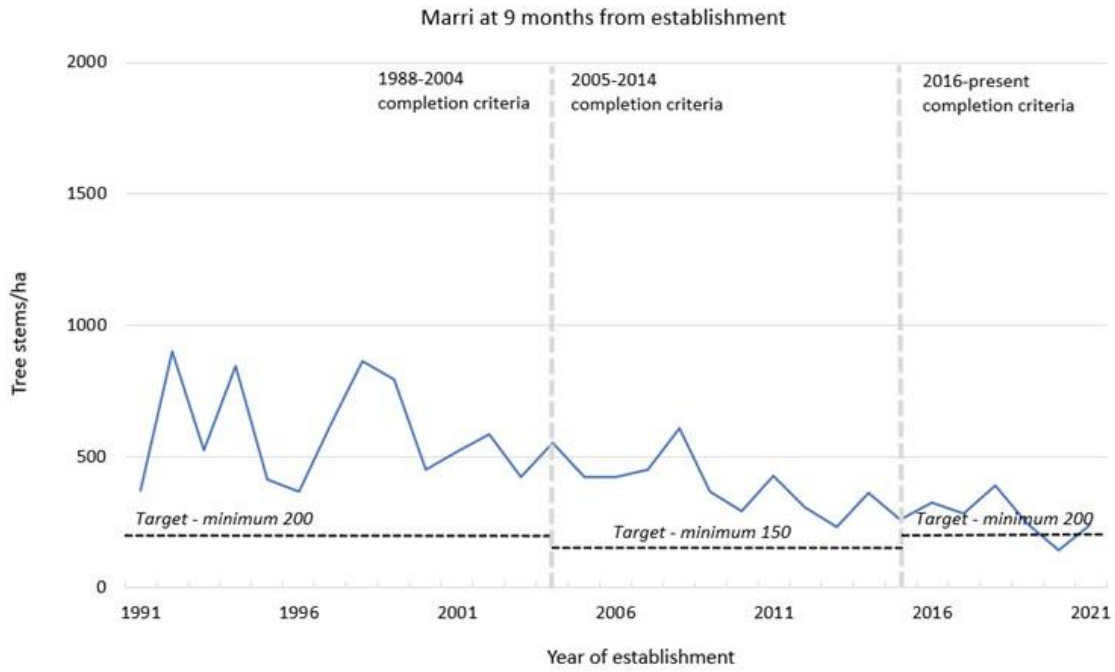

Chart 2-3 Alcoa's rehabilitation performance against completion criteria for the Huntly Mine – establishment of Marri

2.4.8.2 Native plant species richness (including understorey species)

Species richness refers to the total number of different species present in a specific ecological community, ecosystem, or defined area. It is a fundamental measure of biodiversity, providing insight into the variety of life forms within a particular habitat (Rafferty 2023). Alcoa has adopted species richness as a leading performance indicator, whereby early adaptive management can be implemented based on performance against this rehabilitation criterion.

From 2004 onwards, Alcoa has adopted a mean species richness target of 60% of analogue sites. Alcoa utilises analogue reference ecosystems, which are adjacent or nearby sites from which the necessary ecological attributes can be quantified to develop completion criteria (Young et al. 2019). These analogue sites are termed 'permanent forest plots' by Alcoa and are 20 m × 20 m plots (containing quadrats) which have been established in unmined forest adjacent to mining areas in the same Havel Site Vegetation Types (SVTs).

Ten broad vegetation complexes have been described across Alcoa's operations (Havel 1975, Heddle et al. 1980, Mattiske et al. 1998, Havel 2000). These complexes are further divided into 20 Site Vegetation Types (SVTs) (Denoted by letters A to Z), delineating more refined species compositional patterns. Impacts from Alcoa's bauxite mining operations are mostly restricted to Dwellingup 1 (D1) and Dwellingup 2 (D2) and their associated (SVTs: S, T, and P). Although mining is typically in mid-slope to upper-slope positions in the landscape, a small percentage of haul roads and mining infrastructure occasionally intersect Stream Zone vegetation (SVTs: A, C, W, & D).

The current completion criteria requires that all rehabilitated areas achieve a minimum of 60% species richness. On average, 99% of the total rehabilitated area, monitored using on-ground plots, was deemed to have met the species richness target at 15 months of age (Stantec 2023).

As presented in Chart 2-4, Alcoa has successfully met completion criteria targets relating to understorey establishment, which are monitored in 80 m^2 plots in rehabilitation pits. Species richness has averaged over 80 per cent of un-mined forest control plots, well above the target of 60 per cent. This has been achieved through a combination of methods including direct returned topsoil, topsoil handling and ripping in the dry season, and applying a seed mix treated to promote germination (Koch 2007).

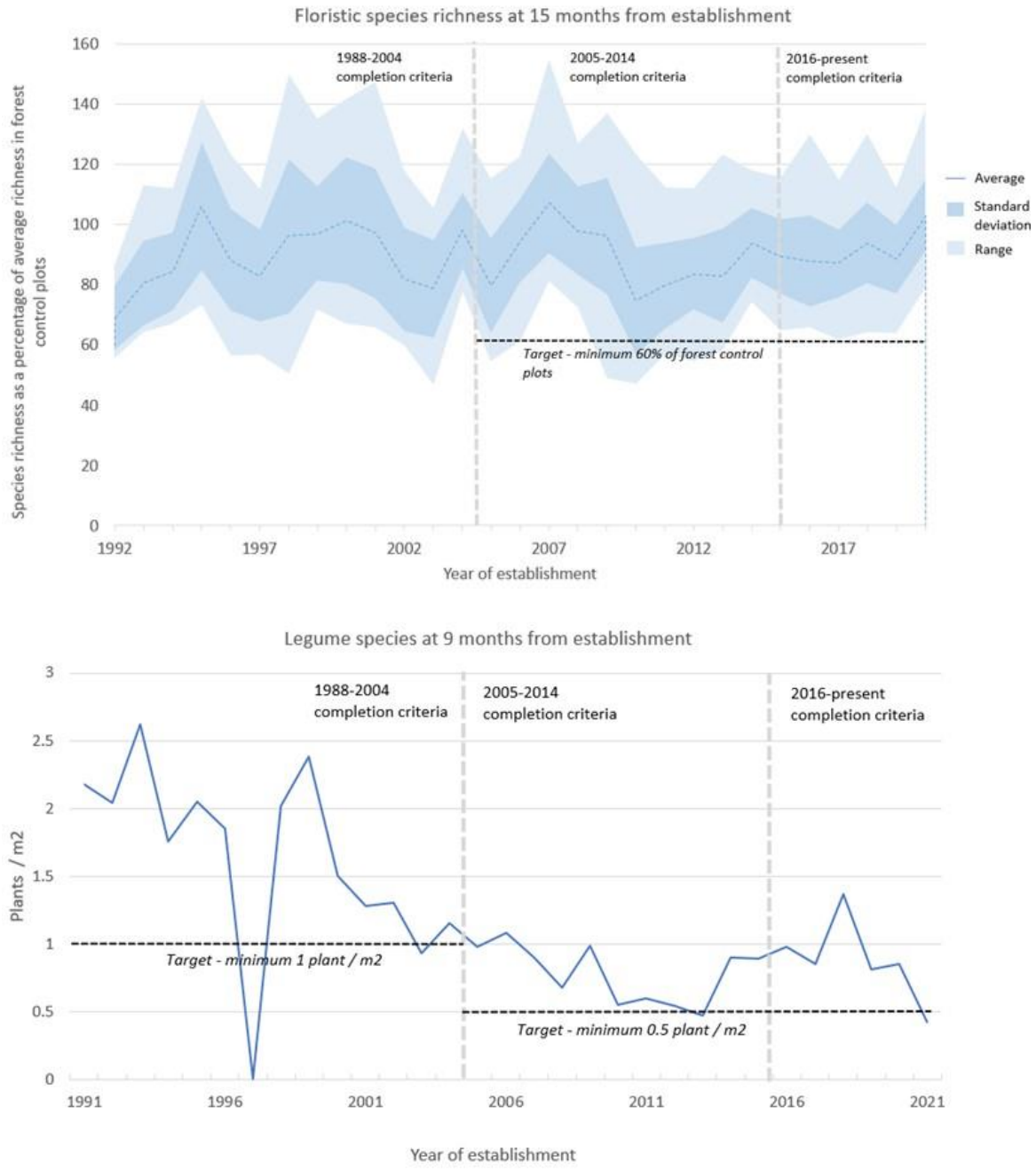

Chart 2-4 Alcoa's rehabilitation performance against completion criteria – establishment of understorey

A summary of species richness of monitored 80 m^2 plots in rehabilitation pits at the age of 15 months was undertaken as per the EPA request (item 13 of ESD addendum). Table 2.6 presents this summary of plots for P, S and T SVTs monitored between 1992 and 2021. These

SVTs have a comparable range of species richness values with averages close to the overall total. There was little variability in the species richness between P, S and T type rehabilitation in comparison to forest completion criteria targets, with a mean of 80-82% species richness return. Therefore, it appears that the success in rehabilitation, in terms of returning species richness, has not been substantially different between each of these forest types (Stantec 2023).

Table 2.6 Summary of 15 month rehabilitation plot species richness for P, S and T SVTs (1992 – 2021)

SVT	Number of plots	Species Richness (Average)	Species Richness (Range)	Rehabilitation richness as a percentage of reference forest
P	283	39.88	16 - 77	82%
S	1,250	41.77	13 - 78	82%
T	340	40.16	16 - 71	80%

Alcoa-funded research studies have suggested that native species richness has been found to persist, but not increase, over monitoring periods of up to 20 years (Norman et al. 2006, Daws and Koch 2015, Daws et al. 2019, Daws et al. 2021). It is estimated that 70% of species that occur in Alcoa's rehabilitation originate from seeds in returned topsoil (Koch 2007b). A further 10-20% originate from the broadcast seed mix. The variability in seed bank contributions to rehabilitation areas is due to the difficulty in ascertaining whether the introduced seeds are sourced from Alcoa's seeding program or introduced via external factors (i.e. windblown seeds from adjacent areas). The final 0-10% are "recalcitrant" species which propagated in a nursery and planted into the rehabilitation areas, as discussed in Section 2.4.7.3.

Long-term monitoring also observed species 'turnover' in rehabilitation over longer time periods, where shorter-lived 'pioneer' species (weeds and ephemerals, Acacias and other legumes) are replaced by late-arriving species including re-sprouters and other species, including orchids (Daws et al. 2021, Grant and Koch 2003).

Standish et al. (2021) found that species richness of 25-year old rehabilitation was comparable to that of non-mined forests. Analyses of species richness trajectories in Alcoa's rehabilitation performed by Standish et al. (2021) demonstrate that species richness declines along with the age of restored sites. This pattern is likely due to the reduction in early-colonising plants like weeds and short-lived plants, especially in the short term, followed by the progressive reduction of legumes (Daws et al. 2021).

This pattern appears consistent with research from other temperate forests which demonstrate a U-shaped model for forest succession predicated on the general observation of higher richness in the early and late stages of forest succession (Hilmers et al. 2018). If we apply this model to the regenerative stages of the Jarrah forest, postulated by Bradshaw (2015), we might expect that early-colonising plants would progressively decline during younger ages (0–15 years), with reduced richness detected in the juvenile–immature age classes (15 – ~120 years).

While Alcoa's oldest rehabilitation is ~ 40 years, fire (an enforced standard built into the last four completion criteria eras) has acted as a disturbance mechanism, effectively resetting this model in older areas; subsequently, the oldest age in Standish et al.'s (2020) research was around 25 years of age, corresponding with species decline phase of the trajectory.

Still, Bradshaw (2015) posits that Jarrah and Marri trees begin to die off at around 250 years of age – with larger trees living up to 450 years. Corresponding with this degenerative phase (~120 – 250 years), where natural decay would lead to canopy gaps and the formation of microhabitats, we might expect to see an increase of habitat specialist species effectively increasing species richness. While ongoing research is necessary, the trajectory remains

promising despite the relatively short (post-fire effective rehabilitation age of 25 years) timeframe, given that these forests require approximately 120 years to reach the stage in which increasing richness is hypothesised.

However, there was also a negative relationship between species richness and restoration age, which is likely due to the loss of early-colonising weed and ephemeral species, and some reseeding species at 10-15 years. Campbell et al. (2024) noted that restoration has low structural similarity to the reference ecosystem after more than 30 years (i.e. areas rehabilitated prior to 1994), however, it should also be recognised that older rehabilitation had different completion criteria to more recently rehabilitated areas, and Alcoa's rehabilitation methods have evolved significantly in that time.

Rehabilitated forest is largely comprised of common native plant species, and while meeting completion criteria, it has lower diversity than non-mined forest, due to the presence of rare, functionally distinct species in the latter (e.g. some resprouters) (Norman et al. 2006). Species diversity is high in the NJF with understorey species contributing significantly to species richness in jarrah forest, Standish et al. (2021) considered that the environment in the NJF have led to the evolution of species with similar or overlapping traits. High functional redundancy may explain the lack of relationship between species richness and functional richness in rehabilitated forest (Standish et al. 2021).

Despite improvements in rehabilitation methods, differences in compositional similarity between rehabilitation and unmined forest remain (Stantec 2023). Furthermore, rehabilitation does not aim to reinstate the specific upland SVTs that were cleared (P, S and T), as the subtle differences in soil profile and landscape that defined the vegetation types are lost with the mining and rehabilitation process (Koch 2007). Accordingly, while rehabilitation achieves comparable species richness and cover, it is expected to have a lower diversity of vegetation types compared to native jarrah forest (Stantec 2023).

2.4.8.3 Recalcitrant species

Despite the restoration of the majority of floristic diversity in the 1990s, rehabilitation monitoring indicated that there was a shortage of 'recalcitrant' species, which generally have very low seed production and are difficult to restore from the soil seed bank or collected seeds. Across the vegetation communities most impacted, Campbell et al. 2024 identified over 100 species of fire-resistant resprouter species that are difficult to regenerate from seed.

To address rehabilitation of recalcitrant species, Alcoa has invested tissue culture research since 1992, developing techniques to grow recalcitrant species in the laboratory and nursery, and successfully plant the species in rehabilitation. Propagation of recalcitrant species includes growth of seedlings from cuttings, scarce seed quantities, or by tissue culture.

Planting of seedlings generally occurs via hand, in the second winter (June/July) following completion of rehabilitation, when sufficient soil moisture is present to support seedling establishment. From 1999-2005, recalcitrant species were planted in rehabilitation at densities of approximately 200-300 plants/ha and comprising 15-28 species, mostly graminoids, such as sedges (Cyperaceae), rushes (Restionaceae), and certain species of lily (Anthericaceae) and lomandras (Dasypogonaceae) (Koch 2007).

Current planting rates of recalcitrant species, in place since 2006, are approximately 800 plants/ha with similar species richness. Table 2.7 shows the total number of recalcitrant plants planted in rehabilitated mine pits between 2021 and 2023. The number of plants produced is on an upward trend as external suppliers become more experienced in propagating these plants and new species are introduced (Stantec 2023).

Table 2.7 Plantings of recalcitrant species 2021 to 2023

Year of Planting	Number Planted	Target
2021	490,328	551,040
2022	556,123	427,560
2023	439,046	426,720

There are other species abundant in vegetation types that are not currently considered in compositional targets but have important functional roles (Stantec 2023). Examples include mid-storey species *Banksia grandis*, *Allocasuarina fraseriana* and *Xanthorrhoea preissii* (Koch 2007). Stantec (2023) indicated that the frequency of *Xanthorrhoea preissii* presence in a selection of rehabilitation plots (2019, 2020 and 2021) was similar or higher than forest reference plots.

To improve survival of recalcitrant species plantings, reducing herbivory (using plant guards) and competition with other understorey plants has significantly increased spread and height growth for plantings of recalcitrant species. Daws and Koch (2015) found that survival and spread of planted species over a 16-year period, indicating that planting nursery-raised plants can be a viable strategy for establishing populations in both newly restored and older restored sites.

The 2016 completion criteria include the standard to establish recalcitrant species at a minimum of 200 plants/ha at 15 months from establishment, which Alcoa has exceeded, as presented in Chart 2-5. Recalcitrant species provide the Jarrah forest vegetation a higher resilience to natural disturbance, particularly fire and grazing (Koch 2007) and Alcoa's rehabilitation performance in establishing these species contributes directly to the biodiversity and ecological integrity of the NJF, as well publishing research that contributes indirectly to wider rehabilitation performance by other mining operations.

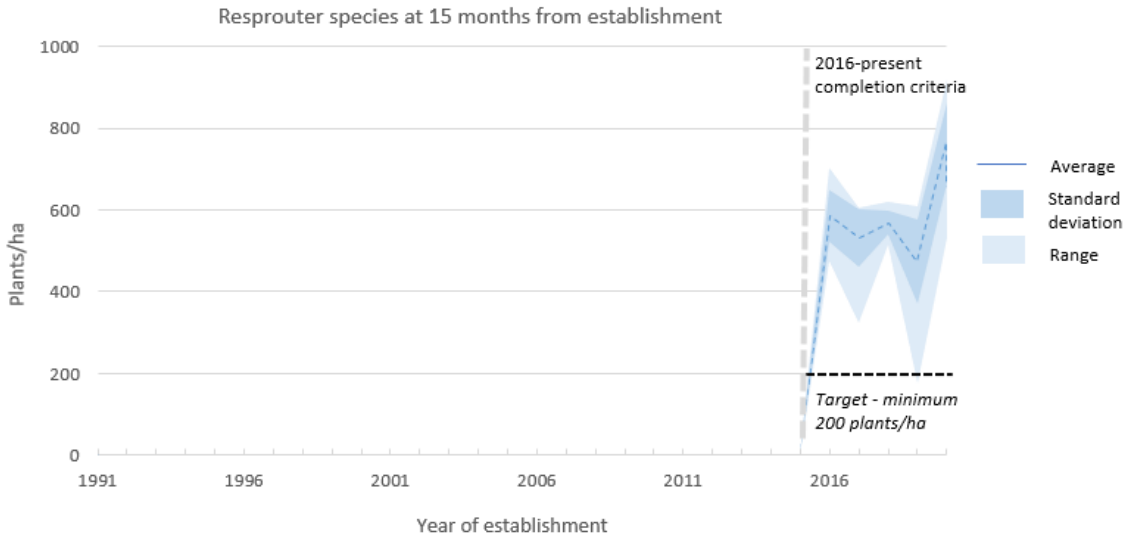

Chart 2-5 Alcoa's rehabilitation performance against completion criteria – establishment of recalcitrant species

2.4.8.4 Rehabilitation resilience

Structurally, by 12– 15 years of age, the rehabilitation has transitioned from one in which tree crowns and the shrub understorey form a mostly continuous layer to one in which there is vertical separation because of ongoing tree growth and the senescence (the process of ageing) of pioneer mid-storey shrubs (Figure 2-5).

Tree growth trajectories are well-established at this age (Bi 2012), and trees have sufficiently thick bark to survive high-intensity fires (Grant et al. 1997).

Trees are, therefore, resilient to prescribed fire, and the reintegration of rehabilitated areas at this age is possible (Smith 2001, Grant 2006, Grant et al. 2007, Grigg and Grant 2009) and has been routinely practised for over 20 years. Tree survival is relatively stable from this age within the range of stand stocking proposed (Koch & Ward 2005, Daws et al. 2023).

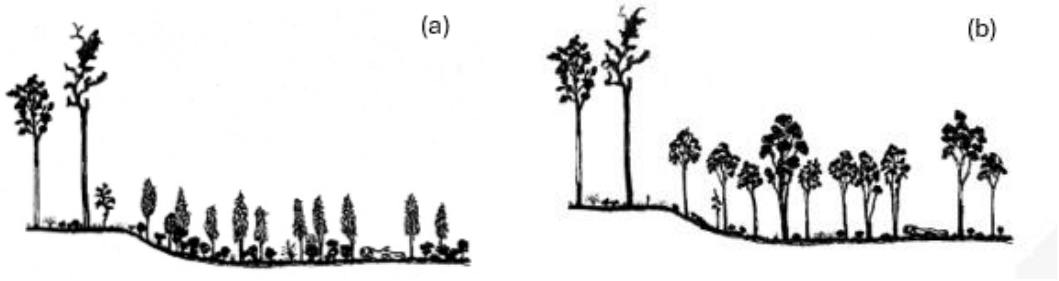

Figure 2-5 Typical rehabilitation development at (a) approximately 7 years of age and (b) approximately 15 years of age.

From 12 years, other ecological aspects of rehabilitation are also developing satisfactorily. For example, soil microbial function is on a trajectory towards full recovery (Liddicoat et al. 2022, Banning et al. 2011) and is resilient to fire (Cookson, Murphy, & Roper 2008). There is also the substantial return of vertebrate fauna groups, including mammals, reptiles and bird communities (Nichols & Grant 2007), responding to vegetation structure and composition and other forest elements such as coarse woody debris (Craig et al. 2012, Craig et al. 2015). Additionally, research by Smith et al. (2000) suggests that by around 12 years of age, the topsoil seedbanks will be replenished naturally by the standing vegetation, enabling recruitment following future disturbances.

2.4.8.5 Leaf Area Index and Resilience to disturbance

Leaf Area Index (LAI) is a metric for understanding ecosystem functions and is relatively easy to measure on a large scale. It provides insights into photosynthesis, which stores carbon while using water, affecting forest water dynamics (Fang et al. 2019). LAI is typically measured remotely using satellite imagery and other remote sensing technologies (Macfarlane et al. 2007). Remote sensing capability allows for large-scale monitoring and assessment of forest ecosystems with minimal fieldwork, requiring only ground truthing of specific areas. LAI provides essential data for ecological modelling and the environmental management of rehabilitation projects.

Research studies have used LAI as an indicator of combined overstorey and understory vegetation cover and shown that historic LAI of rehabilitation was higher than the unmined forest range, as a result of higher stem densities, consistent with the assumption regarding development of long-term cover (Bradshaw 2015). While for contemporary rehabilitation with lower tree density targets, even the oldest sites of the current prescription (rehabilitated in 2016) are too young to verify that current prescriptions result in a lower equilibrium LAI than rehabilitation established under earlier prescriptions.

LAI summary data for rehabilitation at Huntly since 2016 indicates that the LAI of contemporary rehabilitation (2016 onwards) is trending towards that of non-mined forest but on average remains substantially lower at 6 to 7 years of age; however, at this age it will be dominated by understory rather than trees. At 12 years of age rehabilitated areas have a greater coverage than that of non-mined forest; however, understory cover decreases (notable exception 17 years of age) such that at 25 years old understory cover of rehabilitation is approximately half that of the average understory cover recorded in non-mined forest areas. Peaks and subsequent decreases in understory between 12 and 17 years of age are likely related to the growth and then senescence of 'seeder' species (including longer-lived, nitrogen fixing legumes) (Daws et al. 2021).

The 1988-2004 completion criteria specifies that rehabilitation is to be capable of recovering from a wildfire. Chart 2-6 presents analysis of rehabilitation established in 1990 and 1992 prior to and following a 2007 wildfire event at the Huntly Mine, with analysis of adjacent un-mined forest affected by the same wildfire. The analysis is based on Leaf Area Index (LAI) as an indicator of combined overstorey and understorey vegetation coverage. LAI was generated for the NJF using the method described in Macfarlane, Grigg and Daws (2017). Chart 2-6 demonstrates that both the rehabilitation and adjacent un-mined forest recovered their LAI within a period of a few years following the wildfire event, indicating that the vegetation restored in rehabilitation is relatively resilient to wildfire.

Previous research indicates that rehabilitated vegetation is resilient and will regenerate without intervention (Grant et al. 2007). Restored areas can be prescribed burnt in association with unmined native Jarrah forest using appropriate fire regimes. Furthermore, silvicultural research in restored bauxite mining areas has shown that thinning may help to reduce the fire risk in restored areas at an early age with the added advantage of increased water yield into water catchments resulting from decreased tree density (Grant et al. 2007).

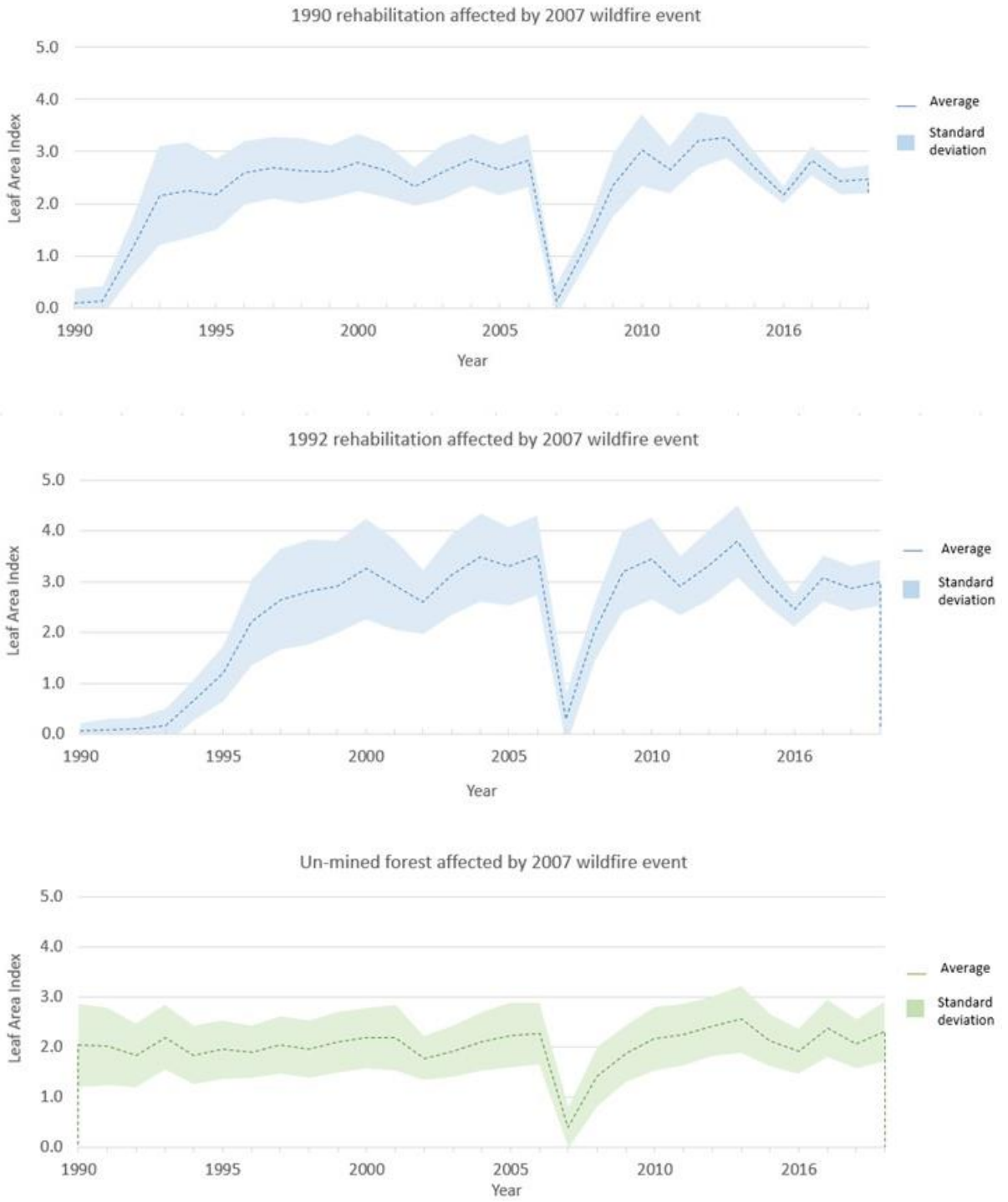

Chart 2-6 Recovery of rehabilitation following a wildfire event

2.4.8.6 Floristic composition

Comparing the composition of flora between rehabilitated sites and forest reference plots aims to consider how closely they resemble one another. In this context, many different 'resemblance coefficients' have been used to quantify the similarity (or dissimilarity) between the two objects (Podani 2006). The colloquial use of the term 'similarity' has caused confusion in the field of ecology. It has been applied in various ways, often describing how alike two objects are in terms of species richness or density (both described above) rather than directly addressing how they resemble each other compositionally. The Euclidean, Sørenson, and Bray-Curtis indexes are common and easily understood coefficients which describe how two objects resemble each

other by using the number (or abundance) of species which are shared, missing in one object but present in another, or missing from both objects (i.e. comparing floristic composition).

Standish et al. (2021) and Daws et al. (2021) provide comprehensive assessments of how the floristic composition of rehabilitation resembles unmined forests. Using 131 permanent plots established across rehabilitation and forest reference sites, Standish et al. (2021) demonstrate that the Bray-Curtis similarity coefficient (i.e., composition) of rehabilitation is progressing towards the forest reference state.

Similarly, Daws et al. (2021), using a different subset of permanent plots, applied Sørensen's similarity coefficient to a comparable effect. Their study found that the similarity between rehabilitation and forest reference sites ranged from approximately 30% to 70%, showing improvement with rehabilitation age. It is especially interesting because Bray-Curtis incorporates both species abundance and presence, while Sørensen focuses on species presence and absence. The convergence of results from these two different coefficients indirectly suggests that both the abundance and diversity of species in the rehabilitation areas are shifting towards levels comparable to the forest reference plots.

2.4.8.7 Weed establishment

Preventing weed invasion and spread into rehabilitated communities can lead to noticeable changes in plant species abundance, often resulting in reduced diversity. Beyond this, weeds also subtly disrupt ecosystem functions, affecting nutrient cycling, hydrology, and disturbance regimes such as fire (Groves and Willis 1999). These impacts can affect the recovery and stability of native plant communities, making weed removal a critical step in successful rehabilitation efforts.

All eras of completion criteria have had a requirement relating to weed establishment and potential competition with native species. The completion criteria for 2016 onwards states that there is no evidence within early establishment (first 5 years) that significant introductions of new weed species (environmental and declared) are persisting or that weed competition is restraining sustainable development of native species (Stantec 2023).

2.4.9 Rehabilitation restoring ongoing ecological function post-disturbance

Alcoa's current rehabilitation prescription and methods are designed to restore ecological function to the forest post-disturbance. Ecological function ensures that the species in the rehabilitated landscape can perform essential functions such as nutrient cycling, fire tolerance, weed invasion resistance, and phytophthora resistance. This approach aims to create rehabilitation that is taxonomically diverse but also functional, self-sustaining and resilient to ongoing challenges, reducing the need for ongoing external management.

Further, the evolution of Alcoa's rehabilitation standards and techniques, informed by interactions in research and practice. Table 2.8 presents an assessment of the expected changes between current ecological functioning and post disturbance ecological functioning in the context of the key biodiversity indicators (see Section 4.4).

Table 2.8 Comparison of unmined forest and rehabilitation in context of the Biodiversity Indicators

Biodiversity Indicator	Comparison of Unmined Forest and Rehabilitation
1: Areas with a Protective Mechanism within the NJF within the ML1SA, lasting for at least the State Agreement lease period	Not applicable.
2: Disturbance to vegetation communities of conservation significance (restricted range vegetation types limited distribution vegetation, TECs, PECs, wetlands, veg types known to contain threatened flora, old growth forest)	Rehabilitation of vegetation communities of conservation significance is varied. Currently, there is no rehabilitation prescription for areas associated with granite outcrops. The standard upland rehabilitation prescription is applied in the limited areas that may be cleared. Given this, there is a permanent loss of granite outcrops when clearing is required. Stream zone vegetation is subject to a specific prescription, designed to return species present within these communities. There is a reduction in species richness within the rehabilitated areas, however this is consistent with standard upland vegetation rehabilitation.
3: Ecological condition of native vegetation (upland vegetation)	Overstorey species richness is restored by current rehabilitation prescriptions and methods, considering monitoring at 15 months (refer Section 2.4.8). It is considered unlikely that overstorey species richness would decline as a result of implementing the Proposal. The current completion criteria requires that all rehabilitated areas achieve a minimum of 60% species richness. On average, 99% of the total rehabilitated area, monitored using on-ground plots, was deemed to have met the species richness target at 15 months of age. Species richness in rehabilitated forest has averaged over 80 per cent of un-mined forest control plots, well above the target of 60 per cent. Alcoa-funded research studies have suggested that native species richness has been found to persist, but not increase, over monitoring periods of up to 20 years. Long-term monitoring also observed species 'turnover' in rehabilitation over longer time periods, where shorter-lived 'pioneer' species are replaced by late-arriving species including re-sprouters and other species, including orchids. Tree (overstorey) densities post clearing are set by the current rehabilitation prescription, which has been designed to achieve the current completion criteria. It is expected that the current target densities will be reviewed in response to the proposed FMP 2024-2034, and the anticipated revision of the proposed end use of conservation rather than the historical end use of timber production due to the planned cessation of native timber harvesting. Current areas of rehabilitation have higher tree densities than unmined forest (Section 2.4.8), influencing forest structure. It is anticipated that ecological thinning of overstocked (pre-2016) rehabilitation areas may be required, forming part of the proposed FMP management strategy. Canopy cover is restored within 20 years of completion of initial rehabilitation activities. As canopy cover is related to tree densities, current areas of rehabilitation do have higher canopy cover than unmined forest, potentially influencing understorey composition through reduced light availability. It is anticipated that ecological thinning of overstocked rehabilitation areas will be required, forming part of the proposed FMP management strategy. Historical data from rehabilitation monitoring programs and published literature (Koch 2007) demonstrates that understorey species richness returns to approximately 80% of un-mined forest reference plots. This is reflected in the current completion criteria.
4: Ecological condition of native vegetation (stream and swamp vegetation)	As above for BI 3, under the current rehabilitation completion criteria, stream zone vegetation is considered under the same rehabilitation monitoring framework as upland vegetation. As part of updated rehabilitation completion criteria, Alcoa is currently developing specific criteria for stream zone rehabilitation, based on unmined stream zone reference plots.

Biodiversity Indicator	Comparison of Unmined Forest and Rehabilitation
5: Waterway health	Monitoring data show that stream flow rates and water quality within rehabilitated catchments return to pre-mining levels within three years of completion of rehabilitation works. The current rehabilitation prescriptions result in waterway health that is comparable to unmined forest catchments.
6: Ecological connectivity of vegetation	Progressive rehabilitation, reducing the area open at any one time, reduces the impact of fragmentation at a local scale. While young rehabilitation has reduced ecological connectivity, the recorded use of rehabilitation after 8 years by both avian and ground mammal fauna (see Section 6.4.4.2) demonstrates a reduction in fragmentation over time.
7: Avifauna	Published literature and records from the LTFMP show that rehabilitation has a comparable avifaunal assemblage to unmined forest after approximately 10 years. There is a temporal loss of avifauna species richness in the short term, until the vegetation structure matures to provide both foraging and protective habitat.
8: Ground fauna presence/absence – threatened mammal species	Published literature and records from the LTFMP show that ground fauna returns to rehabilitated areas with a temporal loss of fauna species richness in the short term.
9: Forest red-tailed black cockatoo population estimates	Published literature and records from the LTFMP show foraging occurs within rehabilitated areas eight years and older. While the foraging occurs in lower densities, this evidence shows that impacts to foraging habitat are temporal in the short term.
10: Inappropriate fire regimes	The current rehabilitation prescription, and fire management within, is sympathetic to existing prescribed burning practices, with changes to rehabilitation prescriptions and methods considering future developments in research and policy with respect to biodiversity and ecological integrity.
11: Feral predators and invasive species.	Construction and mining activities can potentially lead to an increased presence of feral animals through increased availability of food and water supplies. Clearing can also provide additional pathways for feral predators to access threatened fauna habitats within unmined forest resulting in increased predation. Rehabilitation will close these pathways over time and is sympathetic to the current feral management undertaken by DBCA. Weed coverage of rehabilitation has been demonstrated to be less than 0.3 per cent and declines to less than 0.1 per cent after 20 years from establishment, this is consistent with unmined forest.
12. Dieback infection	Contemporary rehabilitation largely restores upland Jarrah Forest vegetation including susceptible species that has at least a moderate vulnerability to Phytophthora dieback. Alcoa's dieback management system ensures rehabilitation implementation does not contribute to the spread of infected areas and have been demonstrated to effectively mitigate dieback spread during mining (Section 5.5.2). Evidence also suggests infected areas of rehabilitation show less expression of infection than unmined forest areas, resulting in reduced impacts to species richness and structure.

2.4.10 Rehabilitation in adaptation to future needs

Alcoa's rehabilitation has been monitored against the completion criteria approved by BSEC (formerly known as MMPLG) to meet the objective of a self-sustaining jarrah forest ecosystem that meets multiple forest uses. The completion criteria have evolved in response to research and practice, with ongoing publication of research findings in the scientific literature.

Alcoa's success in implementing and evolving its rehabilitation program provides confidence in its capacity to adapt as the objective for rehabilitation changes into the future. This may include an objective that reflects new State Government objectives for the NJF with the cessation of timber harvesting and release of the 2024 FMP and the potential requirement for enhanced resilience to future climate change.

Alcoa remains committed to collaborating with DBCA and other agencies to ensure that the Huntly Mine rehabilitation is planned and implemented to provide outcomes that maintain the biodiversity and ecological integrity of the NJF and meet the policy and desired outcomes of State Government.

2.4.11 Rehabilitation in the context of a drying and heating climate

The Intergovernmental Panel on Climate Change (IPCC) notes the south-west forests of Australia as an ecosystem risk due to climate change. The Jarrah forest ecoregion of south-western Australia has experienced a 17% reduction in mean annual rainfall from 1975 to 2011 compared with mean rainfall from 1900 to 1974.

The current completion criteria require rehabilitation at late stage (12 years of age) to not show any evidence of being more affected by drought (water stress) relative to non-mined forest. Although climate variability has had a significant negative effect on species richness, the effect size was relatively small, being less than half that of varying restoration practice (Standish et al. 2015). Further research is required to assess multiple metrics of climate change to understand community responses which will further inform adaptive rehabilitation practices in a drying and heating climate.

2.4.12 Independent peer review of rehabilitation methods and success to date

The EPA required an independent peer review of rehabilitation methods and success to date (ESD item 13). This includes ongoing rehabilitation methods and, taking into account biodiversity indicators, assess whether ongoing rehabilitation for the Proposal is likely to be consistent with the ongoing ecological integrity of the NJF. Stantec were commissioned to undertake this independent peer review, which is presented in Appendix B23. This section provides a summary of the methods of the assessment.

2.4.12.1 Terms of reference

The scope of peer review of rehabilitation, and assessment in the context of climate change, is for the Huntly Mine and excludes rehabilitation at the Pinjarra Refinery. The review aimed to address the following Terms of Reference:

1. Examine the current draft Environmental Review Document (ERD) (Alcoa 2022) to provide context of the Proposal with regard to the historical, current and proposed rehabilitation program.
2. Assess and discuss the historical, current and proposed rehabilitation methods and success to date, with reference to the approved completion criteria and the proposed Northern Jarrah Forest post-mining land use.
3. Summarise the rehabilitation success to date by vegetation unit.
4. Analyse, assess and discuss the efficacy and suitability of the rehabilitation methodology in the context of climate change (drying/heating climate).

5. Provide comment and if required recommendations for changes to current and proposed rehabilitation methods based on the outcomes of the above.
6. Taking into account biodiversity indicators, assess whether ongoing rehabilitation for the Proposal is likely to be consistent with the ongoing ecological integrity of the Northern Jarrah Forest.

The review was structured as follows:

- Assessment of rehabilitation success to date - vegetation
- Alignment of rehabilitation methods and success with proposed Northern Jarrah Forest post-mining land use
- Consistency with ongoing ecological integrity of the Northern Jarrah Forest
- Conclusions on current and proposed rehabilitation methods.

2.4.12.2 Summary of findings

Stantec 2023 surmised Alcoa's rehabilitation practices after bauxite mining in the NJF, together with a substantial program of related research published in peer reviewed journals, remain as sophisticated and comprehensive as any mining operation globally. In addition, the process of development and sequential refinements of publicly available completion criteria, commencing more than 30 years ago, exceeds that of other mining operations in WA, if not globally.

Despite this, rehabilitation standards and practices, and stakeholder expectations have increased over time such that continuing improvements in biodiversity outcomes and ecological integrity are required. Several areas of improvement were identified:

- Species richness targets have generally been met, however, where remedial works have been undertaken, the works are assumed successful (based on research standards)
- The peer review did not identify or review any monitoring data for understory cover
- Composition similarity analysis showed bias with the analysis dependent on Jarrah, Marri, Legumes, and recalcitrant species only
- The monitoring and self certification process relies on Alcoa's internal data tracking which is subject to a level of inaccuracy and reliant on DBCA identifying errors during the sign off process which has not always been successful
- Alcoa places a reliance on the creation of fauna habitat in absence of studies on recolonisation of fauna in current era rehabilitation; however, recent studies highlight the need for caution when assuming that revegetation will lead to the establishment of appropriate faunal communities
- Further research is required to understand the long-term implications of differences in community composition in rehabilitation compared to unmined forest and the impacts posed by climate change, fire regimes, *Phytophthora* dieback, and drought

Stantec (2023) concluded that Alcoa will require a more holistic landscape scale assessment of rehabilitation performance over time and need to continually examine how rehabilitation practices can be adapted to support both sustainability of rehabilitation and ecological integrity of the surrounding forest matrix.

In response to the cessation of native timber harvesting in the Northern Jarrah Forest, and in accordance with Ministerial Approval Conditions for the 2023-2027 Mining and Management Program (MMP), Alcoa is required to consult with the DBCA in the drafting of a revised set of Rehabilitation Completion Criteria. Through this process Alcoa will seek to address the improvement areas identified in the peer review.