Alcoa of Australia Limited

Mining and Management Program (MMP)

2025-2029 Inclusive

Final

Huntly Mine and Willowdale Mine

30 May 2025

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Acronyms

Abbreviation	Definition
ADWG	Australian Drinking Water Guidelines
AEP	Annual Exceedance Probability
AER	Annual Environmental Review
AFFF	Aqueous Film Forming Foams
AHD	Australian Height Datum
ACHIS	Aboriginal Cultural Heritage Inquiry System
ANFO	Ammonium Nitrate Fuel Oil
ASSI	Australia Seed Scaling Initiative
BAM	Blast Acoustic Model
BC Act	Biodiversity Conservation Act 2016 (WA)
BHC	Bauxite Hydrological Committee
BOM	Bureau of Meteorology
BSEC	Bauxite Strategic Executive Committee
CAR	Comprehensive Adequate Representative
CER	Consultative Environmental Review
CHMP	Cultural Heritage Management Plan
CFM	Carter's Freshwater Mussel
DAP	Drilling Approval Plan
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCMP	Drainage Control Management Plan
DG	Dangerous Goods
DEMIRS	Department of Mines, Energy, Industry Regulation and Safety
DP	Declared Pest
DPLH	Department of Planning, Lands and Heritage
DPS	Drainage Protection Slots
DRA	Disease Risk Areas
DWER	Department of Water and Environmental Regulation
DWRA	Drinking Water Risk Assessment
EDF	Exploration Disturbance Footprint

Abbreviation	Definition
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
EPS	Pinjarra Refinery Efficiency Upgrade, Environmental Protection Statement
FCA	Forest Clearing Advice
FEL	Front End Loading
FMP	Fauna Management Plan
FPC	Forest Products Commission
FVMP	Flora and Vegetation Management Plan
GDE	Groundwater Dependent Ecosystems
GDP	Ground Disturbance Permit
GDV	Groundwater Dependent Vegetation
GIS	Geographic Information System
GKB	Gnaala Karla Booja Aboriginal Corporation
GL	Gigalitres
GPS	Global Positioning System
GWRAF	Groundwater Risk Assessment Framework
HVAS	High Volume Air Sampler
IBRA	Interim Biogeographic Regionalisation of Australia
INMS	Integrated Noise Management System
IRZ	Intermediate Rainfall Zone
ITAG	Independent Technical Advisory Group
IWSS	Integrated Water Supply Scheme
JIRZRP	Joint Intermediate Rainfall Zone Research Program
JTSI	Department of Jobs, Tourism, Science and Innovation
LAI	Leaf Area Index
LCU	Landscape Character Unit
LDA	Limited Disturbance Area
LOA	Life of Asset
LOC	Loss of Containment
LPI	Leading Performance Indicators
LTFMP	Long Term Fauna Monitoring Programme

Abbreviation	Definition
MAZ	Mining Avoidance Zone
ML	Megalitres
ML1SA	Mineral Lease 1SA
MMP	Mining and Management Program
MMPLG	Mining and Management Program Liaison Group
MOG	Mine Operations Group
MS	Ministerial Statement
Mtpa	Million tonnes per annum
NEMP	National Environmental Management Plan
NJF	Northern Jarrah Forest
NSHA	Noongar Standard Heritage Agreement
NTU	Nephelometric Turbidity Units
OCA1	Operational Control Area 1
OCA2	Operational Control Area 2
PDWSA	Public Drinking Water Source Areas
PEC	Priority Ecological Communities
PER	Public Environmental Review
PHR	Potential habitat rating
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
POW	Prisoner of War
RAMP	Recreation and Access Management Plan
RIWI	Rights in Water and Irrigation Act 1914 (WA)
ROM	Run of Mine
RPZ	Reservoir Protection Zone
RTFMP	Recreational Trails and Facilities Management Plan
RUSLE	Revised Universal Soil Loss Equation
SCP	Swan Coastal Plain
SIA	Social Impact Assessment
Simcoa	Simcoa Operations Pty Ltd
SRE	Short-Range Endemic
TARP	Trigger Action Response Plan
TDS	Total Dissolved Solids

Abbreviation	Definition
TEC	Threatened Ecological Communities
TMP	Trial Mining Project
tpa	tonnes per annum
TWI	Topographical wetness Index
TWL	Top Water Level
UWA	University of Western Australia
WA	Western Australia
WC	Water Corporation
WoNS	Weed of National Significance
WRM	Wetland Research & Management
WRMP	Water Resource Management Plan
WRP	Western Ringtail Possum
WWTP	Waste Water Treatment Plant

Definitions

Term	Definition
Activities	Refers to mining activities, and infrastructure development and sustainment.
Assessment 2253	The Pinjarra Alumina Refinery Revised Proposal Assessment No. 2253 currently under consideration by the EPA under Part IV of the EP Act. This MMP is not seeking environmental approval for these areas.
Assessments 2384 and 2385	Alcoa's bauxite mining on the Darling Range in the southwest of WA considered in the Mining and Management Program 2022 to 2026 and Mining and Management Program 2023 to 2027 under consideration by the EPA under Part IV of the EP Act. This MMP includes some Assessment 282 and 2386 areas for approval.
Average pit slope	Average slope of a pit area based on Department of Land Administration (DOLA) derived slope dataset as per s6 exemption Compliance Assessment Plan prepared in accordance with clause 9 s6 exemption and MMP Compliance Assessment Plan.
Black Cockatoo habitat trees	• Trees on a haul road alignment that have the potential to provide nest hollows in the future. These are primarily marri trees with DBH ≥500mm. The tree should already be starting to develop a hollow or have a form that is conducive to hollow formation.

Black Cockatoo nest trees	As per Fauna Management Plan and Compliance Assessment Plan prepared in accordance with Clause 9 s6 exemption:
	• A tree containing one or more hollows that appear to be, or have been, used as a black cockatoo breeding habitat; or
	• A tree containing 1 or more hollows that:
	  ○ have a diameter not less than 100mm; and
	  ○ have a depth not less than 500mm.
	and
	• is conducive of being used as a nesting hollow by black cockatoos, as determined by a suitably qualified and experienced person (as defined below). The assessment will consider entry angle and size, hollow chamber size and shape, height from ground (not less than 6 m) and health of the tree; or
	• has the potential to develop into a suitable nesting hollow, as determined by a suitability qualified and experience person (as defined below). The assessment will be based on the potential to meet the above criteria.

Black Cockatoo significant trees	As per Fauna Management Plan and Compliance Assessment Plan prepared in accordance with Clause 9 s6 exemption: • A jarrah tree with a diameter of not less than 2,000 mm at a height of 1300 mm above ground level; or

Term	Definition
	• A marri tree with a diameter of not less than 1,500 mm at a height of 1,300 mm above ground level.
Completion criteria	Agreed standards or levels of performance that indicate the success of rehabilitation and enable Alcoa to demonstrate when its liability for ongoing management of an area will cease.
Conservation significant fauna	Environmental values which are protected by legislation or are of ecological importance, which includes: • Threatened Fauna under BC Act and EPBC Act • Priority Fauna
Conservation significant flora or vegetation	• Environmental values which are protected by legislation or are of ecological importance, which includes: ◦ Threatened Flora under BC Act and EPBC Act ◦ Priority Flora ◦ Significant species (novel species, range extensions, and restricted occurrences) ◦ Vegetation types which support conservation significant flora species ◦ Threatened ecological communities. ◦ Priority ecological communities ◦ Old growth forest
Cumulative catchment scale risk assessment	A cumulative catchment scale risk assessment for Alcoa's mining operations is to ensure a consistent approach to assess the cumulative risk of mining operations from sub catchment to whole of catchment. It will enable evaluation of the risk of mining activities on the catchment both spatially and temporally, for inherent and residual risk.
Drainage incident	• a runoff from a disturbance area to the surrounding environment of surface water that has a turbidity of at least 25 nephelometric turbidity units for a period of at least 1 hour; or • a surface water discharge from containment infrastructure that includes or may include environmentally hazardous material;
Drainage controls	Controls to manage surface water runoff from the mining disturbance footprint to surrounding environment
Environmentally hazardous material	Components of the waste stream which by its characteristics poses a threat or risk to public health, safety or the environment (includes substances which are toxic, infectious, mutagenic, carcinogenic, teratogenic, explosive, flammable, corrosive, oxidising and radioactive).
Exploration	Exploration targets areas outside of Alcoa's current mining operational envelope with a broader extent but less intense activities. As per the EP (Darling Range Bauxite Mining) Exemption Order 2023 "Exploration" is defined as: activities carried out in search of minerals, including (without limitation) (a) mapping; (b)

Term	Definition
	surveying; (c) drilling; (d) the collection of and assaying of soil, rock, groundwater, and minerals samples; and (e) other activities involving the application of 1 or more of the geological sciences.
Failure of containment infrastructure	Uncontrolled or unmanaged release of surface water from constructed drainage management infrastructure
Full mining cycle planning	A documented planning process that ensures the management measures required to mitigate the risks identified in the Risk Assessment are considered and implemented at the appropriate stage of the mine planning process.
Infrastructure	Includes any structures that enable or support mining activities including (but not limited to) stockpiles, haul roads, conveyors, crushers, water storage, and water pumps.
Landscaping	Means the moving or shaping of land, including but not limited to: (a) resloping or altering disturbed surface topography for the purpose of shaping the landform to blend with the adjacent landscape surface; and (b) movement, placement or removal of bauxite or other material; and (c) ripping for the purpose of shaping the landform to blend with the surrounding environment.
Mature growth forest	Defined by (Bradshaw F., 2015) 'Reference material for jarrah forest silviculture. Forest Management Series FEM061' as forest stands aged between 70 and 250 years, characterised by trees with an average diameter of 45-60cm. These trees develop large, persistent branches and begin to exhibit dead branches within their crowns, indicating a reduced capacity to expand into open spaces. The occurrence of tree hollows, which are critical for fauna habitat, increases from 130 years reflecting advanced ecological development and structural complexity.
Mining activities	Refers to the integrated process of extracting bauxite from mineral reserves below the surface by coordinating the use of people and equipment. This refers specifically to removing topsoil and overburden, breaking caprock (blasting or ripping) to expose the viable bauxite, removal of viable bauxite, crushing and conveying bauxite to the refineries. Excludes infrastructure or rehabilitation activities.
Mining Avoidance Zone	Spatial area which prohibits mine pits and infrastructure, with the exception of monitoring and management activities (rehabilitation and drainage control management) which have minimal impacts
Limited Disturbance Area	Spatial area which prohibits mine pits but allows for infrastructure and haul roads.

Term	Definition
Old growth forest	Defined in the National Forest Policy Statement 1992 (Commonwealth of Australia, 1992) as: 'ecologically mature forest where the effects of unnatural disturbance are now negligible. The definition focuses on forest in which the upper stratum or overstorey is in a late mature to senescent growth stage'.
Other operations	Adjunct activities associated with mining, infrastructure, and rehabilitation
Rehabilitation	In relation to an area that has been disturbed, includes: (a) stabilisation of the area; and (b) restoration of the landforms of the area to a state that is as close as practicable to its original undisturbed state; and (c) the return of the native vegetation of the area to a state that is as close as practicable to its original undisturbed state. The rehabilitation process consists of landscaping, ripping, returning overburden and topsoil, contour ripping and seeding, and access to perform these activities.
Rehabilitation season	In relation to an area that has been disturbed, includes: (a) stabilisation of the area; and (b) restoration of the landforms of the area to a state that is as close as practicable to their original undisturbed state; and (c) the return of the native vegetation of the area to a state that is as close as practicable to its original undisturbed state.
Stabilising	Landscaping and ripping to promote infiltration and manage surface water runoff.

Executive Summary

Alcoa of Australia Limited (Alcoa) has been mining bauxite and refining alumina in Western Australia since 1963.

Alcoa operates two bauxite mines, located approximately 100 km south of Perth. The Huntly Mine, established in 1972, supplies bauxite to the Pinjarra and Kwinana refineries. The Willowdale Mine, established in 1984, supplies bauxite to the Wagerup Refinery.

On June 30 2024, production of alumina was curtailed at the Kwinana Refinery as it entered a transitional operating phase before a move into care and maintenance (planned for 2025). Production of alumina at the Pinjarra and Wagerup refineries is not impacted by the curtailment of the Kwinana refinery. The Kwinana refinery and associated residue storage facilities continue to be actively managed, and Alcoa's Kwinana port facilities continue to import raw materials and export alumina produced at the Pinjarra Refinery.

Alcoa submits a mine plan for bauxite mining within Mineral Lease 1SA (ML1SA) to the State for review and approval. The 10 Year Mine Plan is submitted in accordance with clause 5 of the *Alumina Refinery (Wagerup) Agreement Act 1978* (Wagerup State Agreement) and as voluntarily agreed by the State and Alcoa for mining not covered by the Wagerup State Agreement. Mining and Management Programs (MMP) were previously submitted to the Mining and Management Program Liaison Group (MMPLG). Following a State Government review in 2024, a revised administrative framework was developed, resulting in the Bauxite Strategic Executive Committee (BSEC) and Alcoa Independent Technical Advisory Group (ITAG). This 2025-2029 MMP has been developed to relate to Alcoa's proposed mining operations for Huntly and Willowdale mines within ML1SA from 1 January 2025 to 31 December 2029.

The MMP outlines proposed maximum final boundaries of native vegetation clearing that will enable mine pit and infrastructure design to be implemented (clearing schedule; Table ES 0-1). Clearing associated with the O'Neil and McCoy mine region haul roads includes conceptual clearing buffers to provide flexibility for final infrastructure detailed design and further avoidance of environmental values. This MMP identifies mine development activities associated with EPA Assessment 2253, however, is not seeking the Minister for State Development's approval under this MMP for these areas as they are currently under consideration by the EPA under Part IV of the EP Act. Furthermore, the majority of new clearing and operations in the 2025 – 2029 MMP within a not previously Part IV referred area are proposed to be incorporated as amendments to Assessment 2253 or future Part IV EP Act referrals. A schedule of activities which this MMP seeks to approve is detailed in Table ES 0-3. Clearing associated with Assessment 2253 is excluded from the schedule of activities.

Alcoa has an annual native vegetation clearing cap (800 ha) based on the 2023-2027 MMP Ministerial Approval Condition 9. As per 2023-2027 MMP Ministerial Approval Condition 10, unused capacity for any year may be rolled over into the following year, by approval from the State and Industry Development Minister. This MMP includes 425 ha of unused capacity expected from 2024, which is requested to be rolled over into subsequent years for clearing.

This MMP also provides a summary of the proposed rehabilitation plan, as detailed in Table ES 0-2: Proposed Rehabilitation Plan for 2025-2029.

Table ES 0-1: Proposed Clearing Schedule for 2025-2029

Proposed Clearing	2025	2026	2027	2028	2029
Proposed Conceptual Clearing Area for Huntly Mine (ha)	1,630	594	1,076	272	-
Proposed Conceptual Clearing Buffer for Huntly Mine (ha)	706	2	81	-	-
Huntly EPA Assessment 2253 Proposed Conceptual Clearing Area (ha)	-	607	728	1,010	598
Huntly EPA Assessment 2253 Proposed Conceptual Clearing Buffer (ha)	-	265	582	369	-
Total Huntly Clearing (ha)	**2,336**	**1,468**	**2,467**	**1,651**	**598**
Total Proposed Conceptual Clearing Area for Willowdale Mine (ha)	**803**	**244**	**382**	**248**	**287**
FCA endorsed areas (ha)	**1,574**				
Clearing cap (Huntly & Willowdale combined)[1] (ha)	**800**	**800**	**800**	**800**	**800**
Clearing cap – unused capacity to be rolled over to subsequent years (Huntly & Willowdale combined)[2] (ha)	**392**				

Table ES 0-2: Proposed Rehabilitation Plan for 2025-2029

Proposed Rehabilitation	2025	2026	2027	2028	2029
Rehabilitation for Huntly Mine (ha)	500	596	754	750	750
Rehabilitation for Willowdale Mine (ha)	200	220	248	250	250
Total Planned Rehabilitation (ha)	**700**	**816**	**1,002**	**1,000**	**1,000**

As clearing for 2027 to 2029 is conceptual only, and subject to change pending detailed design, this MMP focuses on impacts associated with 2025 and 2026 (24 Month Clearing Schedule), which have greater certainty on clearing locations.

Threatened fauna species considered likely to occur within the spatial area considered in the 24 Month Clearing Schedule include:

- Three Black Cockatoo species.
- Chuditch, Quokka.
- Western Ringtail Possum (relevant to Willowdale only).
- Woylie.

[1] Clearing cap applies to actual MMP-approved native vegetation clearing

[2] Clearing cap applies to actual MMP-approved native vegetation clearing and any surplus native vegetation clearing from one year may roll over into subsequent year, following approval from the Minister for State Development53 as part of this MMP submission

No direct impacts to Threatened flora are expected to occur, due to avoidance of any individuals identified from pre-clearance surveys.

The 24 Month Clearing Schedule has the potential to directly and indirectly impact upon conservation significant flora and fauna. Management Plans (Flora and Vegetation, Fauna, Water Resources and Recreational Trails and Facilities) have been previously developed and submitted to minimise potential impacts.

Alcoa is committed to transitioning to contemporary regulatory approval standards, therefore the following additional commitments from the 2024-2028 MMP have been included in this MMP:

- Rehabilitation target of 1,000 ha per year is expected to be reached and extended into 2028 onwards.
- Decrease of 22,091 ha within the Exploration Disturbance Footprint, with the inclusion of indicative drilling intensity regions.
- Continued implementation of Mining Avoidance Zones associated with Dwellingup and Jarrahdale, with removal from the Exploration Disturbance Footprint.
- Inclusion of conceptual clearing for the current 10-year mine plan, noting some areas are subject to future EPA referral and assessment.
- Implementation of a 30 m Mining Avoidance Zone around Black Cockatoo Nest and Significant trees, with the exception of exploration, critical infrastructure, groundwater bores and rehabilitation activities.
- Development of a Mining Avoidance Zone around Logue Brook Dam.
- Requirement to undertake TEC pre-clearance surveys and avoid all direct impacts to any identified TECs.
- Requirement to undertake further surveys to confirm PEC boundaries.
- Requirement to undertaken Western Ringtail Possum surveys in suitable habitat at Larego.
- Requirement to undertake further groundwater dependent ecosystems surveys and studies into potential impacts.
- Inclusion of the following with this and future MMPs:
    - available pre-clearance flora, fauna and Black Cockatoo targeted survey results with the commitment to include any relevant surveys in future MMPs and FCAs.
    - current quantities of conservation significant flora and Black Cockatoo Nest, Significant and Habitat trees within the 24 Month Clearing Schedule.
    - available IBSA spatial data.
    - further details on potential open areas at both mines, including areas under current EPA assessment.
    - Relevant Mining Avoidance Zones and Limited Disturbance Areas
- Development of a Mine Closure Plan.
- Revision of relevant Management Plans as a result of adaptive management, above commitments and survey/study outcomes.

- Submission of monthly clearing reports to provide transparency of clearing activities and quarterly report of proposed exploration drill hole locations
- Submission of a previously endorsed FCA register which justifies clearing required
- Further studies in the following areas:
    - Long -term hydrological and hydrological impacts of mining and rehabilitation
    - Indirect impacts on flora, vegetation and fauna
    - Impacts on flora, vegetation and fauna from changes in surface water hydrology

Table ES 0-3: 2025-2029 MMP Activity Schedule

<table>
<tr><th>Activity</th><th>Location</th><th colspan="7">Extent</th></tr>
<tr><td colspan="9">Physical activities</td></tr>
<tr><td rowspan="6">Huntly Mine activities, including:
Pits
Haul Roads
Topsoil stockpiles
Conveyors
Supporting infrastructure
Rehabilitation</td><td rowspan="6">Figure 3-10</td><td colspan="7">The clearing limit for Huntly and Willowdale combined is detailed in Table 1. Physical activities will be contained within the Clearing Schedule Areas as detailed in Table 1. The maximum clearing within restricted areas is detailed within the Restricted Clearing Areas in Table 1.
Table 1: Maximum clearing extent</td></tr>
<tr><td rowspan="2">Clearing Type (ha)</td><td colspan="5">Timeframe</td><td rowspan="2">Total</td></tr>
<tr><td>2025</td><td>2026</td><td>2027</td><td>2028</td><td>2029</td></tr>
<tr><td>Clearing cap (Huntly & Willowdale combined) [3] ((ha)</td><td>800</td><td>800</td><td>800</td><td>800</td><td>800</td><td>4,000</td></tr>
<tr><td>Clearing cap – unused capacity to be rolled over to subsequent years (Huntly & Willowdale combined)[4] (ha)</td><td colspan="5">392</td><td>392</td></tr>
<tr><td colspan="7">Clearing Schedule Areas (ha)</td></tr>
<tr><td>Conceptual clearing area</td><td>1,630</td><td>594</td><td>1,076</td><td>272</td><td>-</td><td>3,572</td></tr>
</table>

[3] Clearing cap applies to actual MMP-approved native vegetation clearing
[4] Clearing cap applies to actual MMP-approved native vegetation clearing and any surplus native vegetation clearing from one year may roll over into subsequent years, following approval from the Minister for State Development as part of this MMP submission

Activity	Location	Extent						
		Conceptual clearing buffer	706	2	81	-	-	789
		FCA Endorsed Areas	827					827
		Open Areas	3,564					3,564
		Rehabilitated areas	13,888					13,888
		Restricted Clearing Areas (ha)						
		Within 200 m of Reservoir Top Water Level[5]	6	-	-	-	-	6
		Within 1 km of Reservoir Top Water Level[5]	21	-	-	-	-	21
		Within Reservoir Protection Zone	149	42	26	-	-	217
		Within Public Drinking Water Catchment	2,334	595	1,157	272	-	4,358
		An indicative rehabilitation plan is detailed in Table 2, with 2025 and 2026 indicative rehabilitation shown in Figure 3-19.						
		Table 2: Rehabilitation Plan						
		Rehabilitation Type (ha)			**Total**			
			2025	**2026**	**2027**	**2028**	**2029**	**Total**

[5] Clearing only permitted for rehabilitation, monitoring activities ,modification of existing road infrastructure or construction of drainage control infrastructure

<table>
<tr><th>Activity</th><th>Location</th><th colspan="7">Extent</th></tr>
<tr><td></td><td></td><td>Rehabilitation for Huntly Mine</td><td>500</td><td>596</td><td>754</td><td>750</td><td>750</td><td>3,350</td></tr>
<tr><td>Willowdale Mine activities, including:
Pits
Haul Roads
Topsoil stockpiles
Conveyors
Supporting infrastructure
Rehabilitation</td><td>Figure 3-11</td><td colspan="7">The clearing limit for Huntly and Willowdale combined is detailed in Table 3. Physical activities will be contained within the Clearing Schedule Areas as detailed in Table 3. The maximum clearing within restricted areas is detailed within the Restricted Clearing Areas in Table 3.
Table 3: Maximum clearing extent
<table>
<tr><th rowspan="2">Clearing Type (ha)</th><th colspan="5">Timeframe</th><th rowspan="2">Total</th></tr>
<tr><th>2025</th><th>2026</th><th>2027</th><th>2028</th><th>2029</th></tr>
<tr><td>Clearing cap (Huntly & Willowdale combined) [6]</td><td>800</td><td>800</td><td>800</td><td>800</td><td>800</td><td>4,000</td></tr>
<tr><td>Clearing cap – unused capacity to be rolled over to subsequent years (Huntly & Willowdale combined)[7]</td><td colspan="5">392</td><td>392</td></tr>
<tr><td colspan="7">Clearing Schedule Areas</td></tr>
<tr><td>Conceptual clearing area</td><td>803</td><td>244</td><td>382</td><td>248</td><td>287</td><td>1,965</td></tr>
<tr><td>Conceptual clearing buffer</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>FCA Endorsed Areas</td><td colspan="5">747</td><td>747</td></tr>
</table></td></tr>
</table>

[6] Clearing cap applies to actual MMP-approved native vegetation clearing
[7] Clearing cap applies to actual MMP-approved native vegetation clearing and any surplus native vegetation clearing from one year may roll over into subsequent year, following approval from the Minister for State Development as part of this MMP submission

Activity	Location	Extent						
		Open Areas	1,626					1,626
		Rehabilitated areas	5,718					5,718
		Restricted Clearing Areas						
		Within 200m of Reservoir Top Water Level	-	-	-	-	-	0
		Within 1 km of Reservoir Top Water Level	-	-	-	-	-	0
		Within Reservoir Protection Zone	-	-	-	-	-	0
		Within Public Drinking Water Catchment	662	142	237	220	163	1,424
		An indicative rehabilitation plan is detailed in Table 4, with 2025 and 2026 indicative rehabilitation shown in Figure 3-20. Table 4: Rehabilitation Plan						
		Rehabilitation Type (ha)	**Total**					
			2025	**2026**	**2027**	**2028**	**2029**	**Total**
		Rehabilitation for Willowdale Mine	200	220	248	250	250	1,168
Operational elements								
Bauxite production	Figure 3-10, Figure 3-11	Production of up to 38 Mtpa (wet) of bauxite ore						
Water abstraction		Abstraction of 3.7 GL/annum						

Activity	Location	Extent
Bauxite Crushing		Processing of up to 38 Mtpa (wet) of bauxite ore
Bauxite conveying and transport		Transport of up to 38 Mtpa (wet) of bauxite ore
Exploration	Appendix 1	105,000 drill holes per year within the Exploration Disturbance Footprint (211,397 ha)

1 Legislative Framework

1.1 Introduction and Background

Alcoa of Australia Limited (Alcoa) began operations in Western Australia (WA) in 1963 with the commissioning of the Kwinana Refinery, in accordance with the *Alumina Refinery Agreement Act 1961* State Agreement. This State Agreement, between Alcoa and the WA Government, permitted Alcoa to mine bauxite within Mineral Lease 1SA (ML1SA, Figure 1-1) and supported development of the Kwinana Refinery. Since then, two further State Agreements were struck to support development of the Pinjarra Alumina Refinery and the Wagerup Alumina Refinery:

- *Alumina Refinery (Pinjarra) Agreement Act 1969.*
- *Alumina Refinery (Wagerup) Agreement and Acts Amendment Act 1978*.

Alcoa's operations in Western Australia include:

- Two bauxite mines (Huntly and Willowdale).
- Three alumina refineries (Kwinana[8], Pinjarra and Wagerup).
- Two dedicated port facilities (Kwinana and Bunbury).

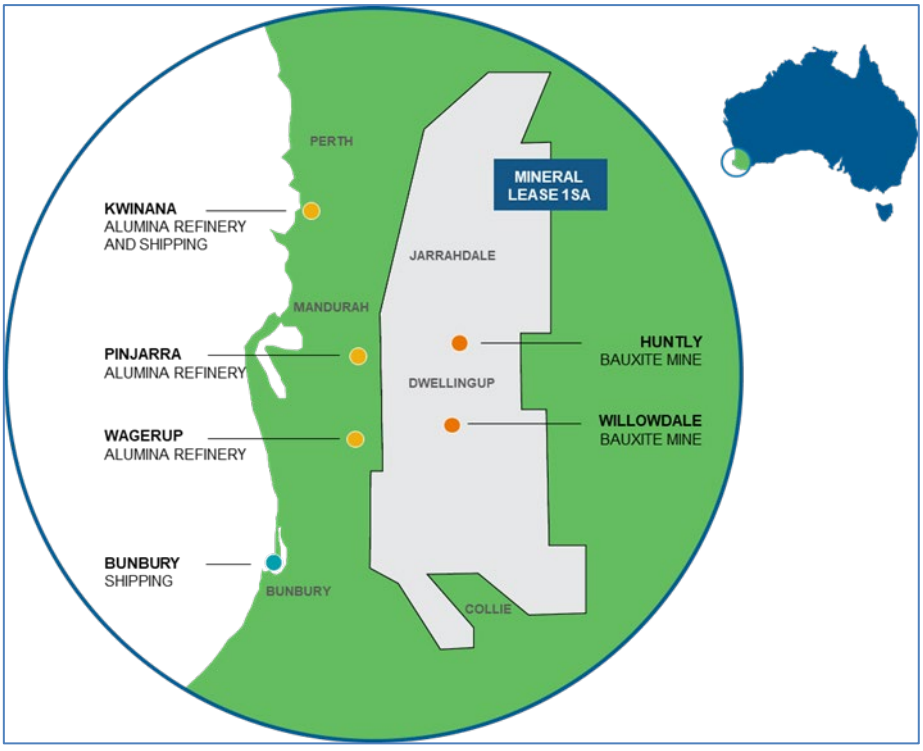


Figure 1-1: ML1SA and locations of Alcoa mining operations

[8] Curtailment of the Kwinana refinery was announced on 30 June 2024

1.2 Purpose and Objective of this Document

The purpose of this document is to fulfill Alcoa's requirements to submit a 10-Year Mine Plan[9] and an annual MMP that provides a rolling five-year operational plan[10]. The MMP requires approval from the Minister for State Development, on advice received from BSEC and with advice provided as or when required from the Minister for the Environment and Minister for Water.

This MMP is structured to facilitate regulators and stakeholders to assess, consider and endorse Alcoa's plan for operations at the Huntly and Willowdale mines.

This MMP, and the supporting data, demonstrates that all potential risks and impacts are well understood and will be adequately managed as reasonably practicable.

1.3 Approvals framework

Alcoa's operations are assessed by the WA Government through various Environmental Impact Assessment (EIA) processes. Alcoa complies with the processes under relevant State Agreements, legislation, and legislative instruments (Table 1-1).

Under Clause 5 of *Alumina Refinery (Wagerup) Agreement Act 1978* and *Acts Amendment Act 1978,* Alcoa (after consultation with the Conservator of Forests) must annually prepare and submit a mining plan outlining proposed mining operations during the succeeding ten years (10-year mining plan).

Table 1-1: Statutory Approvals and Licences

Legislation	Approval/Licence	Expiry Date
State Agreement	*Alumina Refinery Agreement Act 1961* *Alumina Refinery (Pinjarra) Agreement Act 1969* *Alumina Refinery (Wagerup) Agreement and Acts Amendment Act 1978* *Alumina Refinery Agreements (Alcoa) Amendment Act 1987*	-
Biodiversity Conservation Act 2016 - Authorisation to take or disturb Threatened Fauna in a Management Operation (section 40)	TFA 2324-0001 (Larego mining region – FCA23A) TFA 2324-0211 and TFA 2324-0211b (Myara mining region – FCA23B) TFA 2324-0251 (Myara mining region – FCA23B) TFA 2324-0273 (Larego mining region – FCA23B) TFA-2425-0025 (Myara mining region – FCA23B)	28/2/2026 31/3/2027 30/4/2027 1/7/2027 31/8/2027
Biodiversity Conservation Regulations 2018 – Regulation 28 Fauna Taking (Relocation) Licence	FR28000432-b	30/4/2027
Environmental Protection Act 1986 - Part IV	Wagerup Refinery Ministerial Statements 728, 1069, 1157	-

[9] Clause 5 of the *Alumina Refinery (Wagerup) Agreement Act 1978 and Acts Amendment Act 1978*
[10] MMPLG Terms of Reference (July 2020)

Legislation	Approval/Licence	Expiry Date
	Pinjarra Refinery Ministerial Statement 646	
Environmental Protection Act 1986 - Part V Operating Licences	Huntly Mine: L6210/1991/10 Willowdale Mine: L6465/1989/10	12 September 2035 [amended 09/02/2021] 4 October 2031 [amended 28/10/2024]
Environmental Protection Act 1986	Alcoa – Huntly and Willowdale Mine Sites Exemption Order 2004 *Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023*	-
Dangerous Goods Safety (Storage or Handling of Non-Explosives) Regulations 2007	Huntly Mine Licence: DGS008201 Huntly Mine Site: DGS012913 Willowdale Mine: DGS009279	14 April 2029 31 July 2026 28 July 2026
Dangerous Goods Safety (Explosives) Regulations 2007	Huntly Mine Licence: ETS002357 Willowdale Mine: ETS002354 Willowdale Mine: ETS002933	18 May 2029 18 May 2029 21 February 2029
Rights in Water and Irrigation Act 1914	Banksiadale Dam: 63409(5) Pig Swamp Waterhole: 153635(4) Boronia Dam: 83356(6) Marrinup Nursery: 68893(6) Samson Dam: 61024 (4)	16 September 2034 16 September 2034 16 September 2034 16 September 2034 12 January 2034
Metropolitan Water Supply Sewerage and Drainage Act 1909 and subsidiary legislation	Compliance and observation of relevant provisions with regards to water reserves or catchment areas as per Clause 33(2) of the *Alumina Refinery Agreement Act 1961*.	-
Public Health Act 2016	Observation of relevant provisions with regards to operating within Public Drinking Water Catchments.	-

1.3.1 Environmental Protection Act 1986

In response to stakeholder feedback and to meet contemporary expectations, Alcoa is modernising its environmental approvals framework and referring all proposals for future mining regions for assessment under Part IV of the State *Environmental Protection Act 1986* and the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.3.1.1 Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023

The *Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023* (s6 exemption) is a legislative order issued by the Western Australian Minister for Environment with the

approval of the Governor under Section 6 of the EP Act. The order exempts Alcoa from certain compliance requirements under the EP Act, specifically sections 41 and 41A.

The exemption order is applicable to Alcoa's bauxite mining on the Darling Range in the southwest of WA considered in the Mining and Management Program 2022 to 2026 and Mining and Management Program 2023 to 2027[11] (Figure 1-2, Table 1-2).

Table 1-2 Huntly and Willowdale Section 6 Mine Footprints

Mine Region	Mine Disturbance Footprint (Section 6) (ha)	Native Vegetation Disturbance Footprint (Section 6) (ha)
Huntly	39,071	3,747
Willowdale	2,137	0
Total	**41,208**	**3,747**

Section 41A of the EP Act generally prohibits the implementation of a proposal that is under assessment by the Environmental Protection Authority (EPA). The exemption order allows Alcoa to conditionally (Table 1-3) proceed with its bauxite mining proposals in the Darling Range while the EPA's assessment is ongoing.

The EPA is combining the two referred Proposals into one assessment and have provided an Environmental Scoping Document (ESD) to Alcoa[12]. An Environmental Review Document is to be completed, along with a Section 43a Amendment under the EP Act for minor changes to the disturbance footprint.

This 2025-2029 MMP includes clearing, operational and rehabilitation activities associated with Assessment 2384 and Assessment 2385.

Table 1-3: s6 exemption – key conditions

Clause	Condition
2.2 2.3	Mining activities must not disturb land outside the Huntly or Willowdale Mine disturbance footprint; and must not disturb native vegetation outside the Huntly Mine native vegetation disturbance footprint.
2.4	Exploration activities must not disturb land outside the Darling Range exploration disturbance footprint
2.5	Bauxite extracted, conveyed, crushed or otherwise processed must not exceed 38 megatonnes (wet) in any calendar year.
2.6	Exploration activities must not bore more than 105 000 drill holes in any calendar year.
3.2 3.3	Clearing or other activities likely to disturb a forest clearing advice area must not occur (except rehabilitation or monitoring activities)
4.2 4.3 5.1 5.2	Mining activities must not be undertaken: • within 1 km of the top water level margin of any water reservoir; or • within the Serpentine Pipehead Dam Catchment Area; or • in any area that is within the Reservoir Protection Zone (RPZ) and has an average slope greater than 16%; or

[11] Both referred to the EPA on 27 February 2023 under Section 38 Part IV of the EP Act (Assessments 2384 and 2385).
[12] *Bauxite Mining on the Darling Range in the Southwest of WA – 2022 to 2026 and 2023 to 2027 ESD* dated 29 August 2024.

Clause	Condition
	• within 10 metres of a black cockatoo nesting tree or a Huntly Mine black cockatoo significant tree; or • on or after 1 January 2027, within 50 metres of a black cockatoo nesting tree. Excluded activities include: a) rehabilitation; or b) monitoring activities; or c) use and maintenance of existing mining infrastructure; or d) modification of existing road infrastructure; or e) construction of drainage control infrastructure; or f) mining within 1 km of the top water level margin of any water reservoir within the Huntly Mine disturbance footprint carried out before 30 June 2024. If excluded activities occur, then: a) implement drainage control until the area is stabilised; and b) as soon as practicable, but in any event not later than the stabilisation date for the activity, stabilise the area; and c) as soon as practicable, complete the rehabilitation of the area.
5.3 5.4	Mining activities within the RPZ or within 1.5 km of Mt Solus peak must as soon as practicable, but no later than the stabilisation date either commence stabilising the area or implement drainage controls until stabiliised. Within 24 months of activity ceasing, the area must be stabilised.
6.2	Upon becoming aware of a drainage incident, Alcoa must report the incident within 24 hours, investigate and report on the outcomes within 21 days.
8.2 11.2	Alcoa must appoint and retain an independent qualified expert to undertake continuous compliance monitoring (not less frequently than weekly) and prepare reports.
9.1	Alcoa must prepare a plan for assessing compliance.
10.1 10.2	Alcoa must provide a monthly report that set out the results of any monitoring and activities undertaken during the month and to be undertaken in the following two months.

1.3.1.2 Wagerup Refinery and Willowdale Mine

The Wagerup Refinery was first granted State government approval in 1978 under *Alumina Refinery (Wagerup) Agreement Act 1978 and Acts Amendment 1978* for a refinery production capacity of up to 2 million tonnes per annum (Mtpa). The refinery was commissioned in 1984 with a capacity of 670,000 tonnes per annum (tpa) (subsequently expanded to 840,000 tpa in 1988).

Wagerup refinery operations are further regulated through Ministerial Statements (Table 1-4). In January 2021, amendments to MS 728 via MS 1157 permitted the refinery to increase production in two stages, the first to 3.3 Mtpa, and the second to 4.7 Mtpa, subject to implementation of Ministerial conditions.

Table 1-4: History of Ministerial Statements at Wagerup Refinery

Activity	Statement Number	Approval Year
Consultative Environmental Review	N/A	1989
Wagerup Alumina Refinery Expansion	MS 095	1990

Activity	Statement Number	Approval Year
Increase in Alumina Production to 3.3 Mtpa at Wagerup Alumina Refinery, and Associated Bauxite Mining Activities	MS 390	1995
Amend Conditions Applying to the Proposal: Increase in Alumina Production to 3.3 Mtpa at Wagerup Alumina Refinery, and Associated Bauxite Mining Activities	MS 564	2001
Revised Proposal: Wagerup Alumina Refinery – Production to a Maximum Capacity of 4.7 Mtpa and Associated Bauxite Mining	MS 728	2006
Amend Conditions Applying to the Proposal: Wagerup Alumina Refinery – Production to a Maximum Capacity of 4.7 Mtpa and Associated Bauxite Mining	MS 897	2012
Amend Conditions Applying to the Proposal: Wagerup Alumina Refinery – Production to a Maximum Capacity of 4.7 Mtpa and Associated Bauxite Mining	MS 1069	2017
Amend Conditions Applying to the Proposal: Wagerup Alumina Refinery – Production to a Maximum Capacity of 4.7 Mtpa and Associated Bauxite Mining	MS 1157	2021

The associated Willowdale Bauxite Mine is located in the Darling Scarp, east of Waroona and Cookernup, and was established in 1984 to supply bauxite ore to the Wagerup Refinery. In 2020, the Willowdale Mine supplied approximately 10 million tonnes of bauxite to the Wagerup Refinery via a direct overland conveying system.

1.3.1.3 Kwinana Refinery, Pinjarra Refinery and Huntly Mine
Pinjarra Refinery and Huntly Mine

In December 2003, Alcoa referred an increase in production from 3.5 Mtpa to 4.2 Mtpa and associated increase in the bauxite mining rate[13] to the EPA under Part IV of the EP Act.

In March 2004, the proposal was assessed and approved by MS 646, which sets out the key proposal characteristics of alumina production of 4.2 Mtpa and a project life of greater than 45 years (Schedule 1 of MS 646).

The EPS document included a commitment that bauxite mining would continue to be undertaken following an MMP approved by the Minister for State Development in concurrence with the Minister for Environment and Minister for Water considering the advice of the MMPLG. The MMPLG is recognised by the Minister for Environment in Ministerial Statements (95, 390, 564, 728, 897, 1069 and 1157) regarding expansion of Alcoa operations.

Environmental Protection Act 1986 Ministerial Statement 728 and the Pinjarra Refinery Efficiency Upgrade Environmental Protection Statement[14] require that, in addition to the 10-year mining plan, Alcoa submit mining and management programmes to the State. These programmes will specify the areas which are proposed to be mined, the method of mining and the proposed method of rehabilitation in accordance with the procedures agreed between Alcoa and the State.

Changes to the proposal were approved under Section 45C of the EP Act after MS 646 was issued (MS 646 Attachment 1 (1 July 2008) and MS 646 Attachment 2 (21 September 2015)). Approval of the

[13] The *Pinjarra Refinery Efficiency Upgrade, Environmental Protection Statement (EPS)*
[14] Approved by Ministerial Statement 646.

second amendment in 2015 increased the maximum production of the refinery to 5.0 Mtpa with an associated increase in bauxite mining at the Huntly Mine.

In June 2020, Alcoa submitted the Pinjarra Alumina Refinery Revised Proposal Assessment No. 2253 (Assessment 2253), to the EPA proposing an increase in Pinjarra Refinery's alumina production by 5%, from 5.0 Mtpa to 5.25 Mtpa, and an increase to the mining rate to export up to 2.5 Mtpa of bauxite from the Huntly Mine[15]. Assessment 2253 is currently being assessed by the EPA and covers mining operations for the future mining regions of Myara North and Holyoake within the Huntly Mine.

Subject to receipt of relevant approvals, construction for Myara North and Holyoake is planned to commence in approximately Q2-2026 with first ore scheduled from Holyoake in approximately Q2-2027, with Myara North coming on in Q2-2028.

Alcoa referred two separate Proposed Actions under the EPBC Act (Commonwealth) for the following components:

- Huntly Bauxite Mine Transition – Myara North and Holyoake.
- Pinjarra Alumina Refinery – development of water storage ponds and associated borrow pits.

The referral of these Proposed Actions has been determined as controlled actions and, as such, require assessment under the EPBC Act.

This 2025-2029 MMP identifies mine development activities associated with EPA Assessment 2253, however, is not seeking the Minister for State Development's approval under this MMP for these areas as they are currently under consideration by the EPA under Part IV of the EP Act. Furthermore, any new clearing and operations in the 2025 – 2029 MMP within a not previously Part IV referred area are proposed to be incorporated as amendments to Assessment 2253.

Kwinana Refinery

On commencement of the EP Act in 1987, State Agreements were expressly exempt from the operation of the legislation before the specific exemption for State Agreements was removed in 2003. However, assessment under the EP Act has never been required for the Kwinana Refinery given operations predate the introduction of the Act.

Alcoa has undertaken to seek future approvals under Part IV of the EP Act (refer to section below) for clearing and mining activities for new Huntly Mine regions to supply bauxite to the Pinjarra and Kwinana Refineries under a contemporised assessment process.

[15] A section 43A request to change the Proposal submitted on 19 May 2023 includes the removal of the bauxite export component.

Legend

- Assessment 2384 & 2385 Development Envelope - s6 exemption Mine Disturbance Footprint
- s6 Native Vegetation Disturbance Footprint
- Previously EPA Referred
- Assessment 2253 Mine Development Envelope
- Assessment 2253 Infrastructure Development Envelope
- Assessment 2253 Refinery Development Ennvelope
- Cleared Areas
- Rehabilitation

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 1-2: Alcoa mining operations EP Act Approvals

Scale: 1:230,000

Date Printed: 1/10/2024

1.3.2 Bauxite State Agreement – Administrative Framework

The Mining and Management Program Liaison Group (MMPLG) was initially created in 1979 by an arrangement between Alcoa and the State pursuant to Clause 5 (Mining Plan) of the *Alumina Refinery (Wagerup) Agreement and Acts Amendment Act 1978*. Clause 5 of the *Alumina Refinery (Wagerup) Agreement and Acts Amendment Act 1978* obligates Alcoa to prepare and submit by 30 June each year an annual 10-year mine plan. This statutory obligation does not legally apply to Alcoa's *Alumina Refinery Agreement Act 1961* or the *Alumina Refinery (Pinjarra) Agreement Act 1969*.

In practice, a diversion from this statutory obligation has evolved over time as the 'accepted' administrative framework for Alcoa's mine planning and approval process, which was subsequently formalised through an exchange of letters between the State and Alcoa in 1979 (Administrative Framework). The Bauxite Mining Operations of Alcoa of Australia Ltd – Guidelines for Submission and Approval of Mining and Management Programmes dated 13 February 1979 contemplated that a cross-agency working group of senior State officers would liaise with Alcoa in the preparation of the initial MMP and thereafter, as necessary. The Administrative Framework committed Alcoa to the annual submission of an MMP for a minimum period of five years for all its mining operations including those serving its Kwinana and Pinjarra refineries operating under the Principal Agreement and the Pinjarra Agreement.

Ministerial Statement 728 identifies the MMPLG as comprising representatives of State Government agencies whose areas of responsibility are affected by the mining operations of Alcoa. MS 728 states that the MMPLG will continue to review Alcoa's mining plans, manage issues relating to its mining operations and coordinate environmental auditing of Alcoa's MMP.

The Department of Jobs, Tourism, Science and Innovation released the Bauxite State Agreements – administrative framework review in July 2024 (Current Administrative Framework), which endorsed a revised process to facilitate stakeholder advice to inform State Agreement decisions.

The Current Administrative Framework is detailed in Table 1-5. The MMP is submitted to the Minister for State Development for approval. The Bauxite Strategic Executive Committee (BSEC) will then refer the MMP to the Independent Technical Advisory Group (ITAG) for technical review and feedback to BSEC.

BSEC provides final advice to the Minister for State Development to inform the Minister's decision for endorsement in concurrence with the Minsters for Environment and Water. Alcoa consults closely with the State on the preparation of the MMP and does not implement it until agreement has been reached with the State or it has been determined by arbitration.

The Current Administrative Framework is expected to be in place until Alcoa transitions its operations to a Part IV EP Act approved framework. In the interim, continual improvement to current regulatory standards is expected, with the regulatory expectation that Alcoa undertakes the following:

- Accelerated move to lower-risk areas through broader exploration and identification of mineralised areas elsewhere within ML1SA;
- Accelerated rehabilitation;
- Rapid exit from all RPZs and areas around Dwellingup and Jarrahdale; and
- Transition from a 5-year MMP to 10-year detailed mine planning under the State Agreement.

Table 1-5: Current State Agreement Admistrative Framework

Group	Function	Representatives
Bauxite Strategic Executive Committee (BSEC)	Provision of final advice to inform Ministerial decisions making	Executive Director level or higher representation from the following: • JTSI (Chair) • Department of Biodiversity, Conservation and Attractions (DBCA) • Department of Mines, Energy, Industry Regulation and Safety (DEMIRS) • Department of Water and Environmental Regulation (DWER) • Department of Planning, Lands and Heritage (DPLH) • Department of Health (DoH) • Forest Products Commission (FPC) • ITAG Chair
Independent Technical Advisory Group (ITAG)	Consists of two functions: • Function 1 – Technical review of MMP, environmental and other reports and assessment of proposed CAR informal reserve incursions. Provision of advice to BSEC. • Function 2 - Co-design and implementation of technical studies and reports (as required in MMP approval conditions or by BSEC). Provision of advice to BSEC.	Function 1 members: • Independent Chair • DWER • Water Corporation • DBCA • DPLH • DEMIRS • DoH Additional members for Function 2: • Representation from academic and research institutions, relevant Catchment Councils and Alcoa
Mining Operations Group (MOG)	Technical assessment of Forest Clearing Advice (FCA) submissions and provision of advice to BSEC.	DBCA and DWER

1.3.2.1 Transition to lower-risk areas

Alcoa is focusing exploration activities on the Antiope and Larego South mining areas, which are expected to be the future mine regions. The Antiope and Larego South areas, as well as parts of the of Holyoake area) are considered to be lower-risk due to:

- Antiope being located outside of public drinking water catchments.
- Portions of Larego South and Holyoake being located outside of public drinking water catchments.
- Absence of towns and private landowners.
- Avoidance of conservation parks.

Exploration activities associated with this MMP will only include groundwater bore drilling within the RPZ, not exploration and development or supplementary drilling.

Alcoa has developed an indicative schedule for mining in specific regions to illustrate the timing of the move to lower risk areas :

- Myara North and Myara mine regions are expected to be actively mined until approximately 2035
- Holyoake mine region is expected to be actively mined until approximately 2044
- EPA Referral of future mine region (which could include the remainder of Holyoake and Antiope) will be required to allow mining to commence in approximately 2032 for Huntly
- EPA Referral of future mine region (Larego South) in late 2025 for Willowdale, which will exclude RPZs.

1.3.2.2 Rehabilitation acceleration

The rehabilitation targets (as per Ministerial Condition 15) are based on clearing over a four-year timeframe. Alcoa has made significant investment in resources and reviewed processes to achieve the 1,000 ha target, including:

- Rehabilitation planning has been embedded within the medium term mine plan, with rehabilitation prioritised based on impacts to water and visual amenity.
- Optimisation of the rehabilitation plan through review of Direct Return Topsoil (DRT) supply, ore exhaustion and clearing reduction.
- Completion of decoupling project focused on decreasing the timeframe which pits remain open through ore optimisation.
- Since 2023, Alcoa has:
    - Purchased $36 million in additional resources (equipment), including, 9 bulldozers.
    - Hired additional equipment including dry hire of 9 bulldozers, one bulldozer wet hire and Haul fleet (3 x PC1250 excavators and 12 Cat 777 Dump trucks) for bulk dirt and soil movements to meet rehabilitation pit design and target.
    - Employed 54 Alcoa mine site rehabilitation employees and 34 contract rehabilitation operators (Huntly & Willowdale).
    - Redeployed the mining contractor associated with Kwinana to focus on rehabilitation.
    - Engaged Rehabilitation Rework contractors completing repair work in rehab pits to ensure completion criteria is met and legacy issues are rectified in preparation for handback.
    - Procured Alcoa owned DRT spreader to improve efficiencies and derisk.
- Creation of a Rehabilitation Strategy and Performance Team to implement the Rehabilitation Strategy, which included:
    - Implementation of improvement projects to ensure Operations are equipped to deliver increased internal and external targets.
    - Identification of risks and headwinds and mitigation plans.
    - Executive and stakeholder communications and performance monitoring.
- Additional resources are planned to meet the 2027 rehabilitation target including:
    - 21 personnel
    - 10 dozers, 5 diggers and 9 trucks

Sufficient volumes of topsoil and overburden have been stockpiled to meet planned rehabilitation requirements for the next five years, ensuring topsoil availability is not compromised.

Alcoa continues to refine its rehabilitation strategy and implement best practices to ensure successful and timely rehabilitation, with a focus on maintaining long term environmental integrity and alignment with Government expectations.

As detailed in Table 3-12, the rehabilitation target of 1,000 ha is expected to be maintained. The resulting open areas are detailed in Section 3.2.4.2, noting re-forecast indicative actual clearing indicates that open areas will be maintained below 6,000 ha.

1.3.2.3 Exit from RPZs and local towns

Exploration drilling will not occur within the following areas:

- Mining Avoidance Zones associated with Jarrahdale and Dwellingup,
- Areas within 1 km of all reservoir top water levels (within the Reservoir Protection Zones (RPZs)) whereby no further drilling will occur.
- Areas within 1 - 2 km of all reservoir top water levels (within the RPZs) whereby no further exploration development or supplementary drilling will occur. However, groundwater bore drilling may occur to understand groundwater impacts.
- Areas within Serpentine Pipehead Catchment whereby no further drilling will occur.

Mining Avoidance Zones have previously been committed to surrounding Jarrahdale and Dwellingup, as shown in Figure 3-2 and Figure 3-4, respectively. These areas have been incorporated into Alcoa's Long and Medium Term Mine Plans to ensure avoidance. Alcoa's current 10 Year Mine Plan avoids close proximity to any local towns. The State Government has formalised the Dwellingup MAZ through applying a File Notation Area over the area.

The Long and Medium Term Mine Plans are currently under revision in relation to activities in the RPZs. The current potential clearing impacts to RPZs are detailed in Table 1-6, with the following items of note:

- No clearing within RPZs associated with the Willowdale mine as part of the Ten Year Mine Plan.
- Clearing is only expected within the Serpentine, North Dandalup and South Dandalup RPZs associated with the Huntly mine.
- The majority of clearing within Serpentine RPZ consists of ore contained within the 24 Month Clearing Schedule.

The cumulative impacts (including open areas and rehabilitation) to RPZs at the Huntly and Willowdale mines are detailed in Table 7-14 and Table 7-15, respectively. Rehabilitation within RPZs is prioritised, as shown in the Rehabilitation Schedule (Appendix 9). A mine plan review will be undertaken to prioritise RPZ clearing and rehabilitation.

Table 1-6: Proposed clearing - RPZs

RPZ	Purpose	24 Month Clearing Schedule	Remaining 5 year Clearing Schedule	Remaining 10 Year Mine Plan	Total
	Haul Road	-	1.8	-	1.8
	Ore	-	4.6	-	4.6

RPZ	Purpose	24 Month Clearing Schedule	Remaining 5 year Clearing Schedule	Remaining 10 Year Mine Plan	Total
Huntly - North Dandalup	Turbidity Monitor	0.1	-	-	0.1
	Sub-total	0.1	6.4	-	6.5
Huntly - Serpentine	Haul Road	28.2	23.2	-	51.4
	Miscellaneous	10.4	-	-	10.4
	Ore	138.5	17.4	-	156.0
	Stockpile	1.7	-	-	1.7
	Turbidity Monitor	0.6	-	-	0.6
	Sub-total	179.4	40.7	-	220.1
Huntly - South Dandalup	Conceptual Clearing Buffer	7.8	-	-	7.8
	Haul Road	-	24.7	6.8	31.5
	Miscellaneous	2.5	-	-	2.5
	Water Supply	2.4	-	-	2.4
	Sub-total	12.7	24.7	6.8	44.2

1.3.2.4 Transition to longer term detailed mine planning

Alcoa is committed to aligning its mine planning processes to support ongoing operations under Part IV of the EP Act. Huntly's future mine regions (Myara North and Holyoake) are currently under EPA Assessment and a referral of Willowdale's future mine region (Larego South - outside of the previously referred extent) is expected in late 2025. These areas are shown in Figure 3-6 and Figure 3-7, respectively.

Current practice involves detailed mine planning occurring after MMP submission and prior to FCA development – whereby pre-clearance surveys are completed, MAZs and LDAs are determined and avoidances appropriately implemented. It is acknowledged that further social, ecological and water related studies are required to support future EPA referrals, therefore a dedicated team has been established to deliver the uplift in survey requirements. Once further survey information is obtained, detailed mine planning can occur. This will allow Alcoa to uplift its mine planning processes to develop a detailed 10 year mine plan.

In the interim, Alcoa is developing its MAZ and LDA processes through ensuring spatial avoidance and minimisation areas are implemented at all stages of the mine planning process – drilling, infrastructure and mine pit design.

In addition, a Full Mine Cycle Planning Methodology has been developed to establish a systematic and forward-looking framework for addressing environmental, social and economic objectives in mine planning. Some key outcomes are:

- Part IV EP Act assessment will consist of Environmental Review Documents submitted approximately four years prior to clearing occurring.
- Implementation of the methodology is expected to occur within approximately two years (once methodology agreed with ITAG).

- Whilst many of the activities are already occurring, the methodology provides transparency with regards to survey timing, risk identification, avoidance implementation and mine planning design process.

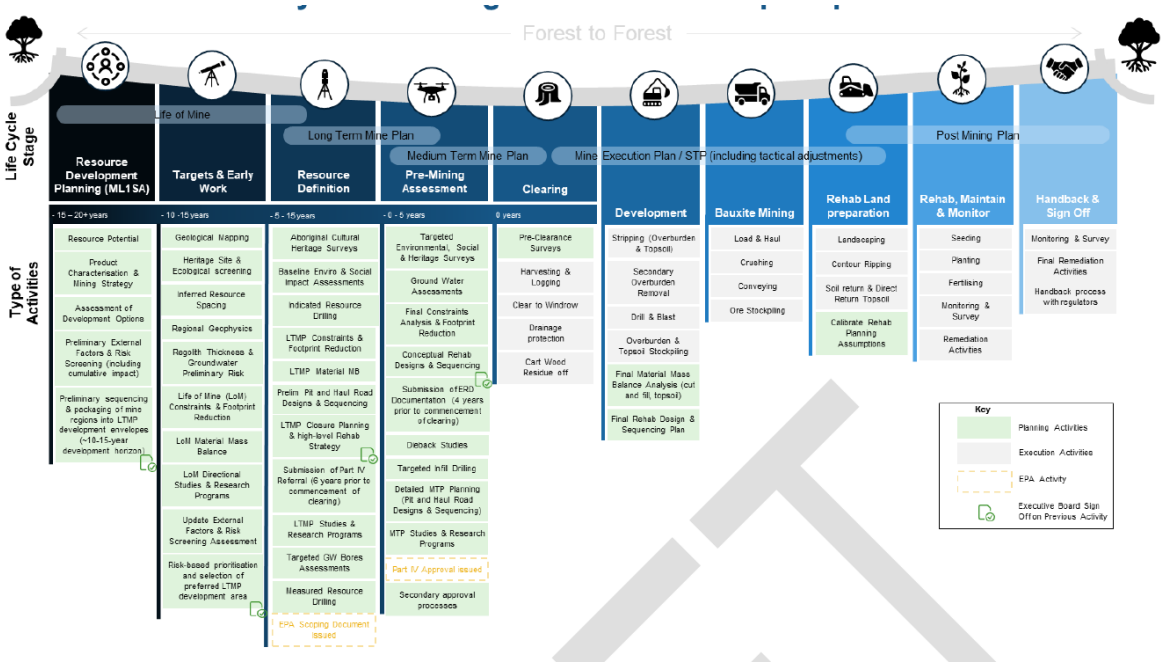


Figure 1-3: Full Mine Cycle Planning Methdology - Overview

1.3.2.5 Mining and Management Program

The MMP (this document) details the proposed Five Year Mine Plan, relevant operational details, environmental management, community consultation, and is submitted annually to the Minister for State Development.

The MMP seeks endorsement of:

- Activities contained within the Five Year Mine Plans, which consists of the Clearing Schedule, Rehabilitation and Opens areas, for the Huntly and Willowdale mines (Figure 3-10 and Figure 3-11), noting EPA Assessment of some areas is underway.
- Activities contained within the Exploration Disturbance Footprint (EDF) (Appendix 1).

The 10 Year Mine Plan, which provides indicative clearing areas, is presented for consideration in Figure 3-6 and Figure 3-7.

The proposed clearing areas (Clearing Schedule) included in the MMP are conceptual clearing footprints and the area will not be cleared in their entirety. However, all clearing will be contained within the Clearing Schedule (similar to a Development or Disturbance Envelope detailed in Mining Act or EP Act approvals).

Actual native vegetation clearing will be limited to 800 ha per year (Ministerial Condition 9), noting that unused capacity may be rolled over to the following year, upon approval by the Minister for State Development.

It should be noted that minor clearing activities occur outside the Five Year Mine Plan and Exploration Disturbance Footprint spatial extent, such as:

- Installation of monitoring infrastructure for surface water, groundwater, and air quality.
- Minor clearing for rehabilitation remediation activities or drainage control.

If required, the minor clearing activities associated with these activities will be applied for through a Native Vegetation Clearing Permit (NVCP) under Part V of the EP Act prior to native vegetation clearing and reported in the Annual Environmental Review.

The 2023-2027 MMP was approved by the Minister for State Development on 20 December 2023 with a set of Ministerial Approval Conditions (Table 1-6). Alcoa is committed to continued implementation and compliance against the 2023-2027 MMP Ministerial Conditions and supports a rollover of these same conditions applying to the 2025-2029 MMP. Compliance to these conditions in included in associated Compliance Assessment Reports and future AERs.

Table 1-7: 2023-2027 MMP Ministerial Approval Conditions

#	Condition
1	The following conditions set out in this document are in addition to the requirements imposed on Alcoa of Australia Limited (Alcoa) by the Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023 (Exemption Order) however to the extent that the following conditions may be in their terms or operation inconsistent with the requirements of the Exemption Order in relation to the area of operation of the Exemption Order then the following conditions are subject to and do not detract from the requirements of the Exemption Order. In this document, subject to the context: "date of the MMP approval" means the date that the Minister for State Development approved the MMP; "rehabilitation", in relation to an area that has been disturbed, includes - (a) stabilisation of an area; and (b) restoration of the landforms of the area to a state that is as close as practicable to their original undisturbed state; and (c) the return of the native vegetation of the area to a state that is as close as practicable to its original undisturbed state; "stabilise", in relation to an area that has been disturbed, means carry out landscaping, ripping and other appropriate operations to prevent erosion of sediment, promote infiltration and manage surface water runoff, and "stabilisation" has a corresponding meaning; In complying with the following conditions, Alcoa shall ensure compliance by its officers, employees, contractors, subcontractors and agents.
2	Alcoa will treat as not having been endorsed, 1,231 ha of Forest Clearing Advices (FCA) endorsed prior to 1 September 2023 as defined in Figure 5 of the Exemption Order, being: a) 1,016 ha of FCA in Huntly; and b) 214 ha of FCA in Willowdale.
3	Within 10 business days of the date of the MMP approval, Alcoa must submit written evidence, to the satisfaction of the Minister for State Development, demonstrating that the mining contemplated by the MMP within the Serpentine Dam Catchment is required from a social and economic perspective.
4	Any clearing, exploration, mining or other operations permitted by this MMP approval must be implemented by Alcoa to meet the following environmental objectives: a) avoiding or otherwise minimising clearing within 50 metres of Black Cockatoo nesting trees; and

#	Condition
	b) avoiding or otherwise minimising discharge of environmentally hazardous material outside of containment infrastructure. - If: c) clearing within 50 metres of Black Cockatoo nesting trees; and/or d) discharges of environmentally hazardous material outside of containment infrastructure, cannot be avoided, Alcoa must provide, to the satisfaction of the Minister for State Development, a written report explaining why the relevant avoidance cannot be met prior to the clearing being undertaken.
5	Alcoa must not undertake any clearing, exploration, mining or other operations: a) within 1km of the top water level of any water reservoir; or b) within the Serpentine Pipehead Dam Catchment; c) in any area with an average slope greater than 16% within the Reservoir Protection Zone of any water reservoir; or d) within 10 metres of any Black Cockatoo nesting trees or Black Cockatoo significant trees.
6	Condition 5 does not apply to: a) stabilisation or rehabilitation activities; or b) environmental monitoring activities; or c) use and maintenance of existing infrastructure; or d) modification of existing road infrastructure with the written consent of the Minister for State Development; or e) construction of drainage control infrastructure; or f) mining within 1 kilometre of the top water level of any water reservoir in Myara Central and Myara South carried out before 30 June 2024.
7	If any activity described in paragraphs (b) – (f) of condition 6 is undertaken, the disturbance must be stabilised either within 12 months of the relevant activity ceasing, or within the first available rehabilitation season, whichever is earliest. Alcoa must implement drainage controls in the affected area until the area is stabilised.
Clearing restrictions	
8	Alcoa will not undertake any MMP-related clearing until the Mine Operations Group (MOG) has provided its endorsement of the relevant FCA.
9	Alcoa will not clear more than 800ha of native vegetation for MMP-related mining activities per calendar year for the duration of the Exemption Order.
10	Unused capacity from the annual clearing cap detailed within Condition 9 may be rolled over into the following year, only following approval from the Minister for State Development as part of any subsequent MMP submissions.
11	Alcoa will ensure that FCA submissions to the MOG for pits or haul roads within the public drinking water catchment areas are accompanied by Drainage Control Management Plans (DCMP) that are capable of meeting the requirements of condition 14(b)(iii). DCMPs are conceptual designs and will be developed using the Drainage Design Manual and field data and will include an assessment against the Groundwater Risk Assessment Framework (2021 Forest Clearing Advice 23 March 2022).
12	Alcoa will ensure that for MOG-endorsed clearing for haul roads or pits where the average slope is greater than 16% or where sub-catchments in which mining disturbance is greater than 30% of the total sub catchment area: a) pit and drainage control as-builts and details on any design variations will be provided to the MOG twice a year, at least 4 months apart; b) conceptual rehabilitation designs will be provided to the MOG 6 months after FCA endorsement; c) no clearing will be undertaken where the topographic wetness index is greater than or equal to 9, and groundwater data availability is less than 12 months; d) undertake targeted fauna and flora and vegetation surveys for all future clearing under the MMP, as per the Flora and Vegetation and Fauna Management Plans; and

#	Condition
	Following completion of the work required by condition 26(a), undertake a clearing risk assessment to ensure appropriate avoidance and management measures are implemented for all future clearing under the MMP, and submit these to MOG with each FCA submission.
Management Plans From the date of the MMP approval:	
13	Alcoa will implement to the extent practicable the plans referred to below until the relevant revised plan is submitted to the Minister for State Development in accordance with condition 14: a) Fauna Management Plan (Version 0) submitted to the Minister for State Development on 13 November 2023, as included in the MMP; b) Water Resources Management Plan (Version 1) submitted to the Minister for State Development on 13 November 2023, as included in the MMP; c) Recreational Trails and Facilities Management Plan submitted to the Minister for State Development on 13 November 2023, as included the MMP; and d) Flora and Vegetation Management Plan submitted to the Minister for State Development on 13 November 2023, as included the MMP.
14	Alcoa will review and update the plans referred to below and submit them to Minister for State Development for approval within the timeframes outlined in condition 17, and in accordance with Environmental Protection Authority's Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA, 2021): a) the Fauna Management Plan (Version 0), in consultation with the Department of Biodiversity, Conservation and Attractions (DBCA) and relevant stakeholders so that it: i. satisfies the requirements of conditions 18 and 19; and b) the Water Resources Management Plan (Version 1) so that it: i. satisfies the requirements of conditions 18 and 19; ii. satisfactorily addresses comments received by the MMPLG; and iii. includes data and analysis that demonstrates the effectiveness of implementation of drainage controls, stabilisation and rehabilitation at avoiding, minimising and mitigating potential impacts to drinking water quality within water reservoirs, as proposed in each DCMP submitted in accordance with conditions 11 and 16. c) the Recreational Trails and Facilities Management Plans, in consultation with DBCA and relevant stakeholders so that it: i. satisfies the requirements of conditions 18 and 19; d) the Flora and Vegetation Management Plan, in consultation with DBCA and relevant stakeholders so that it: i. satisfies the requirements of conditions 18 and 19.
15	Alcoa must prepare the management plans referred to below and submit them to the Minister for State Development for approval within the timeframes outlined in condition 17 and where relevant, in accordance with Environmental Protection Authority's Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA, 2021): a) Rehabilitation Schedule and Management Plan that: i. initially satisfies the requirements of condition 17(b), and then as part of any subsequent MMP submission; ii. demonstrates that condition 7 has been complied with; 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); and iv. demonstrates that Alcoa is prioritising rehabilitation within public drinking water catchment areas. b) Environmentally Hazardous Materials Management Plan that: i. satisfies the requirements of conditions 18 and 19; and ii. demonstrates how the environmental objective in condition 4(b) will be achieved.

#	Condition
	c) ML1SA operational Cultural Heritage Management Plan, in consultation with Gnaala Karla Booja and the Department of Planning Lands and Heritage.
16	If undertaking clearing for pits and haul roads within a public drinking water catchment area, Alcoa must: a) develop a DCMP prior to commencement of the activity; b) implement the relevant DCMP; c) provide the Minister for State Development with a copy of DCMPs upon his/her request; and d) provide the Minister for State Development with a copy of a DCMP as-builts within four months of construction, upon his/her request.
17	Alcoa must submit the management plans to the Minister for State Development within the following time periods, or such other time period should the Minister for State Development determine, following a request from Alcoa: a) revised Fauna Management Plan, within 6 months of the date of the MMP approval; b) Rehabilitation Schedule and Management Plan, by 30 June 2024; c) revised Water Resources Management Plan, within 6 months of receiving feedback from the MMPLG; d) Recreational Trails and Facilities Management Plan, by 31 December 2024; e) Environmentally Hazardous Materials Management Plan, within 6 months of the date of the MMP approval. f) ML1SA operational Cultural Heritage Management Plan, by 31 December 2024. g) Flora and Vegetation Management Plan, by 31 December 2024.
18	The management plans required under condition 17 must contain evidence to demonstrate compliance with relevant Operational restrictions and Clearing restrictions conditions, and must also include: a) threshold criteria and trigger criteria that are relevant to the environmental impacts that the plans are mitigating and managing; b) monitoring parameters, sites, control/reference sites, methodology, timing and frequencies, which will be used to measure threshold criteria and trigger criteria; c) methodology for determining alternate monitoring sites as a contingency if proposed sites are not suitable in the future; d) data collection and analysis methodologies; e) adaptive management methodology; f) contingency measures which will be implemented if threshold criteria or trigger criteria are not met; and g) reporting requirements.
19	The management plans required under condition 17 must, also contain provisions which demonstrate whether conditions 4 (a) and (b) and relevant Operational restrictions and Clearing restrictions conditions are reasonably likely to be met, and must also include: a) management actions; b) management targets; c) contingency measures if management targets are not met; and d) reporting requirements.
20	Upon submission of each management plan, Alcoa must to the extent practicable: a) implement the submitted management plan(s) until receiving notice from the Minister for State Development confirming that the management plan(s) satisfies the relevant requirements (i.e. is approved); and b) following approval by the Minister for State Development, implement the most recently approved version of the management plan.
21	Alcoa: a) may review, revise and re-submit to the Minister for State Development any management plan listed in condition 17 at any time provided it meets the relevant requirements of that management plan, including any consultation that may be required when preparing the management plan; and

#	Condition
	b) must review and revise any management plan listed in condition 17 and ensure it meets the relevant requirements of that management plan, including any consultation that may be required when preparing the management plan, as and when directed by the Minister for State Development.
22	Approved management plans, and any revised management plans, must be published on Alcoa's website and provided to the Minister for State Development in electronic form suitable for on-line publication within twenty (21) business days of being implemented, or being required to be implemented (whichever is earlier).
23	Rehabilitation Completion Criteria Alcoa will consult with the DBCA in the drafting of a revised set of Rehabilitation Completion Criteria and once agreed, provide these to the Minister for State Development by 31 December 2024.
Re-establishment and operation of the Independent Technical Advisory Group (ITAG)	
24	Alcoa will provide adequate resourcing to ensure that the ITAG (formerly Bauxite Hydrology Committee), with an independent chair, is reconstituted by 30 June 2024.
25	Alcoa will, in consultation with the ITAG, develop agreed methodologies for a full mining cycle planning approach and cumulative catchment scale risk assessment, and submit these to the Minister for State Development by 31 December 2024.
26	Alcoa will consult with the ITAG to develop the following for submission to the Minister for State Development by 31 December 2024, or at a later time as recommended by the ITAG and agreed by the Minister for State Development: a) a risk assessment methodology that enables appropriate avoidance and management measures to be implemented for all future clearing under the MMP; b) a drainage design manual; and c) a rehabilitation design manual.
Monitoring	
27	Alcoa must ensure that an independent qualified party undertakes monitoring capable of: a) determining whether the limitations in conditions 5 and 9 are exceeded; and b) determining whether the objectives of conditions 4 (a) and (b) have been met.
28	Alcoa must submit as part of the Compliance Assessment Report required by condition 32, a compliance monitoring report that: a) outlines what monitoring was undertaken of any activities carried out in accordance with condition 18 (b) and (c); b) identifies why the monitoring was capable of substantiating whether the limitations in conditions 5 and 9 are exceeded; c) identifies why the monitoring was scientifically robust and capable of determining whether all conditions have been met; d) outlines the results of the monitoring and provides the data; and e) reports whether the conditions have been met, based on analysis of the results of the monitoring.
Compliance, time limits, audits and other conditions	
29	If Alcoa becomes aware of a failure of drainage, or discharge from containment infrastructure that includes any potentially environmentally hazardous material, Alcoa must: a) report this to the Department of Water and Environmental Regulation, the Water Corporation and the Minister for State Development within 24 hours; b) implement contingency measures; c) investigate the cause; d) investigate environmental impacts; e) advise rectification measures to be implemented; f) advise any other measures to be implemented to ensure no further impact; and g) provide a report to the Minister for State Development within twenty-one (21) calendar days of being aware of the potential non-compliance, detailing the measures required in conditions 29(a)-(f).

#	Condition
30	Failure to comply with the requirements of a condition, constitutes a noncompliance with these conditions. The Minister for State Development will consider the contingency measures, rectification or other measures immediately put in place by Alcoa to remedy the non-compliance, before determining further action in response to the non-compliance.
Compliance and monitoring reporting	
31	Alcoa will ensure surface water and groundwater monitoring data collected in accordance with the relevant monitoring requirements detailed in condition 28, will be provided to the Department of Water and Environmental Regulation and Water Corporation as per a monitoring schedule agreed by those agencies.
32	Alcoa must provide an annual Compliance Assessment Report to the Minister for State Development for the purpose of determining whether the conditions in this MMP approval are being complied with.
33	Unless a different date or frequency is approved by the Minister for State Development, the first annual Compliance Assessment Report must be provided within six (6) months of the date of the MMP approval, and subsequent reports must be provided annually from that date.
34	Each annual Compliance Assessment Report must be endorsed by a Director (as defined in the Corporations Act 2001) of Alcoa, or a person approved by a Director of Alcoa to be delegated to sign on behalf of the Director.
35	Each annual Compliance Assessment Report must: a) state whether each condition has been complied with, including: i. the limitations in conditions 5 and 9; ii. requirements to implement the content of Drainage Control Management Plans or an approved management plan; iii. monitoring requirements; iv. implementation of contingency measures; v. requirements to implement adaptive management; and vi. reporting requirements; b) include the results of any monitoring (inclusive of any raw data) that has been required under these conditions in order to demonstrate that the conditions have been met; c) provide evidence to substantiate statements of compliance, or details of where there has been a non-compliance; d) describe progress and status of any consultation undertaken to review and update management plans; e) include the corrective, remedial and preventative actions taken in response to any potential non-compliance; f) be provided in a form suitable for publication on Alcoa s website; and g) be prepared and published consistent with the latest version of the Compliance Assessment Plan required by condition 36 which the Minister for State Development has approved in writing satisfies the relevant requirements.
36	Alcoa must prepare and submit to the satisfaction of the Minister for State Development, a Compliance Assessment Plan at least two (2) months prior to the first Compliance Assessment Report required by condition 32.
37	The Compliance Assessment Plan must include: a) details of the independent qualified person engaged to undertake monitoring under condition 28; b) what, when and how information will be collected and recorded to assess compliance; c) the methods which will be used to assess compliance; d) the methods which will be used to validate the adequacy of the compliance assessment to determine whether the conditions outlined in this condition set are being complied with; e) the retention of previous compliance assessments; f) the table of contents of Compliance Assessment Reports, including audit tables; and g) how and when Compliance Assessment Reports will be made publicly available.
Public Availability of Data	

#	Condition
38	Alcoa must make the following documents publicly available on its Website: a) any Mining and Management Plan, accompanying appendices and associated approval conditions, within seven (7) calendar days of receiving notice requiring publication from the Minister for State Development; b) any Management Plan required in accordance with Conditions 13-17 within twenty (21) business days of being implemented, or being required to be implemented (whichever is earlier); c) any Compliance Assessment Report or other report required to be produced by these conditions within sixty (60) days of being provided to the Minister for State Development; and d) all geospatial data relevant to the MMP approval.
39	If any information or data referred to in condition 38 contains: a) Copyright material; b) trade secrets; or c) confidential information (other than trade secrets) that has commercial value to a person that would be, or could reasonably be expected to be, destroyed or diminished if the confidential information were published, Alcoa may submit a request for approval from the Minister for State Development to not make this information or data publicly available and the Minister for State Development may agree to such a request if the Minister for State Development is satisfied that the information or data meets the above criteria.
40	In making a request under condition 39, Alcoa must provide the Minister for State Development with an explanation and reasons why the data should not be made publicly available.

1.3.2.6 Forest Clearing Advice

On 30 June 2004, the WA Government proclaimed amendments to the EP Act, to enhance native vegetation protection (Government Gazette 2004/114). In recognition of the annual MMP process, the Minister for the Environment additionally proclaimed the *Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004)*. This order requires Alcoa to undergo an assessment of clearing areas via the annual MMP process rather than requiring a clearing permit under Part V of the EP Act, providing Alcoa with clearing endorsement, within ML1SA, in accordance with a mine plan approved by the Minister for State Development.

Alcoa submits Forest Clearing Advice (FCA) to the Mining Operations Group (MOG) for endorsement to clear within Conceptual Clearing Areas (as per the 5-Year Mine Plan), approved by MMPs at an average rate of two per year. MOG endorsement of a relevant FCA is required before commencing vegetation clearing activities including timber harvesting for mining, haul roads, and constructing associated infrastructure. Exploration activities undertaken within the Exploration Disturbance Footprint do not require an FCA.

The FCA process was introduced to allow specific issues arising from the implementation of proposed clearing activities within the approved conceptual areas to be resolved at a more granular or technical level (between Alcoa and the MOG), without overtaking the MMP approval process. Alcoa will not undertake approved MMP clearing, unless the relevant FCA is endorsed[16].

[16] 2023-2027 MMP Ministerial Approval Condition 8.

2 Exploration

2.1 Exploration Activities

Exploration activities include the following:

- Non-disturbing activities
  - Mapping – Geographical and geological mapping activities; and
  - Surveying – Conducting surveys to support exploration including ground and airborne surveys, i.e., geophysical; and
- Low-impact disturbing activities
  - Drilling – Drilling to define soil, rock and groundwater properties; and
  - Sample collection and assaying – Collecting and analysing samples to define soil, rock and groundwater properties; and
  - Geoscience applications – Engaging in activities involving one or more geoscience disciplines, i.e., geotechnical, metallurgical, etc.

Exploration disturbance will occur within the Exploration Disturbance Footprint (Appendix 1).

Exploration drilling provides detailed information to support Alcoa's long term strategic decisions and planning for near term future mine development.

Alcoa undertakes three types of drilling (sections 2.1.1,2.1.2 and 2.1.3) to obtain information for mine planning. Although using different drilling techniques, all types of drilling are predominantly aligned in operating practices and risk management controls to ensure minimal to no ground disturbance. No more than 105,000 drill holes will be drilled in a calendar year. Alcoa is committed to providing a quarterly report to BSEC on proposed drill hole locations for the following quarter and current annual exploration plan, to allow transparency of drilling locations.

2.1.1 Exploration and Development Drilling

Exploration and development drilling is used to define the lateral and vertical extents of ore bodies, understanding the location and quality of bauxite and improve the confidence of tonnes and grade estimations.

It represents the bulk of drilling activity and utilises a fleet of tractor-mounted drill rigs, which have been modified to operate in forested areas with minimal ground disturbance. While this fleet uses drilling techniques generally used in the WA mining sector, it has been customised to be compact and self-contained, eliminating the need for support trucks.

A key feature of this approach is that it does not require the construction of drill pads or sumps, further reducing environmental impact. Additionally, access tracks are typically not cleared; instead, drill rigs navigate around large vegetation and traverse over smaller vegetation with minimal disturbance. The rigs are designed to exert low ground pressure, minimising soil compaction. These modifications align with the program's focus on reducing its footprint while efficiently drilling small dimeter, shallow

holes, which have an average depth of 6m and a typical range of 2m to 18m, with small diameter of 4.5 cm to 7.5 cm.

- Exploration drilling targets areas outside of Alcoa's current mining operational envelope with a broader extent but less intense activities, i.e., 240 m x 60 m or 120 m x 60 m drilling densities. During the initial exploration phase, a lower density is typically more appropriate. Wider spacings of 120 m x 60 m or 120 m x 120 are typically employed. The results from this drilling activity allow for longer-term knowledge for planning and assessment of mining constraints, i.e., heritage, water resource planning, forest management planning, to inform longer-term strategic business decisions.
- Development drilling activity enables improved resource knowledge, evaluation of future mine development options, and accurate identification of the proposed clearing boundaries. This drilling is completed in three phases of targeted drilling with 60 m x 60 m, 30 m x 30 m and 15 m x 15 m drilling densities.

  In subsequent infill drilling stages, the focus shifts to more intensive targeting of resource boundaries identified by the initial grid. These higher density configurations increase the number of drill holes per hectare while reducing the overall disturbed area. This methodical approach enhances resource delineation while minimising environmental impact, reinforcing Alcoa's commitment to both efficient resource development and sustainable operational practices.

The extent of exploration and development drilling program areas are shown in Appendix 1.

2.1.2 Supplementary Drilling

Alcoa undertakes small volumes of supplementary drilling, e.g., diamond core or triple tube aircore, as part of ongoing exploration activities. Supplementary drilling improves Alcoa's knowledge of the regolith profile, water tables, geophysical, and metallurgical properties of bauxite. This additional information may be required to support mining studies with respect to approvals, mining, and processing.

The environmental impact of this activity is low and will be minimised through:

- Minimising supplementary drilling by drilling less than 50 holes per annum.
- Employment of the best available drill rigs that can operate without the need to build tracks, pads, or sumps. A sump is a constructed, excavated pit designed to manage volumes of drilling fluids (which are re-circulated). Sumps are often lined to prevent seepage. Post-drilling, fluids may be extracted or left to evaporate.
- Utilising compact design rigs that utilise a method to recirculate and contain drilling fluids for off pad disposal.
- Drill rigs accessing uncleared forest will be mounted on either metal tracks or large diameter tractor style tyres to minimise soil compaction.
- Drilling holes up to 140 mm in diameter with expected maximum depths of 60 m.
- Collar cutting and plugging all holes in line with DEMIRS drill hole rehabilitation guidelines.

- Pre-planning access paths to drill sites to ensure rigs can access drill sites with minimal disturbance to the forest.

If ground disturbance is visibly greater than the typical exploration and development tractor-mounted drill rigs, appropriate rehabilitation of that disturbance will be undertaken. Rehabilitation will be back to a level equivalent to the disturbance that typically results from the exploration and development tractor-mounted drill rigs traversing through the forest.

Such rehabilitation is expected to be completed through the use of manual hand tools; however, the specific methodology will be dictated by the scale and nature of the disturbance. Where ground disturbance requires rehabilitation, a selection of locations will be photographed for record keeping by Alcoa's Environmental Department; showing prior to rehabilitation, immediately post rehabilitation and one year post rehabilitation.

2.1.3 Groundwater Bore Drilling

Groundwater bores are required to identify and monitor groundwater levels and quality. Drilling is undertaken by the smallest and most efficient rig available and support vehicles. A small track mounted rig is currently used.

Proposed groundwater bores are preferably located on or adjacent to existing tracks. Disturbance of native vegetation is minimised and constraints avoided.

Access to a proposed groundwater bore location may include, if necessary:

- Minimal impact to ground vegetation, small shrubs, and trees with trunks up to 150mm diameter at breast height.
- Relocation of logs and branches off the access route if no damage to other vegetation is expected.

Groundwater bore drilling includes:

- No use of sumps.
- No use of drilling fluid additives.
- Use of a "pond" if mud (drill cuttings and water) is produced from the groundwater bore. A pond is a small (<100 L), temporary, unlined, shallow (approximately 100mm bunds) holding area for water and drill cuttings. Recirculation of mud does not occur and once water evaporates or infiltrates, drill cuttings are removed through the use of hand tools.
- Replacing logs and branches that were purposely blocking tracks during rehabilitation.

Rehabilitation of obvious track footprints by a skid steer or small excavator. Groundwater bores may require consultation with DBCA with regards to the bore location, access and level of disturbance. If required, further approvals through DBCA may be obtained, particularly in instances of medium forest disturbance.

2.2 Exploration Disturbance Footprint

The 2025-2029 Exploration Disturbance Footprint (EDF) details the location of drilling and exploration disturbance activities (Appendix 1). Activities such as access considerations and alignment with forest management activities (i.e. harvesting, controlled burns) are discussed during the annual Forest Management Conflict Meetings, held with Alcoa, FPC, DBCA and Water Corporation (WC).

Alcoa's EDF has been revised based on regulatory feedback regarding the extensive current size. The revision has resulted in the removal of 22,091 ha consisting of:

- Mining Avoidance Zones associated with Jarrahdale and Dwellingup
- Areas within 1 km of reservoir top water levels whereby no further drilling is authorised under current approval conditions
- Areas within Serpentine Pipehead Catchment associated with Myara and Myara North whereby no further drilling is authorised under current approval conditions
- RPZ areas associated with Myara, Myara North, and Holyoake whereby no further drilling is expected.

Figure 2-1 illustrates the different types of drilling proposed (i.e. wide spaced & infill drilling). Figure 2-2 provides the current indicative exploration plan for drilling commencement. The drill hole locations provided are indicative only and do not represent drilling activities over the 5 year period, rather they are for illustration purposes of drill hole spacing only.

ALCOA WORLD ALUMINA AUSTRALIA

Figure 2-1: 5 Year Drill Plan

This map is not GDA compliant (Datum: AGD84 Zone 50)

N

1:120,000

0 5 10 15 20 km

Legend

- ML1sa
- Regions
- Indicative Drilling Schedule (Feb - May 2025)

Drill Intensity

- Infill Drilling
- Wide Spaced Drilling
- Infill & Wide Spaced Drilling

Alcoa

Wellbucket
Dale
Beraking East
Victor
Beraking West
Jarrahdale
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
Beryl
Oneil
Oneil East
Duncan
Willard
Mccoy
White
Huntly
Del Park
Holyoake
Teesdale
Antlope
Orion
Hotham
Marradong
East Murray
Arundel
Saddleback
Laregо
Bednall
Cornwall
Leach
Mungalup

30x30 Drill Spacing

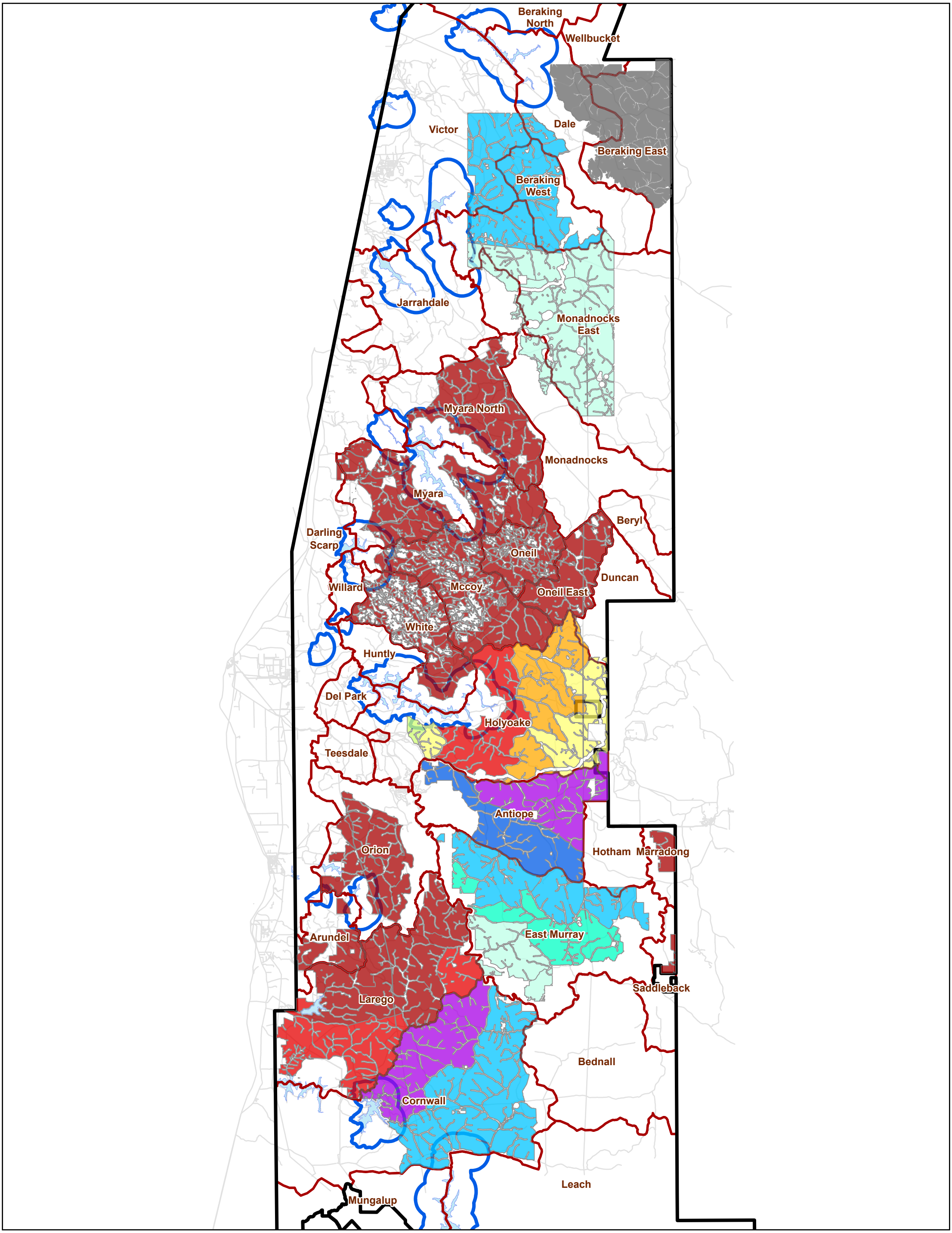
Monadnocks
Oneil East
Duncan

15x15 Drill Spacing

Oneil East
Duncan
Holyoake

60x60 Drill Spacing

Antlope



Legend

In-fill Drilling - Commencement Year
- In Progress
- 2025/2026
- 2026/2027
- 2027/2028
- 2028/2029

Wide Spaced Drilling - Commencement Year
- 2025/2026
- 2026/2027
- 2027/2028
- 2028/2029
- 2029/2030
- >2030

- ML1sa
- Major Dams
- Reservoir Protection Zones (RPZ)
- Regions

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 2-2: Five Year Drill Plan - Year of Drilling Commencement

Scale: 1:380,276

Date Printed: 29/05/2025

2.3 Potential Impacts

The following environmental values have the potential to be impacted from exploration drilling activities:

- Heritage values
- Fauna
- Flora and vegetation
- Water
- Spread of *phytophthora* (dieback).

Alcoa minimises this potential impact through:

- Drilling no more than 105,000[17] drill holes in a calendar year.
- Utilising specially designed drill rigs that are compact (3 meters in width) and self-sufficient, eliminating the need for support trucks (not applicable to rigs covered under section 2.1.2 and 2.1.3).
- Drilling smaller (4.5 cm to 7.5 cm diameter) and shallower (average depth of 6 m) holes than conventional drill rigs (not applicable to rigs covered under section 2.1.2 and 2.1.3).
- Undertaking no direct clearing for drilling.
- Dieback Mapping prior to drilling in areas where dry soil conditions cannot be achieved
- Drilling operations are paused annually during July and August, the wettest months of the year
- Disturbing ground only in the event the smaller custom-built drill rig driving over shrub vegetation.
- Undertaking drilling in minimally vegetated areas, where possible.

2.4 Mitigation

Alcoa's environmental management includes the mitigation hierarchy, consistent with standard environmental risk management principles, in the following order:

- Impact avoidance
- Impact minimisation
- Rehabilitation

As stated above (Section 2.1.1, significant work has been undertaken to develop custom built drill rigs which are more suited to forested areas and allowing for impact minimisation.

[17] As per s6 exemption.

A risk-based approach has been taken to align with Alcoa's environmental management system this includes a risk register for associated mitigation actions (Table 2-2) and a risk assessment methodology (Appendix 2).

During the development of the exploration drilling program, environmental attributes and protected areas are identified (Table 2-1). When preparing Exploration Disturbance Footprints, Geographical Information System (GIS) mapping of environmental constraints is used to identify potential interaction risks, ensuring drill points are planned away from these areas.

Table 2-1: Environmental Constraints Avoided for Exploration Drilling

Environmental Constraints	Environmental Constraints Avoided
Old Growth Forest	Yes
National Parks / Formal Conservation Reserves	Yes
Mining Avoidance Zones associated with Jarrahdale and Dwellingup	Yes
Aboriginal Cultural Heritage Sites	Yes
Serpentine Pipehead Catchment	Yes
Within 1 km of the Top Water Level (TWL) of a public drinking water reservoir[18]	Yes
Areas within 1 - 2 km of all reservoir top water levels (within the RPZs) whereby no further exploration development or supplementary drilling will occur. However, groundwater bore drilling may occur to understand groundwater impacts.	Yes
Avoid features in Constraints layer (including heritage, etc)	Yes
Bibbulmun Track (200 m exclusion zone on either side)	Yes

[18] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

Table 2-2: Exploration and Development Drilling Environmental Risk Assessment

Risk	Description of Impact	Risk Controls	Residual Risk Rating

Drill rigs and support vehicles impact ground vegetation increasing the risk of erosion and turbidity.	Localised erosion and increased turbidity of surface water.	Avoid
		• No exploration drilling [19] within:
		  ○ 1 km of the top water level of any water reservoir.
		  ○ Serpentine Pipehead Dam Catchment.
		  ○ Areas with an average pit slope greater than 16% within any RPZ.
		• No exploration drilling within 100 m of stream vegetation.
		Minimise
		• Groundwater bore installation - utilise small tracked machines where possible.
		• Exploration Drill rigs are designed to minimise impact on vegetation:
		  ○ Good ground clearance
		  ○ Small compact machine
		  ○ Large tyres to minimise compaction
		  ○ 4WD to minimise slippage/wheel spin.
		• Maximise use of and park light vehicles on existing tracks or clearings.
		• Report significant trees or unusual vegetation.
		Rehabilitate
		• Report created tracks that have had high use to assess if additional rehabilitation requirements are required.
		• Report highly disturbed areas to assess if additional rehabilitation requirements are required.
			Low

Damage or harm to / loss of Aboriginal	Non-compliance with Alcoa's Aboriginal Cultural	Avoid • No drilling is undertaken within the standard exclusion zone for Dandalup River.	Low

[19] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
cultural heritage	Heritage Standard (Global Standard) Impact to unidentified Aboriginal cultural heritage	• No drilling is undertaken within the 100 m exclusion zone of the Serpentine River. Minimise • Alcoa's GIS Constraints Layer - which includes heritage survey results and a 10 m non-negotiable exclusion zone on Aboriginal cultural heritage sites. • Training package presented as part of Alcoa's initial training induction to all employees on Aboriginal cultural heritage. • Prior to any proposed drilling activity, on-ground site avoidance surveys are undertaken with knowledge holders for the area(s).	
Damage to / loss of European heritage sites	Impact to unidentified European heritage site	Minimise • Desktop reviews of European heritage • Drilling program designed to avoid European heritage sites. • Consultation with stakeholders prior to disturbance and development of a European Heritage Management Plan will be considered	Low
Loss of fauna due to entrapment	Direct loss of, or injury to, individual fauna	Minimise • New exploration drilling holes will be appropriately backfilled, capped or plugged immediately after drilling	Low
Direct impact to conservation significant fauna habitat		Avoid • Implementation of Exploration Avoidance Zones as per the Fauna Management Plan (FMP) (Appendix 6) for: ○ DBCA Old growth forest ○ National Park, formal conservation reserves ○ Biologically diverse areas such as major granite outcrops (>1 ha + 50 m buffer). ○ Black Cockatoo nest trees and significant trees[20] as per FMP (Appendix 6).	Low

[20] Within 10 m of a Black Cockatoo nesting tree or a Black Cockatoo significant tree or; on or after 1 January 2027 within 50 m of a Black Cockatoo nesting tree (in accordance with the Compliance Assessment Plan prepared in accordance with Clause 9 of SL 2023/200), as per 2023-2027 MMP Ministerial Approval Condition 5. If clearing within 50 m of a Black Cockatoo nest tree, a report is required as per 2023-2027 MMP Ministerial Approval Condition 4.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• No exploration drilling holes are undertaken within mapped or derived (i.e. in the absence of vegetation mapping) streamzone vegetation (excluding any requirement/s for drilling for bores or geological investigation). • Phase 1 targeted Black Cockatoo critical habitat surveys are conducted in all designated survey polygons prior to drilling. Black Cockatoo consultants record locations of suspected nest, significant trees, and GPS track logs. Exploration Field Technicians re-survey the recorded suspected nest and significant trees using a differential GPS. Drilling workpacks are adjusted to ensure that all drill holes are surveyed and at least a 10 m Mining Avoidance Zone is applied around all identified Black Cockatoo Nest and Significant trees.	
Increase in feral predator populations as a result of exploration drilling activities	Direct loss of, or injury to, individual fauna Competition of food resources Destruction of habitats	Minimise • Any food brought to exploration areas will be stored in containers with secure lids and food wastes will be bagged and appropriately disposed off-site. • Fauna will not be fed or interacted with. • No domestic animals / pets are to be brought on site. • Sightings of feral animals within exploration areas to be recorded by all personnel (Alcoa/contractors) for improved feral animal movement, location and understanding and to inform additional feral animal monitoring.	Low

Direct loss of conservation significant vegetation, communities and flora individuals from clearing	Significant impacts to conservation significant flora populations, vegetation or communities as a result of clearing activities
	
	Impact to threatened flora individuals or communities without regulatory consultation and appropriate approvals
		Avoid
		• Implementation of Exploration Avoidance Zones for:
		  ○ DBCA Old growth forest
		  ○ 200 m exclusion zone from reservoir top water level (OCA1)
		  ○ National Park, formal conservation reserves
		  ○ Bibbulmun Track
		Minimise
		• Custom build drill rigs to suit forested areas.
		• Spatial data of conservation significant flora and communities retained and review as Ground Disturbance Procedure to ensure clearing impacts are not significant.
		• Training for all personnel around requirements for licences to handle/remove flora
			Low

Risk	Description of Impact	Risk Controls	Residual Risk Rating

Loss of containment (hydrocarbons, oils and lubricants, hydraulic fluids) from drill rigs or other vehicles.	Localised contamination of surface water and/or groundwater
	
	Cumulative contamination of surface water and/or groundwater
	
	Localised contamination of PDWSA
		Avoid
		• Implementation of Exploration Avoidance Zones for:
		  ○ 200 m exclusion zone from reservoir top water level (OCA1)
		  ○ 1 km exclusion zone from the top water level of any reservoir
		  ○ Serpentine Pipehead Dam Catchment[21]
		Minimise
		• Custom build drill rigs to suit forested areas.
		• Maintenance programs & pre-start checks.
		• Re-fuelling procedure
		• Personnel inductions / training - LOC and spill response
		• Drill rigs chemical approval process.
		• Authority to proceed procedure for contractors.
		• Regular audits & inspections
		• Spill kits and spill remediation equipment kept on hand.
		• Emergency response team and procedure
		Rehabilitate
		• Spill kits and spill remediation equipment kept accessible.
		• Emergency response team and procedure.
		• Remediation Validation Procedure.
			Low

Risk of bacterial contamination of groundwater	Localised contamination of surface water and/or groundwater.	Avoid • Implementation of Exploration Avoidance Zones for:	Low

[21] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
and/or surface water as a result of human pathogens.	Localised contamination of PDWSA	○ 200 m exclusion zone from reservoir top water level (OCA1) ○ 1 km exclusion zone from the top water level of any reservoir ○ Serpentine Pipehead Dam Catchment[22] Minimise • Where practicable, personnel should use designated ablution block facilities, if this is not possible then biological waste must be bagged and disposed of at a designated disposal location outside of the RPZ. • Reservoir Protection Zone Management Plan (AUACDS-2053-5554) • Fit for work policy includes restriction to RPZ for personnel with gastrointestinal symptoms. • Minimise worker access in stream zones. • Worker training and awareness around hygiene practises within the RPZ.	
Spread of *Phytophthora cinnamomi* (Dieback)	Exploration drilling may facilitate the spread of dieback resulting in increased disease incidence that negatively impacts conservation significant flora and associated ecosystems	Avoid • Drilling conducted only under dry soil conditions when dieback mapping is unavailable or outdated • Drilling in dieback high-risk areas during wet or moist soil periods will not occur, unless current (< 12 months old) dieback mapping confirms safe conditions • Drilling not undertaken during the wettest months (typically July and August) by enforcing an 8-week drilling break Minimise • Maintain a continuous, year-round dieback mapping program and ensure that mapping data remains current (< 12 months old) to inform drilling operations • Plan drilling activities so that rigs are consistently positioned within one dieback classification (i.e. dieback free or dieback) for the duration of the weather period • Drill rigs are not moved between areas with different dieback classifications without proper cleaning, minimising cross-contamination	Low

[22] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Ensure that rigs are inspected and thoroughly cleaned prior to entry and when moving into dieback free or uninterpretable zones • Active dieback edges are assessed for changes, along with assessments of dieback free forest areas, to detect any new spot infections • Clean downs for equipment are recorded in registers to ensure traceability and compliance with hygiene protocols • Opportunistic visual observations during activities are conducted to monitor dieback status	

2.4.1 Public Drinking Water Source Areas (PDWSA)

The Exploration Disturbance Footprint intersects Priority 1 Public Drinking Water Source Areas (PDWSA). While drilling activities occur in these catchments, activities involve minimal disturbance and, therefore, pose minimal risk of turbidity impacts.

DEMIRS has previously requested Alcoa plug all drill holes 400 mm beneath the surface then fill to ground level. However, drilling primarily occurs in the laterite making digging to a depth of 400 mm unfeasible due to the presence of caprock.

To avoid the accumulation of surface water, the existing procedure involves inserting a rock approximately 400 mm deep into the small diameter drill holes. The hole is then backfilled with drill hole sample material. This material is then levelled with the ground surface and covered with soil.

2.4.2 Vegetation Impacts

Exploration drilling activities aim to minimise impacts on vegetation disturbance (Section 2.3) and drill rigs are equipped with GPS navigation systems that show constraints (such as dieback) and hazard information to the drillers, allowing for minimal disturbance to the environment.

Drilling activities are managed in accordance with Alcoa/Department of Environment and Conservation[23] Working Arrangements 2015, and associated limitations on vegetation disturbance (i.e. tree diameter), soil disturbance, and dieback management procedures. Where small supplementary drill activities occur (i.e., diamond drilling), minor variations to the working arrangements are sought on a case-by-case basis.

In areas where flora field surveys have not taken place, desktop assessments are completed to identify Threatened (T) or Priority (P) Flora taxa, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) that may occur within the proposed drilling areas. Threatened species and TECs are avoided, ensuring no direct impact. If any of these values are encountered during exploration activities, those areas are excluded from drilling through the GDP process, with drill holes removed before the permit is approved.

Alcoa takes a strategic and proactive approach to managing *Phytophthora cinnamomi* (dieback) risks and minimising impacts on conservation values and significant flora during exploration activities. There is a continuous dieback mapping program that covers requirements for drilling and mining related activities. All mapping and samples collected by the accredited contractor, are shared with DBCA to support broader environmental management efforts. This collaborative approach demonstrates our commitment to maintaining up-to-date dieback information and ensuring responsible operations that safeguard conservation values and significant flora populations.

2.4.3 Fauna

To prevent fauna injury and entrapment in open drill holes, all drill holes are capped as per Section 2.4.1.

[23] Department of Environment and Conservation has become DBCA.

Alcoa's procedures require that a Phase 1 Black Cockatoo Habitat survey be conducted over all planned exploration drilling and groundwater bore hole sites, prior to drilling. This survey aims to identify Black Cockatoo Nest and Significant trees. If identified, at least a 10 m Mining Avoidance Zone is applied around any tree classified as suspected or confirmed Nest or Significant tree.

2.4.4 Phytophthora (Dieback)

Exploration drilling has the potential to spread *Phytophthor*a Dieback. Dieback mapping is carried out over a significant proportion of planned drilling areas to minimise the risk of spread of dieback.

Where dieback mapping has been undertaken, cleaning of drill rigs on entry of areas and between drill holes, and the preferencing of dieback infested areas for drilling during the wetter periods at the start and end of the season are the main dieback control measures.

Where dieback mapping has not been undertaken prior to exploration drilling, drilling can only occur under dry soil conditions as outlined in the working arrangements. Dieback management is central to all drill plan scheduling and an agreed set of operational controls are used to prevent dieback spread.

Scheduling of drilling for wet or moist soil periods generally prioritises areas with a high prevalence of dieback (e.g. Larego). In known dieback "infested" areas, no regular mapping is required as dieback remains persistent once established. Where there is a mix of dieback free, uninterpretable, unmapped zones within the predominantly dieback region, we conduct detailed dieback mapping at the beginning of the season. We then target drilling in the dieback-free and uninterpretable zones for dry weather.

In contrast, for areas that are predominantly dieback free or Disease Risk Areas (DRA), such as parts of Holyoake (managed by DBCA to limit public access during wet periods), we adopt stringent measures:

- Drilling is only conducted under dry soil conditions to prevent soil movement.
- The forest floor must have adequate leaf litter and be free of significant soil moisture.

For all other areas, comprehensive dieback mapping is undertaken in advance of drilling. This ensures we can continue operations safely during changing conditions, as we have clear delineation of dieback boundaries and pre-established washdown points to mitigate the risk of spreading the disease.

3 Mining Cycle Planning

3.1 Ore Bodies and mining cycle sequence

Bauxite occurs as tabular ore pods that vary in depth from 2 – 10 m with an average depth of about 3.5 m. The ore is overlayed with gravel and soils varying in depth from 0 – 1.5 m. The upper part of the ore frequently presents as cemented caprock, ranging in thickness from 0 – 2.5 m. Beneath the caprock is a friable zone that merges into clay and uneconomic quantities of alumina.

Due to the nature of the ore pods, the mine is characterised by a constantly moving mining footprint followed by progressive rehabilitation. The mine consists of a mosaic of shallow mine pits, located within the ore pods, linked via a network of haul roads to a centrally located crusher and facilities area. The mining sequence is illustrated in Figure 3-1 and described below.

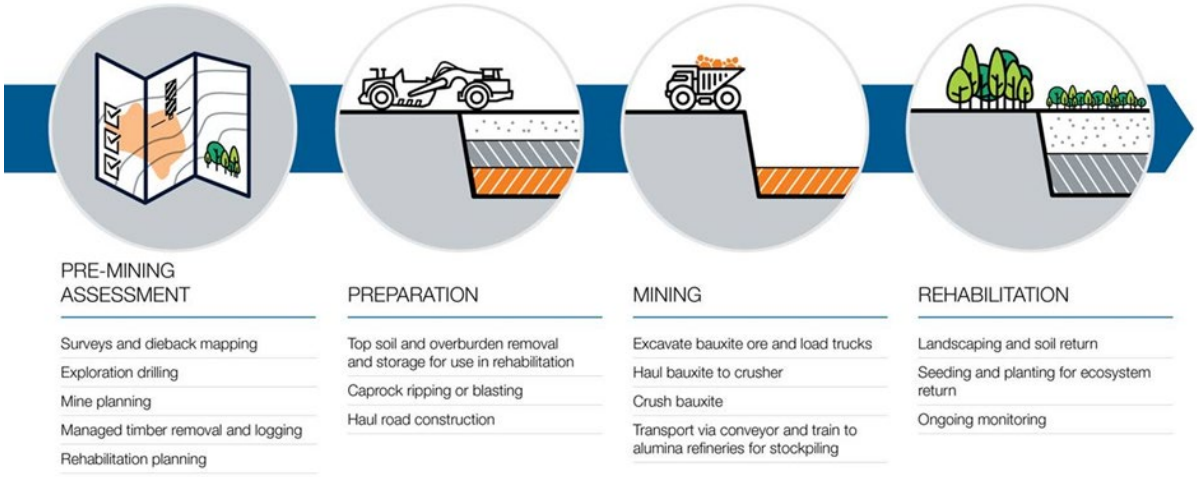


Figure 3-1: Mining cycle sequence

3.1.1 Pre-mining assessment

Pre-mining surveys

Before the mine development phase, Alcoa undertakes surveys to:

- Protect or manage important environmental, cultural heritage and social values.
- Identify constraints.
- Inform mine plan development.
- Facilitate characterisation of ore quality and volumes.
- Assess geotechnical conditions.

The results of the surveys and exploration activities (Section 2) are also used to inform mine planning, including scheduling of mine pits and infrastructure, clearing planning, soil movement, and dieback management activities.

Surveys include:

- Vegetation mapping - to delineate Havel vegetation community types, ensure clearing does not have cumulative impacts on underrepresented species assemblages and identify critical habitat for known threatened species.
- Establishment of forest reference vegetation monitoring plots - for representative comparison with post-mining rehabilitation. Mean species richness of forest reference sites is utilised to measure the effectiveness of rehabilitation.
- Pre-clearance Black cockatoo surveys - to locate trees that will be protected from disturbance, to minimise impact on these species. All nest trees and significant trees are conserved with a Mining Avoidance Zone (at a minimum 30 m excepting critical infrastructure, exploration, rehabilitation and groundwater bores and up to 50 m[24]) wherever they occur in the landscape. Habitat trees are conserved on haul road alignments, where the alignment can be adjusted to avoid these trees.
- Pre-clearance Targeted Flora and Fauna surveys – to identify any conservation significant species requiring avoidance.
- Assessment of *Phytophthora* dieback - to inform activities which may cause soil disturbance, to manage dieback soils and prevent contamination of dieback free areas. This data is also utilised in soil movement and rehabilitation planning.
- Baseline hydrology and hydrogeological data acquisition - to inform detailed design of mine pit and infrastructure (Section 7.3).

Utilising survey data, Alcoa applies avoidance measures to its mining operations to protect environmental and social values, as detailed in Table 3-1. The avoidance measures include:

- Mining Avoidance Zones (MAZs) whereby pits and infrastructure are prohibited, with the exception of monitoring and management activities
- Limited Disturbance Areas (LDAs) whereby mine pits are prohibited, but allows for infrastructure and haul roads

The current MAZs and LDAs for Huntly and Willowdale for this MMP 5 year mine plan are shown in Figure 3-2 and Figure 3-4, respectively. Alcoa is not seeking approval from the Minister to mine in these areas. It should be noted that MAZs and LDAs may change as a result of further survey information, however future MMP and FCA submissions will include the current version of the avoidance measures. Spatial data is provided as per Section 11.

[24] 2023-2027 MMP Ministerial Approval Condition 5 stipulated within 10 m of a Black Cockatoo nesting tree or a Black Cockatoo significant tree or; on or after 1 January 2027 within 50 m of a Black Cockatoo nesting tree (in accordance with the Compliance Assessment Plan prepared in accordance with Clause 9 of s6 exemption. If clearing within 50 m of a Black Cockatoo nest tree, a report is required as per 2023-2027 MMP Ministerial Approval Condition 4.

Table 3-1: Environmental avoidance measures

Environmental Value	Avoidance Measure applied
Granite outcrops >1 ha +50 m buffer	Limited Disturbance Area
Areas within the RPZ with an average slope greater than 16% (except rehabilitation, monitoring, drainage controls and use/maintenance of existing infrastructure)	Limited Disturbance Area
1 km of the top water level of any water reservoir (except rehabilitation, monitoring, drainage controls and use/maintenance of existing infrastructure)	Limited Disturbance Area
Bibbulmun Track	Limited Disturbance Area – as future infrastructure may be required to ensure uninterrupted access occurs (as per Recreational Trails and Facilities Management Plan)
OCA1	Limited Disturbance Area
Stream zone vegetation (100 m buffer)	Limited Disturbance Area
National Parks	Mining Avoidance Zone[25]
Formal Conservation Reserves	Mining Avoidance Zone[24]
Portions of Lane Poole Recreation Reserve	Mining Avoidance Zone
Jarrahdale & Dwellingup Townsite	Mining Avoidance Zone
Yamba Catchment	Mining Avoidance Zone
Old Growth Forest	Mining Avoidance Zone
Threatened flora	Mining Avoidance Zone
Threatened Ecological Communities	Mining Avoidance Zone
Black Cockatoo nest and significant trees	Mining Avoidance Zone
Black Cockatoo Protection Zone	Mining Avoidance Zone
Identified active breeding Chuditch dens	Mining Avoidance Zone
Known Woylie populations	Mining Avoidance Zone

[25] Under Clause 9A of the *Alumina Refinery Agreement Act 1961* Alcoa has access rights in a conservation area to construct, use and operate railways, roads, conveyors or pipelines in connection with its mining operations (subject to consulting with the Conservation Commission). Notwithstanding these provisions, Alcoa has no plans for access into these areas over the life of this MMP.

Environmental Value	Avoidance Measure applied
Serpentine Pipehead Catchment (excludes rehabilitation activities)	Mining Avoidance Zone
Aboriginal Cultural Heritage Sites	Mining Avoidance Zone – unless appropriate consultation and approval occurs.
European Heritage Sites	Mining Avoidance Zone – unless appropriate consultation and approval occurs.
Operational noise >35 dB(A)L10	Mining Sensitivity Zone (refer to Section xxx)

Jarrahdale Townsite

National Parks

Serpentine Pipehead Dam Catchment

Black Cockatoo Protection Zones

Dwellingup Townsite

Legend

Proposed Clearing Schedule

Rehabilitation

Cleared Areas

Mining Avoidance Zones

Aboriginal Heritage Site

Black Cockatoo Protection Zones

Black Cockatoo Trees

Conservation Parks

Dwellingup Townsite

European Heritage Site

Jarrahdale Townsite

Yamba Catchment

National Parks

Nature Reserves

Old Growth Forest

Serpentine Pipehead Dam Catchment

Threatened Fauna Populations

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-2: Mining Avoidance Zones - Huntly

Scale: 1:117,791

Date Printed: 16/05/2025

Legend

- Proposed Clearing Schedule
- Rehabilitation
- Cleared Areas
- Limited Disturbance Areas
- Bibbulmun Track
- Rock Outcrops >1ha & 50 m Buffer
- Streamzone Vegetation & 100 m Buffer
- Top Water Line 1km Buffer
- Top Water Line 200m Buffer (OCA1)

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-3: Limited Disturbance Areas - Huntly

Scale: 1:117,791

Date Printed: 16/05/2025

Dwellingup Townsite

Lane Poole Recreation Reserve Portions

Black Cockatoo Protection Zones

Legend

Proposed Clearing Schedule
Cleared Areas
Rehabilitation

Mining Avoidance Zones
Aboriginal Heritage Site
Black Cockatoo Protection Zones
Black Cockatoo Trees
Conservation Parks
Dwellingup Townsite
European Heritage Site
Lane Poole Recreation Reserve
Nature Reserves
Old Growth Forest
Threatened Ecological Communities

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-4: Mining Avoidance Zones - Willowdale

Scale: 1:72,075

Date Printed: 16/05/2025

Legend

- Proposed Clearing Schedule
- Cleared Areas
- Rehabilitation

Limited Disturbance Areas

- Bibbulmun Track
- Rock Outcrops >1ha & 50 m Buffer
- Streamzone Vegetation & 100 m Buffer
- Top Water Line 1km Buffer
- Top Water Line 200m Buffer (OCA1)

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-5: Limited Disturbance Areas - Willowdale

Scale: 1:72,075

Date Printed: 16/05/2025

3.1.2 Preparation

3.1.2.1 Timber Harvesting and clearing

The FPC is a government trading enterprise established to develop and market Western Australia's renewable timber resources. It operates as an autonomous commercial entity, governed by an independent Board of Commissioners and accountable to the Western Australian Government through the Minister for Forestry.

Before Alcoa begins mining in a new area, the State reserves the right to any marketable timber or other wood products from that area. Alcoa harvests these areas and coordinates with the FPC for product removal following harvest.

Wood salvaged from mine site clearing contributes to local manufacturing..

3.1.2.2 Soil removal

Soil is stripped in two layers including a surface layer of topsoil (~ 150 mm) and a thicker layer (average 400 mm) of overburden.

The topsoil, rich in seeds, organic matter, plant nutrients, and microbial activity, is a vital asset for rehabilitation. The topsoil for direct return is stripped to 75 mm to avoid diluting the seed resource that is concentrated within the top 50-75 mm of the topsoil. This process involves stripping from an area that is about to be mined and returning the soil to an area that is being rehabilitated within three months.

This avoids long term storage in a stockpile, which can cause degradation of the biological components of the topsoil. When topsoil is stockpiled for more than three months, it is stripped to a depth of 150 mm before being used in rehabilitation.

The overburden, which extends to the top of the cemented caprock layer, is stockpiled next to the mined area to be returned to the pit floor during rehabilitation.

3.1.3 Mining

The bauxite ore deposit that frequently presents as cemented caprock is broken either by blasting using conventional Ammonium Nitrate - Fuel Oil (ANFO) explosives, or by ripping with a large bulldozer.

The broken cemented caprock and the underlying friable bauxite are removed by excavators and loaded on haul trucks. The mining fleet is diesel fuelled and includes excavators, loaders, trucks, and earthmoving equipment.

The bauxite is trucked via a network of haul roads to Run of Mine (ROM) pads for primary and secondary crushing. The crushed ore is transported via a conveyor to stockpiles at the Pinjarra or Wagerup Refinery.

3.1.4 Rehabilitation

Alcoa's mine rehabilitation implementation is discussed in depth in Section 3.3.

3.2 Mine Planning

Alcoa's full cycle mine planning process starts with the exploration drilling program. As drilling progresses, the 10 Year Mine Plan is further refined on an annual basis.

The 10 Year Mine Plan provides the directional sequence of mining, and subsequent rehabilitation within mining regions and informs the progressive move to future mine regions.

The 10 Year Mine Plan cascades into a 5 Year Mine Plan, which details the quarterly mining sequence, developed to deliver key requirements (such as bauxite grade targets). The 5 Year Plan includes detailed clearing, mine pit designs and subsequent rehabilitation designs, incorporating seasonality and associated constraints, resources, and equipment productivity.

Year Mine Plans further cascade into plans focused on daily, weekly, and monthly production planning to support mining and refinery requirements, and manage and adapt to daily issues while maintaining alignment with longer term plans.

The proposed clearing areas (Clearing Schedule) included in the MMP are conceptual clearing footprints and the entire area will not be cleared. However, all clearing will be contained within the Clearing Schedule (similar to a Development or Disturbance Envelope detailed in Mining Act or EP Act approvals).

3.2.1 10 Year Mine Plan

The 10 Year Mine Plan (Figure 3-2 and Figure 3-3) includes current mining and rehabilitated areas. The initial five years of the 10 Year Mine Plan mirrors the content of this MMP and includes areas approved by previous MMPs and endorsed under previous FCAs. The last five years of the 10 Year Mine Plan is provisional and subject to change as more data is obtained through exploration drilling, mine cycle planning, and environmental studies. These areas are included for context only and are not part of this MMP, especially as some of the areas will be evaluated and approved under Part IV of the EP Act (Assessment 2253 or any future Part IV EP Act referrals).

Assessment 2253 and any future Part IV EP Act referral is currently under assessment and the development timing of these areas, in addition to the ongoing operational needs of the business, may have implications for the 10 Year Mine Plan. These areas are not intended to be authorised under the Clearing Exemption Order 2004, as they will be authorised under Part IV of the EP Act.

Jarrahdale
Towns
Monadnocks East
Myara North
Monadnocks
Myara
Beryl
Darling Scarp
O'Neil
Willard
McCoy
Duncan
White
Huntly
Del Park
Holyoake
Teesdale
Amphion
Orion

Legend

- Mining Regions
- Conceptual clearing buffer
- FCA Endorsed
- FCA Relinquished
- Five years clearing schedule
  - MMP
  - EPA Assessment 2253[1]
- Indicative Mine Plan (Years 6-10)
  - EPA Assessment 2253[1]
- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams

1 - Excluded from BSEC endorsement

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-6: Ten Year Mine Plan - Huntly

Scale: 1:135,000

Date Printed: 2/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Laregо
Cornwall

Legend

- Mining Regions
- FCA Endorsed
- FCA Relinquished

Five years clearing schedule
- MMP
- Future Part IV EP Act Referral[1]

Indicative Mine Plan (Years 6-10)
- MMP
- Future Part IV EP Act Referral[1]

- Rehabilitation
- Cleared Areas
- Major Dams

1 - Excluded from BSEC endorsement

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-7: Ten Year Mine Plan - Willowdale

Scale: 1:90,000

Date Printed: 7/10/2024

3.2.2 24 Month Clearing Schedule

The 24 Month Clearing Schedules (Table 3-3, Figure 3-4 and Figure 3-5) consist of conceptual clearing areas which represent the maximum proposed boundaries for clearing native vegetation to establish mine pits and infrastructure. The Clearing Schedule included in the MMP contains conceptual clearing footprints and the entire area will not be cleared. However, all clearing will be contained within the Clearing Schedule (similar to a Development or Disturbance Envelope detailed in Mining Act or EP Act approvals).

The actual cleared areas are typically smaller than the conceptual areas, with the actual disturbance averaging 85% of the conceptual areas. This is due to:

- Conceptual clearing areas are refined into detailed clearing areas based on further engineering designs, which are contained within the conceptual boundaries.
- Conceptual clearing areas including:
    - Approximately 100 m width for haul road in areas where detailed designs and pre-clearance surveys are required. The detailed design final haul road is expected to be approximately 40 m wide.
    - A 15 m clearing buffer for conceptual and detailed pits, and infrastructure, which is not expected to be impacted.
- Detailed pit design typically resulting in a smaller footprint of minable ore compared to the conceptual clearing shapes, which only consider the top of the "ore surface".
- Inclusion of additional space for contingencies, such as parcels not approved during the FCA process or the need to avoid specific areas (like a black cockatoo nest or significant tree) based on new information.

An environmental impact assessment is included within this MMP to assess the maximum proposed boundaries (24 Month Clearing Schedule) of potential impacts from the associated clearing and activities.

Actual clearing is limited to 800 ha of native vegetation per calendar year[26] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[27]. This MMP includes 425 ha of unused capacity expected from 2024 (Table 3-2), which is requested to be rolled over into subsequent years for clearing.

[26] 2023-2027 MMP Ministerial Approval Condition 9.
[27] 2023-2027 MMP Ministerial Approval Condition 10.

Table 3-2: Actual clearing expected

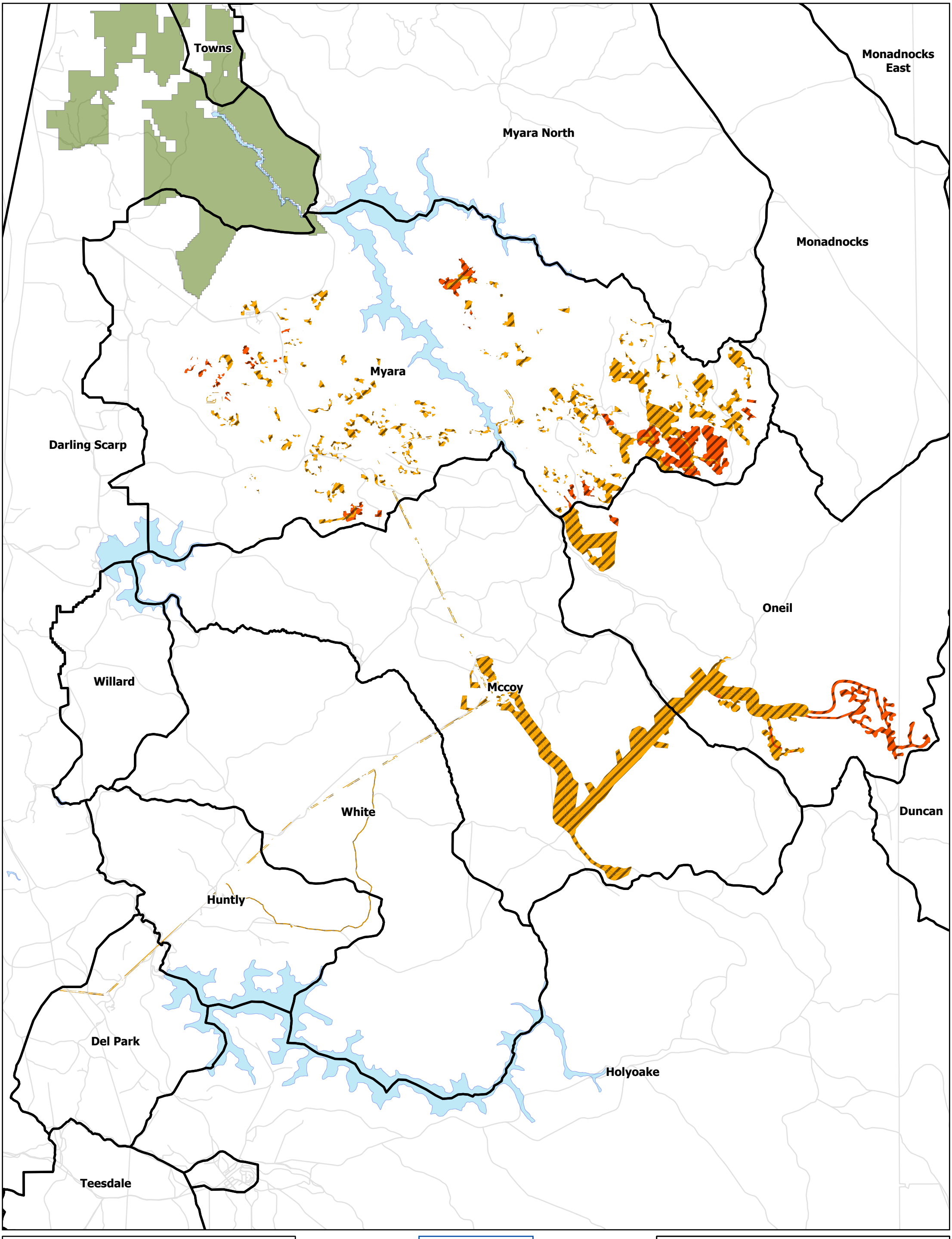
Clearing Type	Year		
	2024	2025	2026
Clearing cap (Huntly & Willowdale combined) [28] (ha)	408	800	800
Clearing cap – unused capacity to be rolled over to subsequent years (Huntly & Willowdale combined)[29] (ha)	-	392	

Table 3-3: 24 Month Clearing Schedule

Region and Proposed Clearing	2025	2026	Total
Huntly			
Conceptual Clearing Buffer (ha)	706	2	708
Ore (ha)	956	492	1,448
Mine plan infrastructure - stockpiles, haul roads, supporting infrastructure (ha)	674	101	775
Huntly Total (ha)	**2,336**	**595**	**2,931**
Willowdale			
Ore (ha)	461	195	656
Mine plan infrastructure - stockpiles, haul roads, supporting infrastructure (ha)	342	49	391
Willowdale Total (ha)	**803**	**244**	**1,047**
Grand Total (ha)	**3,139**	**839**	**3,979**

[28] Clearing cap applies to actual MMP-approved native vegetation clearing

[29] Clearing cap applies to actual MMP-approved native vegetation clearing and any surplus native vegetation clearing from one year may roll over into subsequent year, following approval from the Minister for State Development as part of this MMP submission



Legend

- Mining Regions
- National Parks
- Major Dams

Proposed Clearing Schedule

- 2025
- 2026

Alcoa

0 1 2 4 km

N

2025 - 2029 Mining and Management Plan

Figure 3-8: Huntly Proposed clearing – 24 Month Clearing Schedule

Scale: 1:115,000

Date Printed: 7/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

Mining Regions
Major Dams
Proposed Clearing Schedule
2025
2026

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-9: Willowdale Proposed clearing – 24 Month Clearing Schedule

Scale: 1:75,000

Date Printed: 9/10/2024

3.2.3 5 Year Mine Plan

A 5 Year Mine Plan has been developed for Huntly and Willowdale regions, which includes:

- the 24 Month Clearing Schedule;
- the three subsequent years (2027 – 2029) Clearing Schedule;
- previously FCA endorsed areas (Section 3.2.4.1);
- open areas; and
- rehabilitated areas.

Future mine plans will be predominately focussed on the Myara and O'Neil regions, with some potential pits within McCoy (Figure 3-10) for Huntly. The Larego mine region will make up the majority of the Willowdale region. Portions of the Five Year Mine Plan are covered by the s6 exemption (Figure 1-2). Subject to receipt of approvals under EP Act Part IV Assessment 2253, Huntly Bauxite mine operations will transition to Myara North and Holyoake in the coming years.

The Huntly mine plan (Table 3-2 and Figure 3-10) shows the associated disturbance which provides the bauxite volumes that will support the Pinjarra refinery to operate within the approved alumina production limits. The mine plan reflects the following amendments implemented in the 2023-2027 MMP and recent operational decisions, including:

- Kwinana refinery curtailment from 2024.
- Reduced ore grade cut-off limits, resulting in some increase in pit depths and width (subject to design and groundwater avoidance criteria).
- No clearing or mining[30] within:
  - 1 km of the top water level of any water reservoir.
  - Serpentine Pipehead Dam Catchment
  - Areas with an average pit slope greater than 16% within any RPZ
  - 10 m of Black Cockatoo nest or significant trees
- Prioritisation of rehabilitation within the Serpentine Dam RPZ.
- Prioritisation of clearing outside the RPZ through re-entry to O'Neil mine region.

MMP-related clearing of native vegetation will be limited to 800 ha per calendar year[31], considering:

- The 800 ha cap has been determined by the average annual rehabilitation rate over the 2023-2027 MMP. The intent is that no net increase of open areas will occur because of MMP-related clearing.

[30] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption).

[31] 2023-2027 MMP Ministerial Approval Condition 9.

- The cap is based on actual native vegetation clearing, which will be reported in annual environmental reports.
- The MMP and FCA submissions will include greater than 800 ha of native vegetation clearing per year, to allow for operational flexibility. However, actual native vegetation clearing will not exceed 800 ha.
- Unused capacity from the cap may be rolled over into the following year if approved by the Minister for State Development as part of any subsequent MMP submission.

Table 3-4: Bauxite Volumes for Huntly 5 Year Mine Plan[32] (Wet tonnes in brackets)

Key Activities	2025	2026	2027	2028	2029
Huntly total tonnes X 10^6	17.3 (19.0)	17.3 (19.0)	17.3 (19.0)	17.3 (19.0)	17.3 (19.0)
Pinjarra Refinery tonnes X 10^6	17.3 (19.0)	17.3 (19.0)	17.3 (19.0)	17.3 (19.0)	17.3 (19.0)

The Willowdale mine plan (Table 3-5 and Figure 3-11) shows the associated clearing which provides the bauxite volumes that will support the Wagerup Refinery to operate within the approved alumina production limits.

Table 3-5: Bauxite Volumes for Willowdale 5 Year Mine Plan (Wet tonnes in brackets)

Key Activities	2025	2026	2027	2028	2029
Willowdale total tonnes X 10^6	10.5(11.5)	10.5(11.5)	10.5(11.5)	10.5(11.5)	10.5(11.5)
Wagerup Refinery tonnes X 10^6	10.5(11.5)	10.5(11.5)	10.5(11.5)	10.5(11.5)	**0B**10.5(11.5)

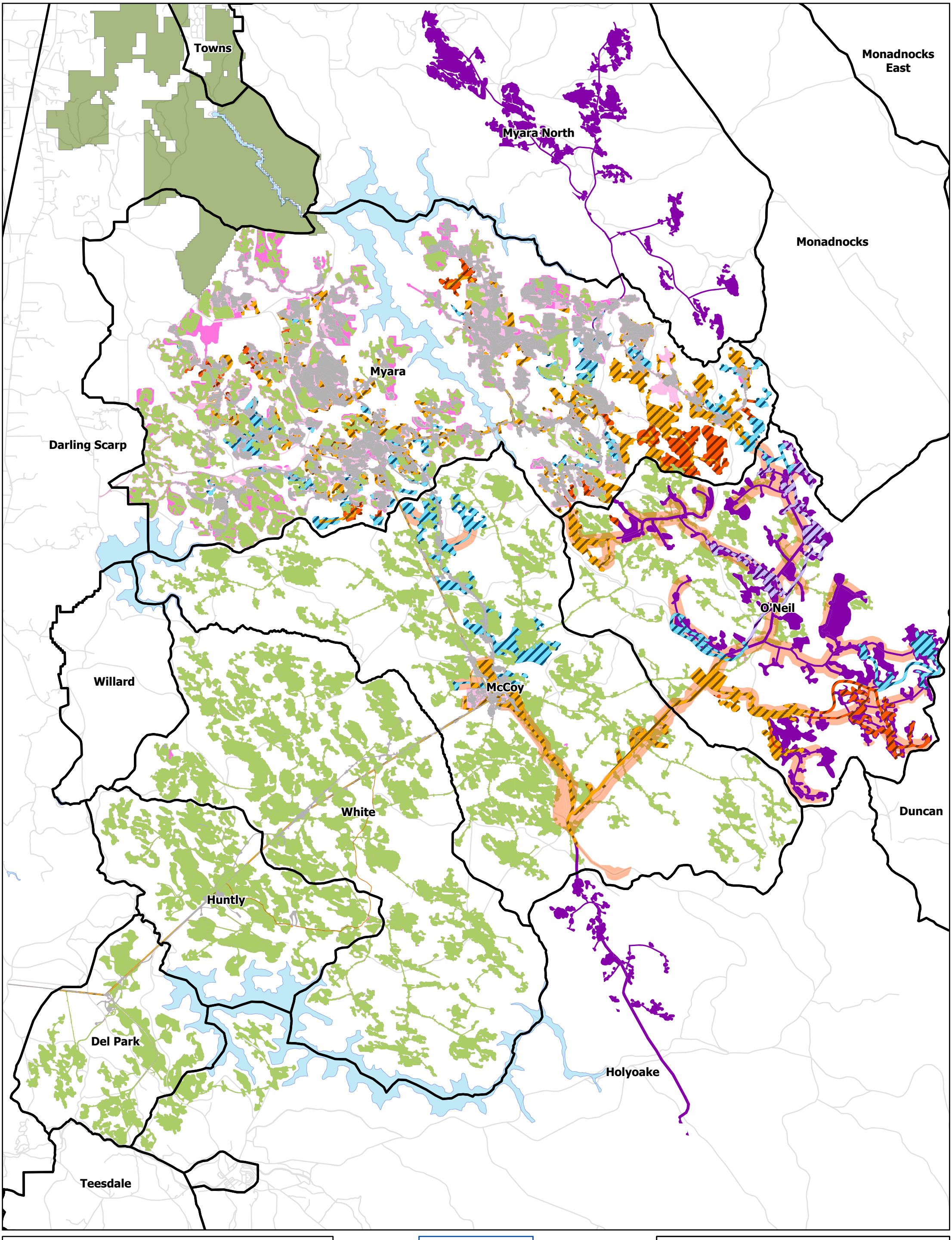
The proposed conceptual Clearing Schedule for the Five Year Mine Plan for both Huntly and Willowdale regions (Table 3-6), excludes any clearing included in the Assessment 2253 or future Part IV EP Act referrals. Assessment 2253 and any future Part IV EP Act referrals are not intended to be authorised under the Clearing Exemption Order 2004, as they will be authorised under Part IV of the EP Act.

The 5 Year Mine plan provides additional clearing due to the uncertainty of the Assessment 2253 approval timeframe. The transition to Myara North will be determined by the Myara mine plan and Assessment 2253 timeframe.

[32] Curtailment of the Kwinana refinery curtailment was announced on 9 January 2024. Alcoa continues to consider a broad range of options for the long term future of the refinery and any potential recommencement will consider a range of factors, such as approvals, market conditions, capital cost and resources along with the needs and aspirations of external stakeholders. Potential production could be 6.8 x 10^6 tonnes

Table 3-6: Year 3 to year 5 - Conceptual Clearing Schedule

Region and Proposed Clearing	2027	2028	2029	Total (ha)
Huntly				
Ore	927	153	0	1,080
Mine plan infrastructure - stockpiles, haul roads, supporting infrastructure	149	119	0	268
Huntly Total (ha)	**1,076**	**272**	0	**1,384**
Willowdale				
Ore	299	231	236	766
Mine plan infrastructure - stockpiles, haul roads, supporting infrastructure	83	17	52	152
Willowdale Total (ha)	**382**	**248**	**288**	**918**
Grand Total (ha)	**1,458**	**520**	**288**	**2,266**



Legend

- Mining Regions
- EPA Assessment 2253[1]
- FCA Endorsed
- FCA Relinquished
- Conceptual clearing buffer

Proposed Clearing Schedule

- 2025
- 2026
- 2027
- 2028

- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams

1 - Excluded from BSEC endorsement

Alcoa

0 1 2 4 km

N

2025 - 2029 Mining and Management Plan

Figure 3-10: Huntly Proposed clearing – Five Year Mine Plan

Scale: 1:115,000

Date Printed: 2/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

- Mining Regions
- FCA Endorsed
- Proposed Clearing Schedule
  - 2025
  - 2026
  - 2027
  - 2028
  - 2029
- Future EPA Referral[1]
- Rehabilitation
- Cleared Areas
- Major Dams

1 - Excluded from BSEC endorsement

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-11: Willowdale Proposed Clearing – Five Year Mine Plan

Scale: 1:75,000

Date Printed: 10/03/2025

3.2.4 Ongoing operations

Ongoing operations includes clearing of FCA endorsed areas, utilisation of open areas and rehabilitation management and monitoring. In addition, Alcoa is committed to the following compliance monitoring and reporting to provide transparency over clearing activities:

- Provision of a register of previously FCA endorsed areas which have not been cleared, to allow transparency over clearing timeframes. The previously FCA endorsed register will include the following information:
    - FCA notice number details
    - Clearing Purpose
    - Indicative clearing timeframe
    - Justification for clearing
- Provision of a monthly report which details:
    - Clearing completed at Huntly and Willowdale Mines in the previous specified month (areas and spatial data)
    - Portion of annual clearing limit (800 ha) utilised
    - Clearing proposed to be undertaken at Huntly and Willowdale Mines during two calendar month following the specified month
    - Associated FCA clearing approval date, notice number and FCA number
    - Total clearing (open areas and rehabilitation) to date within associated sub-catchment and public drinking water catchments

  It is proposed that the monthly clearing report is provided not later than 15 days after the end of the specified month.

3.2.4.1 FCA Endorsed Areas

Huntly and Willowdale have 827 ha and 747 ha, respectively, of endorsed FCA areas that have not yet been disturbed (Figure 3-10 and Figure 3-11) and are included in this MMP. FCA endorsed areas are included in the cumulative impact assessments completed in Section 5.2.4, 6.2.5 and 7.2.9. Alcoa will report on clearing of endorsed FCAs within its monthly clearing report (as detailed in Section3.2.4) and is undertaking a review of all endorsed FCAs to justify clearing.

In response to regulatory feedback, Alcoa committed to treating as not having been endorsed, 1,231 ha of FCA areas that were endorsed prior to 1 September 2023 (FCA Relinquished) in the 2023-2027 MMP[33] (Figure 3-10 and Figure 3-11). Currently, Alcoa is treating 1,016 ha of previously FCA endorsed areas at Huntly and 214 ha of previously FCA endorsed areas Willowdale as not having been endorsed and as FCA Relinquished, totalling 1,231 ha.

[33] 2023-2027 MMP Ministerial Approval Condition 2.

Approximately 15 ha of FCA Relinquished areas had already been harvested, but residual vegetation and topsoil not cleared prior to the 2023-2027 MMP Approval and establishment of associated Ministerial Approval Condition 2. In addition, 2 ha of area now required for the O'Neil Haul Road were FCA Relinquished – which consists of areas which range in size from <1m2 to 0.3 ha and in width from <1m to approximately 50m. These areas are shown in Figure 3-12.

Alcoa is proposing to relinquish alternatives areas to compensate for clearing associated with the above areas. The alternative areas are detailed in Table 3-7, shown in Figure 3-12 and will result in a net increase of 115 ha areas classified as FCA Relinquished. This relinquishment of alternative areas is subject to further discussions between Alcoa, JTSI and DWER.

Table 3-7: FCA Relinquished Areas previously harvested or proposed clearing

Mine	RPZ	Previously Harvested Area (ha)	O'Neil Haul Road Area (ha)	Total Area (ha)	Proposed FCA Relinquished Area (ha)	Net Change in FCA Relinquished Area (ha)
Willowdale	Outside RPZs	1.9	-	1.9	99.2	+97.3
Huntly	Serpentine	9.0	-	9.0	7.4	-1.6
	North Dandalup	0.1	-	0.1	4.9	+4.8
	Serpentine Pipehead	0.01	-	0.01	-	-0.01
	Outside RPZs	4.2	1.4	5.6	20.6	+15
Sub-total		15.3	1.4	16.7	132.1	115.4

Legend

- O'Neil Haul Road Areas
- Previously Harvested Areas
- Proposed FCA Relinquished Areas
- FCA Relinquished
- FCA Endorsed
- Rehabilitation
- Cleared Areas
- Major Dams
- Reservoir Protection Zones (RPZ)

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-12 FCA Relinquished – Proposed Changes - Huntly

Scale: 1:99,272

Date Printed: 30/05/2025

Legend

- Previously Harvested Areas
- Proposed FCA Relinquished Areas
- FCA Endorsed
- Rehabilitation
- Cleared Areas
- Major Dams
- Reservoir Protection Zones (RPZ)

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-13 FCA Relinquished – Proposed Changes -Willowdale

Scale: 1:73,997

Date Printed: 16/05/2025

3.2.4.2 Open Areas

The proposed clearing areas (Clearing Schedule) included in the MMP are conceptual clearing footprints and the entire area will not be cleared. However, all clearing will be contained within the Clearing Schedule (similar to a Development or Disturbance Envelope detailed in Mining Act or EP Act approvals).

Alcoa considers the amount of open area (cleared areas minus rehabilitated areas) to be an appropriate metric of disturbance, as it takes into account actual clearing and rehabilitation activities.

Alcoa is committed to increasing rehabilitation rates to 1,000 ha per year by 2027. The increase in rehabilitation rates requires significant increase in resources and capabilities, hence the incremental year-on-year increase.

Alcoa's planned rehabilitation commitments (Table 3-12) amount to 4,519 ha between 2025 and 2029, including 2,518 ha over the first three years (2025-2027). These commitments exceed the total planned clearing of 2,400 ha during the same period, ensuring a net reduction in open areas aligned with the MMP approval.

Alcoa remains fully committed to achieving the Government's expectations for accelerated rehabilitation and no net increase in open areas within the MMP over the five-year period. Alcoa will continue to further review its mine plan to determine opportunities to decrease open areas.

Table 3-8 and Figure 3-14 details the indicative forecast actual clearing, rehabilitation and resulting open areas based on mine region. Open area calculations are considered indicative with potential for change, particularly after 2030. MMP-only clearing includes any clearing not included in EPA Assessment 2253 (Myara North and Holyoake) or a future mine Part IV EP Act referral (e.g. Larego South). In the interest of transparency regarding open areas, discussion on the detail of indicative actual disturbance associated with all future clearing activities is included in this MMP. The total open area represents the remaining cleared area at end of year, considered the clearing and rehabilitation which has occurred during the year (Table 3-8).

MMP-only related clearing from 2024 – 2027 will have an annual cap of 800 ha, as per Ministerial Condition 9. From 2024 to 2027 a decrease of approximately 800 ha in open area would have occurred within the Myara mine region. A decrease of approximately 200 ha is expected at Willowdale over the same time period. These decreases can be contributed to the increase in rehabilitation rates to 1,000 ha and clearing rationalisation.

A slight increase of 200 ha of all open areas is then predicted in 2027, predominately associated with access to Huntly future mine regions which are subject to EPA Assessment (Assessment 2253). The Myara North and Holyoake regions include long term infrastructure (haul road network, stockpiles, vehicle bays or offices) for ongoing access. The impacts and mitigations associated with access to future mine regions are being considered as part of the EPA Assessments.

From 2030 onwards, all open areas are expected to generally decrease. The cumulative impacts of this clearing will be assessed by EPA, however the area is included in Section 5.2.4, 6.2.5 and 7.2.9.

Open areas are expected to be maintained below 6,000 ha, noting it is not feasible to rehabilitate all open areas due to the inclusion of Long Term Infrastructure (LTI) and active areas that are still in operational use. LTI is critical to ongoing mining operations and the areas associated with it cannot be rehabilitated until the infrastructure is no longer required.

Table 3-8: 10 Year Mine Plan - Indicative Open Areas (including all future Mine Regions under current and future EPA Assessment)

Mine Region	Area (ha) - Year											
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Legacy Long Term Infrastructure (LTI) Huntly	457	457	457	457	457	457	457	457	457	457	457	457
Myara	3,249	3,089	3,005	2,388	1,688	988	567	501	435	369	259	149
O'Neil	0	60	195	669	897	1,117	1,003	547	483	418	353	245
Future regions (Assessment 2253)	0	0	70	522	979	1,374	2,020	2,278	2,375	2,459	2,528	2,615
Total Huntly	**3,706**	**3,606**	**3,727**	**4,036**	**4,020**	**3,935**	**4,047**	**3,783**	**3,749**	**3,702**	**3,597**	**3,466**
Legacy LTI Willowdale	840	840	840	840	840	840	740	640	540	474	423	415
Larego	906	887	799	682	673	617	527	464	480	485	495	505
Future regions (future EPA referral)	0	0	0	0	0	0	119	457	472	553	595	555
Total Willowdale	**1,746**	**1,726**	**1,639**	**1,522**	**1,512**	**1,457**	**1,386**	**1,561**	**1,492**	**1,513**	**1,513**	**1,476**
Total Planned Rehabilitation	641	700	816	1,002	1,000	1,000	1,000	1,000	1,000	1,000	1000	1000
Total Clearing (MMP)	408	581	779	742	518	464	275	53	19	70	35	144
Total Clearing (All)	408	581	849	1,194	975	860	1,041	904	897	974	895	831
Total Open Area (MMP)	5,451	5,332	5,295	5,036	4,554	4,018	3,294	2,610	2,395	2,203	1987	1771
Total Open Area (All)	5,451	5,332	5,365	5,557	5,532	5,392	5,433	5,344	5,241	5,215	5,110	4,941

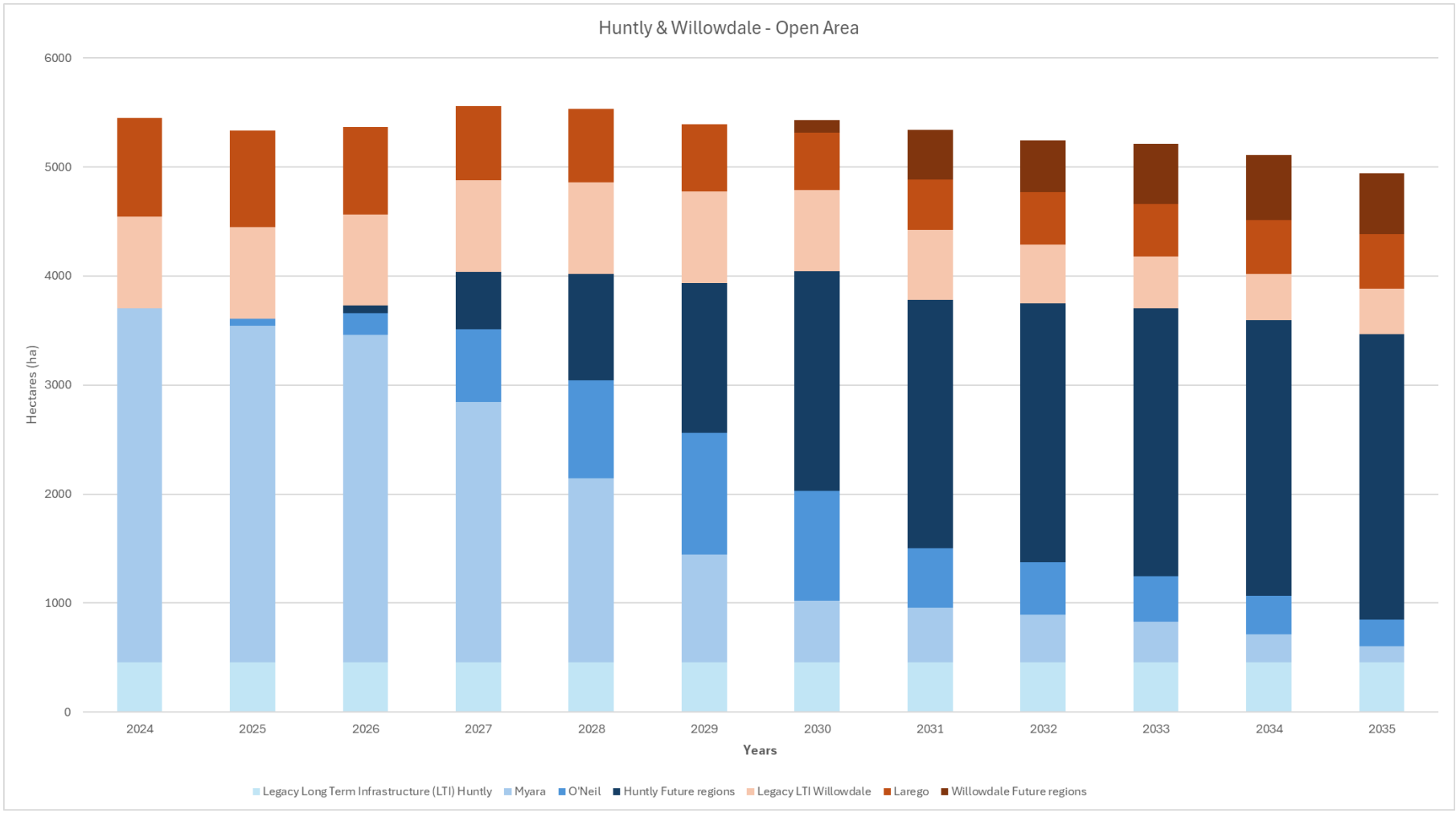


Figure 3-14: 10 Year Mine Plan – Indicative Open Areas

3.3 Rehabilitation

3.3.1 Overview

Alcoa's rehabilitation goal is to establish, and return to the State, a self-sustaining Jarrah Forest ecosystem, that meets the agreed forest values that will support similar management practices as that employed in the surrounding Northern Jarrah Forest. This rehabilitation includes completed earthworks, areas that have been topsoiled and seeded, and areas with regrowth at various stages.

3.3.2 Rehabilitation Performance (Quantity)

Alcoa undertakes an ongoing program of clearing and rehabilitation (Table 3-9, Table 3-10 and Figure 3-16). The current clearing and rehabilitation are shown in Figure 3-16 and Figure 3-17 for Huntly and Willowdale respectively.

Table 3-9: Rehabilitation extents for Huntly and Willowdale mines (to June 2024)

Land area category	Huntly	Willowdale
Total area of native vegetation clearing to date (ha)	17,463	6,815
Total area of completed rehabilitation (ha)21[34]yet	13,427[35]	5,046
Total area of vegetation clearing un-rehabilitated open area (ha)	4,036	1,769

Table 3-10: Rehabilitation age for Huntly and Willowdale (to June 2024)

Rehabilitation Age	Huntly	Willowdale
< 1 year	271	182
1 – 2 years	746	344
3 – 8 years	2,295	796
9 -14 years	2,688	966
15 – 18 years	1,581	673
19 – 34 years	3,906	1,913
35+	1,938	172
Total	**13,425[35]**	**5,046**

[34] rehabilitated land is defined as having been topsoiled and contour ripped and seeded
[35] The datasets of rehabilitation are large and consist of several thousand polygons of various sizes recorded to five decimal points, which when rounded provide these small inconsistencies.

Table 3-11: Rehabilitation age by Completion Criteria for Huntly and Willowdale mines (to June 2024)

Rehabilitation Age by Completion Criteria	Huntly	Willowdale
Completion Criteria 1966 to 1987		
35+	1,769	102
Total	**1,769**	**102**
Completion Criteria 1988 to 2004		
19 – 34 years	3,555	1,771
35+	169	70
Total	**3,724**	**1,841**
Completion Criteria 2005 to 2015		
9 -14 years	2,688	966
15 – 18 years	1,581	673
19 – 34 years	351	142
35+	-	-
Total	**4,620**	**1,781**
Completion Criteria 2016 Onwards		
< 1 year	271	182
1 – 2 years	746	344
3 – 8 years	2,295	796
Total	**3,312**	**1,322**

3.3.3 Rehabilitation Performance (Quality)

Alcoa's rehabilitation quality monitoring approach is outlined in the Rehabilitation Management Plan and Schedule (Version 1 20 June 2024) within Appendix 9 [36], which has been provided to the WA Government and is publicly available on Alcoa's website. The Rehabilitation Management Plan is expected to be revised based on regulatory comments and resubmitted in November 2025.

Alcoa implements an environmental management system to ensure that rehabilitation is executed to a high quality and maintains a comprehensive set of procedural documents to support rehabilitation performance management.

Alcoa's monitoring approach is strongly focused on assessing Leading Performance Indicators (LPIs) at the early establishment phase, to ensure that underperforming rehabilitation can be identified and remedial works carried out while operations are still nearby. Set monitoring intervals and trigger

[36] 2023-2027 MMP Ministerial Approval Condition 17

values allow Alcoa to undertake adaptive management to return rehabilitation to a trajectory that will achieve the agreed Rehabilitation Completion Criteria of the day.

Rehabilitation monitoring is carried out annually across Alcoa's mine sites with species richness being monitored using on-ground plots. Over the period of 1990 to 2021, on average, 99% of the total rehabilitated area was deemed to have met the species richness completion criteria target at 15 months of age (Figure 3-15).

Continuous improvement of rehabilitation methods enabled Alcoa and DBCA to agree that the Completion Criteria of 50% species richness could be increased to 60% of the forested reference sites from 2004 onwards. This change was incorporated into the 2005-2015 Completion Criteria.

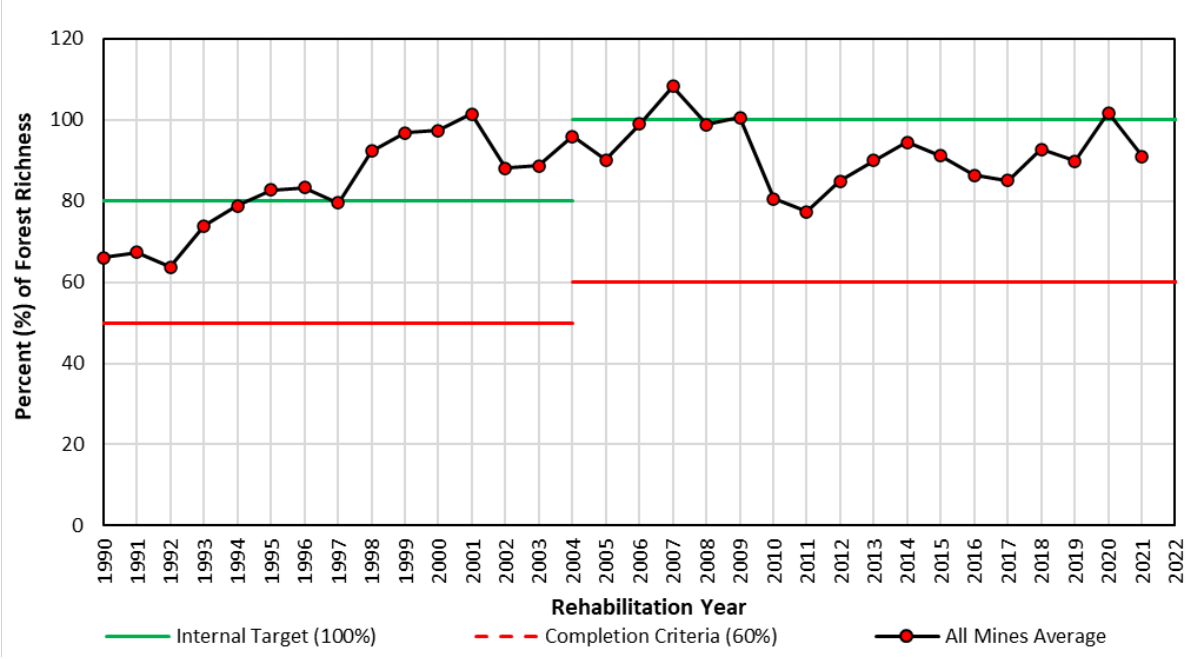


Figure 3-15: Historical mean species richness data

Alcoa has established 12 modern long-term monitoring sites with permanent pitfall transects at Myara for vertebrate fauna (the Long-Term Fauna Monitoring Program (LTFMP)) and compiled a baseline report for the LTFMP (Terrestrial Ecosystems 2023a & 2023b) (Appendix 8). These are the most recently established LTFMP sites and reflect a new monitoring methodology. Three of the sites are in unmined habitat, and nine of the sites are in areas rehabilitated 5, 10 and 15 years ago (i.e., three in each age of rehabilitation). The vertebrate fauna sites will be monitored periodically to evaluate progression towards functional ecosystems, as determined by the terrestrial vertebrate fauna assemblage, like that in unmined areas. In addition to the sites at Myara, there are eight long-term monitoring sites with permanent transects established at Orion. These transects are slightly different from those at Myara, both in number of pits and total length.

The results of flora and fauna monitoring surveys will guide the development of upcoming rehabilitation initiatives and, if necessary, prompt adjustments in the currently rehabilitated areas. Non-conformance with performance metrics and targets is reported, examined, and corrective actions implemented via Alcoa's incident reporting system. This process ensures that there is continuous improvement in rehabilitation practice. Corrective actions may include the following remediation works:

- Additional planting and seeding to correct plant species richness (species range and spatial distribution).

- Additional planting and seeding to correct timber production species stem densities.
- Additional earthworks and/or seeding & planting to correct landform instability (high slope, bare areas, water collection points, subsidence, erosion & sedimentation).
- Additional earthworks to correct aesthetics (landscape integration, rocks on the surface preventing fire vehicle access).
- Complete remediation of the area to correct inadequate pit floor ripping, inadequate soil profile thickness and poor contour ripping.

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
O'Neil
Willard
McCoy
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- Rehabilitation
- Cleared Areas
- Mining Regions
- National Parks
- Major Dams

Alcoa

0 1 2 4 6 km

2025 - 2029 Mining and Management Plan

Figure 3-16: Rehabilitation and Open areas – Huntly

Scale: 1:115,000

Date Printed: 11/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Laregо
Cornwall

Legend

- Rehabilitation
- Cleared Areas
- Mining Regions
- Major Dams

Alcoa

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-17: Rehabilitation and Open areas - Willowdale

Scale: 1:75,000

Date Printed: 11/03/2025

3.3.4 Rehabilitation Plan

Alcoa has developed a rehabilitation schedule for 2025 to 2029 (Table 3-12, Figure 3-19 and Figure 3-20) considering relevant constraints (Table 3-13) and excluding any remediation or re-work of rehabilitation, which is also included in the Rehabilitation Management Plan and Schedule (Version 1).

Alcoa is committed to expanding the area where rehabilitation activities are conducted each year for the next four years on a rolling basis to achieve a minimum of 3,159 hectares of cumulative rehabilitation during the period of 2024-2027[37] This, combined with the annual clearing cap of 800 hectares[38], should ensure no net increase in open areas.

Recognising the significance of rehabilitation in reducing open areas, Alcoa has provided the WA Government with a Rehabilitation Schedule and Management Plan (RSMP)[39] (Appendix 9) which specifies areas expected to be stabilised, and rehabilitated. The RSMP is publicly available on Alcoa's website to enhance transparency regarding activities that could prevent drainage failures and reduce open areas. It is also part of Alcoa's Rehabilitation Strategy to progress towards the handover of rehabilitation once the completion criteria are met. A revision of the current Completion Criteria has been undertaken in consultation with DBCA by 31 December 2024[40].

Table 3-12 Rehabilitation Plan for Huntly and Willowdale mines

Region	Region and year	Proposed Rehabilitation (ha)
Huntly	**2025**	500
	2026	596
	2027	754
	2028	750
	2029	750
	Total	3,350
	5-year average	670
Willowdale	**2025**	200
	2026	220
	2027	248
	2028	250
	2029	250
	Total	1,168
	5-year average	234
Grand Total		**3,518**

Drainage controls, stabilisation or rehabilitation activities will be implemented as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption. To minimise potential impacts to public drinking water high risk or restricted areas will be prioritised for rehabilitation activities (stabilisation or

[37] 2023-2027 MMP Ministerial Approval Condition 15b(iii).
[38] 2023-2027 MMP Ministerial Approval Condition 9
[39] 2023-2027 MMP Ministerial Approval Condition 14
[40] 2023-2027 MMP Ministerial Approval Condition 23

drainage controls). This will result in the following areas being stabilised within 12 months or the first rehabilitation season, following activity cessation:

- 1 km of the top water level of any water reservoir.
- Serpentine Pipehead Dam Catchment
- Areas with an average pit slope greater than 16% within any RPZ
- 10 m of Black Cockatoo nest or significant trees

Once activity is ceased within the RPZ or 1.5 km area surrounding Mt Solus, the area will commence stabilisation or implement drainage controls within 12 months or the first rehabilitation season. Stabilisation would occur within 24 months following activity cessation.

Alcoa has identified five key constraints that have informed the volume of rehabilitation included in the Rehabilitation Plan (Table 3-13, listed in order of impact).

Table 3-13: Rehabilitation constraints

Constraints	Description
1. Area available for rehabilitation	Rehabilitation commences when mining of economic ore is complete. With delays to new mining area approvals, the target ore grade at existing mining areas has been reduced to sustain mine and refinery operations. As a result, some areas previously considered complete are still being mined, delaying area handover to rehabilitation. All efforts are being made to maximise area handover to rehabilitation within the mine schedule, particularly within prioritised areas.
2. Availability of fresh topsoil (<3 months stockpiled)	Topsoil is a key enabler to achieving species richness targets. Rehabilitation can be completed using 'fallow' (i.e. non-fresh) topsoil; however, species richness will be constrained and, therefore, completion criteria may not be met. Fresh topsoil availability is a function of total hectares cleared, the proportion of these hectares that can be cleared during summer months and mapping of dieback and dieback free areas. Recent delays to approvals of new mining areas have reduced the availability of fresh topsoil limiting rehabilitation rates.
3. Resource availability	Additional specialised plant and labour resources are required to execute the higher rates of rehabilitation. Higher than expected pit complexity and improved rehabilitation designs, for enhanced drainage management, will further increase the demand for earthworks and landscaping resources. Increasing the rehabilitation capacity is likely to take 12 months to 2 years to execute due to the lead time to contract or recruit and then train skilled personnel, and equipment lead times.
4. Recalcitrant plant availability	Species richness targets are achieved with contribution from topsoil seedbank, applied seed and plants. If topsoil is limited, then there will be a greater need for plants to achieve richness targets. Availability of additional plants species and numbers required to complete rehabilitation of topsoil is limited. It is likely to take 18 - 36 months to increase availability depending on nursery contractors and research outcomes.
5. Seed availability	Seeds are collected by seed merchants from the provenance areas in accordance with collection rules. Seed collection is impacted by environmental factors and, therefore, it is critical that we maintain a seed bank to support at

Constraints	Description
	least two seasons of rehabilitation. Expansion of existing seed bank and higher collection rates to maintain the seed bank at a sustainable rate is expected to occur over the next 24 months.

Alcoa has implemented a robust strategy to address biological constraints, particularly relating to seeds supply and topsoil limitation. The primary risk mitigation tool is the extensive seed inventory. Recognising that seed production is often variable between seasons and that some species exhibit cyclical seed yields, this inventory significantly reduces the risk of seed shortages in any given season. Seeds are predominantly wild collected from the Northern Jarrah Forest within provenance boundaries agreed with DBCA. To further ensure a reliable seed supply, a range of species is also collected from rehabilitation sites. Alcoa is currently investigating the establishment of managed seed production areas (growing seeds in managed areas like an orchard) to provide an additional contingency.

Alcoa utilises fresh topsoil, which is transported from recently cleared areas, in combination with hand seeding and a planting program to achieve species richness targets. To support the increased rehabilitation targets of 1,000 hectares, the following key measures have been implemented to mitigate the risk:

- The 36-month clearing plan is developed with key considerations to the timing of clearing pits identified as a source of fresh topsoil for the rehabilitation season. For example, clearing may be scheduled between October to February to ensure freshly stripped topsoil can be transported to current rehabilitation areas.
- Seed stocks have been increased from a two-year to a three-year supply
- Training packages and procedures have been updated to ensure all providers meet required rehabilitation standards.

In addition, Alcoa continues to undertake research programs with regards to effective topsoil seedbank/depths, seed mix, seed distribution and plan supply areas.

3.3.4.1 Rehabilitation Remediation activities

Rehabilitation remediation (as identified via monitoring activities) is supplementary to rehabilitation targets or plans. Remediation activities include:

- Remediation of Huntly rehabilitation on the western boundary, which is considered a lower priority.
- Remediation of Serpentine Pipehead Catchment rehabilitation.

Alcoa ceased mining in the Serpentine Pipehead Catchment to minimise impacts to public drinking water source areas. This has left fractured ore remains in some areas, resulting in a landscape that does not meet Alcoa's rehabilitation standards. The Serpentine Pipehead Catchment consists of 97.5 ha of rehabilitation which was undertaken between 2020 and 2021. Additional rehabilitation is planned in the 2023 – 2024 rehabilitation season, which may include:

- Revised landscape design, particularly in locations where fractured ore remains. Further quantification of resource requirements will be undertaken for the associated cut and fill processes.
- Removal of the rehabilitated soil profile for remediation activities, which may necessitate additional fallow soil and Direct Return Topsoil.
- Rectification of groundwater interception in some areas due to impacts to surface water control sump capacity. Due to the risk of drainage incidents, remediation activities will be completed over the summer months.

The 36 Month Rehabilitation Schedule for the prioritisation of drinking water and 2023-2027 MMP Ministerial Approval Condition 5 defined areas is outlined in the Rehabilitation Management Plan and Schedule Version 1 (Appendix 9). The pre-2024 open area is 69.6 ha with 11.2 ha scheduled for rehabilitation in 2024 and 2025.

Given the complexity and priority of the remediation activities, a preferred contractor with known competence to Alcoa standards will be employed. It is expected that at least two rehabilitation seasons will be required to complete remediation activities.

Upon completion of remediation activities, vegetation growth and erosion rates are inspected. Until remedial activities are completed, additional risk mitigation measures will be implemented, including water handling controls to prevent drainage incidents.

3.3.4.2 Future Rehabilitation Strategy

Alcoa has completed a comprehensive review into its rehabilitation performance, which has identified issues, constraints, and opportunities (Section 3.3.4). A Rehabilitation Strategy has been developed to enable rehabilitation quality, quantity, and handback targets to be sustainably met. This will support Alcoa to meet the following objectives:

- Internal and external stakeholder requirements, including commitments contained within the MMP for the 2025 to 2029 period.
- Completion Criteria for rehabilitated forest blocks to be met in a timely and efficient manner.
- Minimised footprint of the Huntly and Willowdale mines.
- Minimised potential impacts and risks to catchment areas and other socio-environmental features within proximity of the mining operations (i.e., dieback management, groundwater systems etc).

As part of the future Rehabilitation Strategy, Alcoa will review the Rehabilitation Completion Criteria by 31 December 2024, in consultation with DBCA[41] . The strategy consists of five key pillars (Figure 3-18, Table 3-14) which enable an acceleration of the rehabilitation program and facilitate the long-term objective of formal handback of rehabilitated forest blocks to the State (Table 3-14).

[41] 2023-2027 MMP Ministerial Approval Condition 23

Additionally, Alcoa commits to the development of a Mine Closure Plan, aligned with the 'Mine Closure Plan Guidance (2020) (or the most recent applicable version). This plan will ensure that all relevant information, currently spread across various documents, is consolidated and refined to meet regulatory expectations.

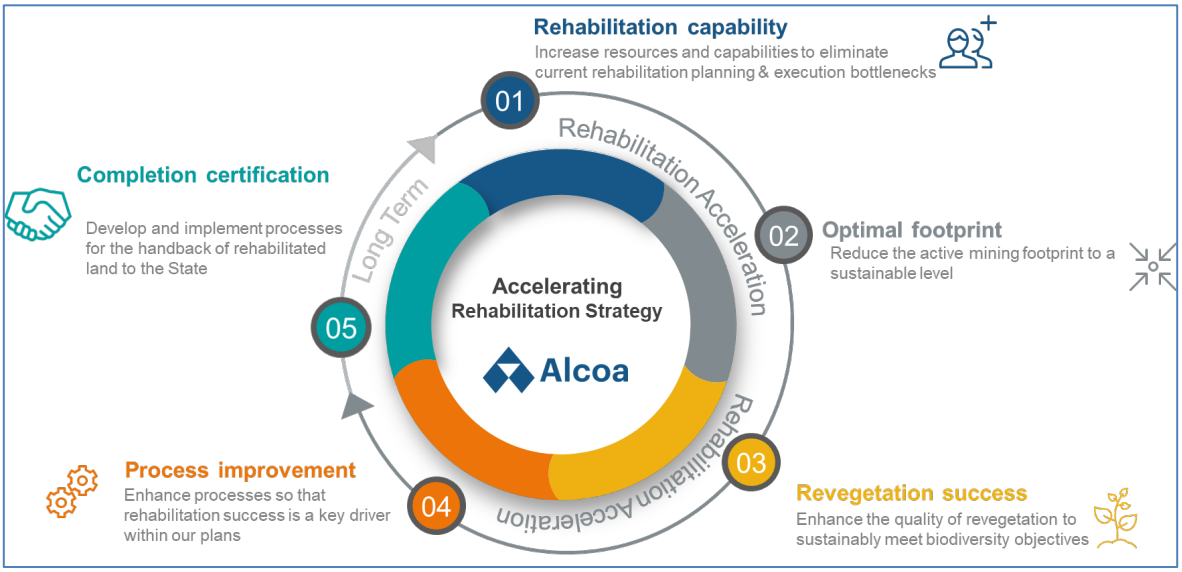


Figure 3-18: Future rehabilitation strategy key pillars

Table 3-14: Future rehabilitation strategy key pillar overview

Pillars	Aim	Targets	Initiative
Rehabilitation capability	Increase resources and capabilities to eliminate current rehabilitation planning & execution bottlenecks.	• Designs are completed for all pits to be rehabilitated by the 2023/24 season, and in advance of the rehabilitation season for future years. • Rehabilitation earthworks supplier contracts for 2023/24 rehabilitation season include incentives to achieve higher productivity. • Procure an additional rehabilitation earthworks provider for 2024/25 rehabilitation season.	• Review organisational chart and increase resourcing to support rehabilitation strategy. • Increase rehabilitation earthworks resources. • Review logging and clearing capacity
Optimal footprint	Reduce the active mining footprint to a sustainable level.	• Optimal mine footprint reached by end of 2028/29 rehabilitation season.	• Develop and implement a decision-making framework for pit handover. • Actively seek to reduce long term infrastructure across the mining lease. • Decouple ore sourcing from feeding the crusher reducing the duration of years that a pit remains open. • Ensure the GIS information is accurate to support reporting and planning activities.
Revegetation success	Enhance the quality of revegetation to sustainably meet biodiversity requirements.	• Ensure sufficient fresh topsoil is available to match the rehabilitation ramp up. • Procure additional seed orders (quantity & species range) to match the rehabilitation ramp up. • Procure additional plants (quantity & species range) to match the rehabilitation ramp up.	• Improve fresh topsoil management and scheduling to minimise waste supported with research to extend topsoil viability. • Increase seed collection (quantity & species range) and build the seed storage capability & enhance security (includes investing in research and development programs such as investigation of provenance genetics to identify additional suitable collection areas). • Increase recalcitrant plant contribution to vegetation through procurement (quantity & species), targeted research and

Pillars	Aim	Targets	Initiative
			development, intervention in early years to increase survivorship.
Process Improvement	Enhance processes so that rehabilitation success is a key driver within the plans.	• Detailed process mapping of mine activities, articulating inputs, outputs, resources, dependencies & risks. • Internal peer review on short- medium- and long-term mine plans for manager's sign-off. • Rehabilitation factors and success measured as a core operational KPI.	• Prioritise most critical areas for rehabilitation such as areas which are visible from public roads or major dams, OCA1 and OCA2 areas. • Update and integrate rehabilitation procedures, policies, and standards. • Develop rehabilitation accountability and ongoing performance management. • Revise closure risk management. • Process and accountability mapping to provide further clarity on roles and responsibilities across the organisation.
Completion Certification	Review rehabilitation completion criteria and accelerate assessment of successfully rehabilitated land.	• External consultative group established to enhance handback transparency. • Rehabilitation completion criteria review by end 2024. • Establish and endorse handback process and tools. • Assess legacy rehabilitated land for suitability for hand-back ~ 1,000 – 2,000 ha p.a. • Submit an Assessment Report for Banksiadale forest block (455 ha) and receive a Certificate of Acceptance.	• Review rehabilitation working arrangements and completion criteria with stakeholders to ensure there is alignment on expectations and outcomes. • Handback a Forest Block (455 ha) to the State in line with the completion criteria and handback program. • Develop rehabilitation handback procedures.

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
O'Neil
Willard
McCoy
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- Mining Regions
- Huntly Medium Term Rehab Plan
  - 2025
  - 2026
- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams

Alcoa

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 3-19: Indicative rehabilitation plan – Huntly

Scale: 1:115,000

Date Printed: 11/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Laregо
Cornwall

Legend

- Mining Regions
- Willowdale Medium Term Rehab Plan
  - 2025
  - 2026
- Rehabilitation
- Cleared Areas
- Major Dams

0 1 2 4 km

Alcoa

2025 - 2029 Mining and Management Plan

Figure 3-20: Indicative rehabilitation plan – Willowdale

Scale: 1:75,000

Date Printed: 11/03/2025

4 Community Engagement and Consultation

4.1 Background

Annual consultation with neighbouring landowners, local and state government, Traditional Owners, and interest groups, is an important part of part of the development of the MMP and annual review process (Figure 4-1).

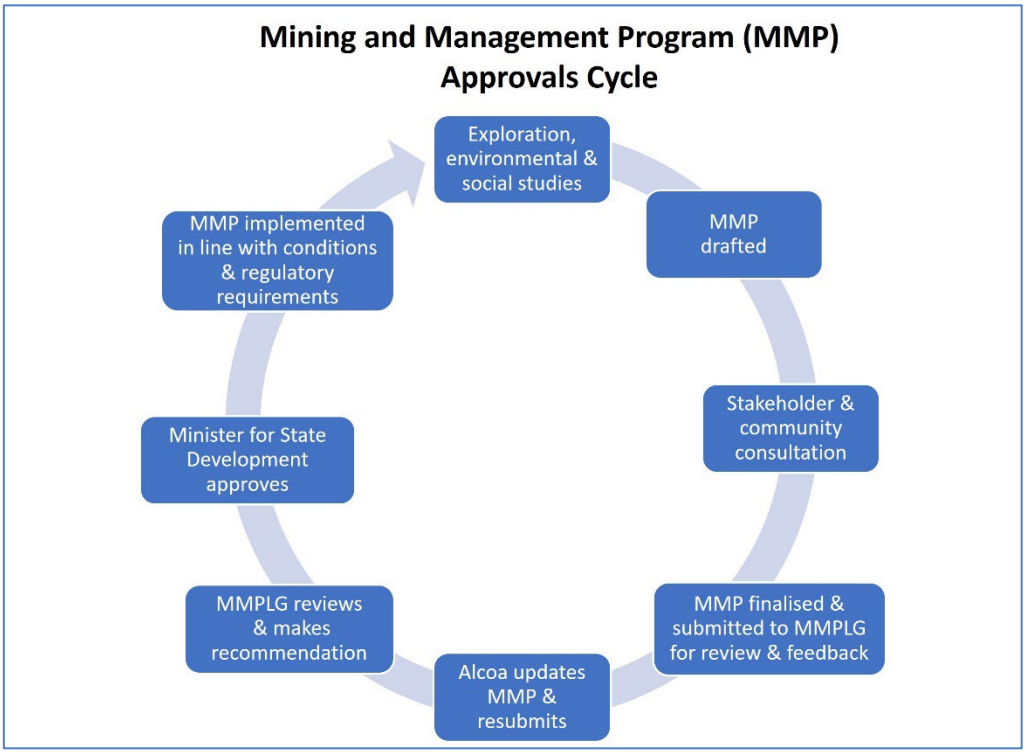


Figure 4-1: Mining and Management Program (Approvals Cycle)

The annual MMP consultation process involves:

- Written invitations to stakeholders offering an opportunity to consult with Alcoa as the MMP is developed.
- One-on-one consultation meetings with stakeholders who accepted the invitation to meet.
- Sharing, discussing and inviting feedback on the rolling Five Year Mine Plan map.
- Considering feedback in development of the annual MMP.

4.2 Delivering on 2023 MMP commitments

Alcoa delivered on commitments made in its 2023 - 2027 MMP to enhance consultation for the 2025-2029 MMP in 2024. Consultation was broader, more transparency and a greater level of information was shared during consultation.

A summary of the enhanced approach and stakeholder feedback has been collated into a detailed register (Appendix 3).

4.2.1 Broadened stakeholder consultation

Alcoa more than doubled the number of stakeholders it invited to consult on the MMP from around 20 stakeholders in 2023 to 55 stakeholders in 2024.

4.2.2 Enhanced community consultation

In addition to sending personal letters of invitation to consult on the MMP to around 200 neighbouring landowners near Huntly and Willowdale mines, Alcoa hosted open-house community information sessions in Dwellingup, Harvey, Jarrahdale, Keysbrook, Pinjarra and Waroona.

The information sessions were extensively promoted across 31 localities within three local government areas to ensure information was broadly shared using a range of tools and channels including:

- More than 13,000 invitations delivered to homes and businesses
- Alcoa's community newsletters
- Posters and flyers
- Digital communications including social media

The information sessions provided an additional opportunity for local businesses and community members to meet with Alcoa's mine planning team, view and discuss the draft 2025 – 2029 MMP map prepared for the purposes of consultation, and provide feedback.

4.2.3 Greater transparency and sharing of information

The MMP draft consultation map used to facilitate stakeholder consultation was significantly enhanced by doubling the proposed future clearing areas shared with stakeholders from five years (2025 – 2029) to ten years (2025 – 2034).

In response to previous feedback from stakeholders, stakeholders who participated in MMP consultation in 2024 were provided with a copy of the draft map to keep for their reference.

4.2.4 Publishing of the approved 2023 – 2027 MMP

Alcoa's approved 2023 -2027 MMP and associated documents were published on its website within seven days of the Minister for State Development approving the plan in December 2023[42].

At this time, Alcoa wrote to landowners and stakeholders invited to consult on the 2023 - 2027 MMP to notify them that the MMP had been approved and details of where to view the documents.

4.3 2024 consultation

4.3.1 Landowners

Alcoa identified neighbouring landowners by undertaking noise modelling to determine properties within the 35 dB(A) noise contour which may be impacted by the proposed mining operations.

[42] 2023-2027 MMP Ministerial Approval Condition 38

Approximately 95 property owners were identified as potentially impacted by the Huntly mine (Figure 4-2) and approximately 100 property owners were identified as potentially impacted by the Willowdale (Figure 4-3).

A letter was sent to landowners inviting them to meet and consult on the draft 2025 – 2029 MMP and included a request to extend the invitation to tenants that may live on their property. Landowners (and tenants) were also offered the opportunity to participate in a personal tour of the relevant mine site.

The discussions and feedback received from landowners was similar to that received during consultation on the 2023 - 2027 MMP. This included proximity of current and future mining activities and potential impacts including dust and/or noise (blasting and operational), and increased traffic movement.

In addition, landowners were interested in understanding the Section 6 exemption conditions Alcoa was operating under and how these conditions were being applied to the 2025 – 2029 MMP.

4.3.2 Stakeholders

Stakeholders who had been invited to consult on past MMPs included local government authorities, local Members of Parliament and Traditional Owners.

Under the enhanced consultation process this was broadened to include peak bodies, advisory groups and associations representing the interests of recreational, trails and outdoor facility users, business associations, tourism and heritage groups, and environmental and conservation groups.

Nineteen individual stakeholder groups were consulted on the 2025 - 2029 MMP. A number of stakeholders acknowledged Alcoa's ongoing commitment to enhance its approach to MMP consultation and welcomed receiving a copy of the draft 2025 -2029 MMP map on conclusion of their consultation.

4.4 Transparency and sharing of information

In addition to Alcoa publishing its 2023 – 2027 MMP within seven days of approval, it continues to deliver on its requirement to provide greater transparency of information. Throughout 2024 Alcoa has published the following MMP related content on its website:

1. Monthly operations reports, stabilisation and seeding spatial data[43]
2. Updated management plans where required[44]
3. Compliance Assessment Report[44]
4. Annual Environmental Review (AER) document will be published once approved by BSEC. Alcoa is committed to providing further information on rehabilitation performance, incident reporting and analysis, operational activities and associated impacts and compliance with approval conditions within future AERs.

[43] S6 exemption clause 13.2
[44] 2023-2027 MMP Ministerial Approval Condition 38

SHIRE OF
SERPENTINE-JARRAHDALE

Myara North

Monadnocks

Myara

Darling Scarp

Oneil

Willard

Mccoy

White

Huntly

Del Park

Holyoake

Legend

Conceptual Clearing Buffer
Community Consultation Properties
Alcoa
Government
Private

Proposed Clearing Schedule
2025
2026
2027
2028
2029

Shire Boundaries
Mining Regions
National Parks
Major Dams
Roads

Alcoa

0 1 2 4 km

N

2025 - 2029 Mining and Management Plan

Figure 4-2: Community consultation locations - Huntly

Scale: 1:115,000

Date Printed: 3/10/2024

Teesdale

Holyoake

Antiope

Darling Scarp

Orion

East Murray

Arundel

Larego

Cornwall

Legend

Community Consultation Properties
- Alcoa
- Private

Proposed Clearing Schedule
- 2025
- 2026
- 2027
- 2028
- 2029

- Shire Boundaries
- Mining Regions
- National Parks
- Major Dams
- Roads

Alcoa

0 1 2 4 km

N

2025 - 2029 Mining and Management Plan

Figure 4-3: Community consultation locations - Willowdale

Scale: 1:75,000

Date Printed: 3/10/2024

5 Flora and Vegetation

5.1 Receiving environment

5.1.1 Baseline studies and surveys

Alcoa has a well-defined understanding of flora and vegetation values within the current and future operational areas Myara, O'Neil and Larego[45]regions through undertaking:

- Key flora and vegetation studies (Table 5-1).
- Studies relevant to the 24 Month Clearing Schedule (Appendix 4).
- Havel vegetation mapping in combination with aerial imagery.

Havel vegetation mapping is a robust baseline assessment methodology undertaken in all areas prior to clearing and involves desktop assessment and field surveys based on a 120 m grid system with site assessments. Site assessment includes recording soil, topography, outcropping, logging and fire history, dieback, and species according to Havel (1975). Further targeted work is undertaken between sites and in specific areas such as granite outcrops and stream zones.

The surveys are used to identify and map vegetation types and indicate the presence of potential suitable habitat for conservation significant flora and fauna.

Future baseline surveys will be expanded to include ground-water dependent ecosystems and vegetation condition. Future vegetation mapping and targeted flora surveys will be undertaken as per the Flora and Vegetation Management Plan (FVMP)[46] (Appendix 10).

Targeted vegetation surveys (survey methodology detailed in Appendix 16 have been initiated for Threatened Ecological Communities (TEC) based on the Likelihood of Occurrence Assessment (Appendix 7). A targeted vegetation survey has identified one Threatened Ecological Community (TEC) within the Willowdale area, *Empodisma* peatlands of southwestern Australia, which is classified as Endangered under the EPBC Act. The '*Empodisma* peatlands' TEC is considered to also have potential to occur within the Huntly Mine DE.

[45] In accordance with MS728 (as amended 1157) Commitment 4.
[46] 2023-2027 MMP Ministerial Approval Condition 17

Table 5-1: Flora and vegetation baseline studies and surveys

Year Range	Author(s)	Study Region(s)	Summary of Methods / Results
2024a	Biologic Environmental Survey	Huntly- Myara	Targeted Flora Survey (included in Appendix 4)
2023a	Eco Logical Australia	Larego	Pre-clearance surveys in the Larego region of Willowdale mine (included in Appendix 4)
2023b	Eco Logical Australia	Willowdale	Pre-clearance flora surveys (included in Appendix 4)
2024a	Ecologia	Huntly Mine Additional Areas	Desktop assessment of the likelihood of occurrence of significant flora over total area 126 ha. Four species were assessed as 'Highly Likely' based on the potential presence of suitable habitat and records occurring within 500 m of the survey area, most of which were recorded during the recent surveys: *Pimelea rara* (P4), *Senecio leucoglossus* (P4), *Tetratheca phoenix* (P2) and *Thysanotus anceps* (P3). Three taxa were assessed as 'Likely' based on the potential presence of suitable habitat and records occurring 0.5–2 km from the survey area: *Acacia drummondii* subsp. *affinis* (P3), *Grevillea pimeleoides* (P3) and *Hibbertia hortiorum* (P1). Seventeen taxa were assessed as 'Unlikely' as, although suitable habitat is potentially present, they were not recorded during the recent nearby targeted surveys. This includes one Threatened species, *Grevillea flexuosa*. The remaining 31 taxa were assessed as 'Unlikely' as suitable habitat is unlikely to be present; these are mostly taxa confined to granite outcrops, wetlands, or streamzone habitats (included in Appendix 4)
2024b	Ecologia	Huntly Mine	Pre-clearance survey focused on threatened flora and declared weeds. Desktop assessment and targeted flora survey over 673.81 ha completed primarily in Spring 2023 (late August and early December). No Threatened flora species and three Priority flora were recorded: *Tetratheca phoeni* (P2), *Senecio leucoglossus* (P4) and *Stylidium ireneae* (P4). No key weed species were recorded (included in Appendix 4)
2024c	Ecologia	Huntly - O'Neil	Targeted survey for conservation significant species in September 2024 (focusing *Hibbertia hortiorum* P1)), weeds of national significance and declared pests within the O'Neil region of the Huntly mine covering an area of 322 ha. *Hibbertia hortiorum* (P1) was recorded in the western part of the survey area, where it was mostly associated with rehabilitated sites on lateritic gravel. Two individuals of *Senecio leucoglossus* (P4) were recorded in Jarrah Forest. There were no WoNS or DP recorded (included in Appendix 4).

Year Range	Author(s)	Study Region(s)	Summary of Methods / Results
1983, 1992, 1993	E.M. Mattiske & Associates	Jarrahdale, Chappell, Kingsbury Drive, Collie	Baseline studies using 120 x 120 m grid surveys. Highlighted flora and site-vegetation types. Focus on novel species, range extensions, and priority species.
1985, 1988, 1991, 1992-1993	E.M. Mattiske & Associates	Del Park, Bates, Jones, Huntly	Similar baseline studies as above. Emphasis on novel species and priority species.
1993, 1994	E.M. Mattiske & Associates	Willowdale	Baseline studies using 120 x 120 m grid surveys. Emphasis on novel species and priority species.
1988 to 1994, 1996 to 2006	E.M. Mattiske & Associates, Mattiske Consulting	Monitoring transects near Wucalup, Cameron, Gordon, Jacup	Assessment of creek lines and valley systems.
1994, 2009, 2012, 2019, 2021, 2022	Mattiske Consulting	Huntly, O'Neill, Myara, Myara North	Baseline and desktop studies. Focus on site-vegetation types and novel species. Studies included regional context for managed forest and conservation areas.
2005 to 2014, 2016 to 2021	Mattiske Consulting	Huntly, Myara, Willowdale	Rehabilitation area assessments at 9 and 15 months. Data collection and monitoring plots assistance.
1994-2024	Mattiske Consulting	Willowdale, Keats, Wucalup, Vaquita, Holyoake (2024b), Squig, O'Neil (2024c), O'Neil Haul Road (2024a)	Baseline and desktop studies. Focus on site-vegetation types, novel species, and priority species. Regional context for managed forest and conservation areas. Assessment of Flora and Vegetation Values. O'Neil, O'Neil Haul Road and Larego is included in Appendix 4.
2023a	Mattiske Consulting	Kingsbury West	Flora and vegetation assessed using site-type classification. Focus on novel species and priority species. Desktop study, baseline flora and vegetation survey over 983 ha. A total of 236 vascular plant taxa were recorded within the survey area. No Threatened flora species and no Priority flora were recorded. No key weed species were recorded. A total of 20 VTs were mapped within the survey area. The majority of the vegetation of the survey area was assessed as being in Excellent condition. No TECs occur in the survey area. Assessments concluded that no PECs occur within the Kingsbury West survey area. Potential GDEs were identified using vegetation complexes and VTs. No Old Growth Forest mapped by DBCA occurs in the survey area (included in Appendix 4).
2023b	Mattiske Consulting	Warrington	Desktop study, baseline flora and vegetation survey over 1,134 ha. A total of 238 vascular plant taxa were recorded within the survey area. No Threatened flora species and two Priority flora species were recorded: *Grevillea prominens* (P3) and *Senecio leucoglossus* (P4). No key weed species were recorded. A total of 15 VTs were mapped within the survey area. The vegetation of the survey area was assessed as being in Very Good condition. No TECs occur in the survey area. Assessments concluded that no PECs

Year Range	Author(s)	Study Region(s)	Summary of Methods / Results
			occur within the Warrington survey area. Potential GDEs were identified using vegetation complexes only. No Old Growth Forest mapped by DBCA occurs in the survey area. Counts of habitat trees and stumps infer that some parts of the survey area may potentially have had lower logging rates (included in Appendix 4).
2023c	Mattiske Consulting	Spion	Desktop study, baseline flora and vegetation survey over 486 ha. A total of 177 vascular plant taxa were recorded within the survey area. No Threatened flora species and one Priority flora species was recorded: *Grevillea prominens* (P3). No key weed species were recorded. A total of 15 VTs were mapped within the survey area. The vegetation of the survey area was assessed as being in Very Good condition, aside from one very small, cleared area. No TECs occur in the survey area. Assessments concluded that no PECs occur within the Spion survey area. Potential GDEs were identified using vegetation complexes. No Old Growth Forest mapped by DBCA occurs in the survey area. Counts of habitat trees and stumps infer that some parts of the survey area may potentially have had lower logging rates, which could indicate the presence of Old Growth Forest (included in Appendix 4).
2024c	Mattiske Consulting	Huntly Mine – O'Neil	Flora and vegetation assessed using site-type classification. Focus on novel species and priority species (included in Appendix 4)
2024a	Mattiske Consulting	Huntly Mine – O'Neil Haul Road	Flora and vegetation assessed using site-type classification. Focus on novel species and priority species. Desktop study, baseline flora and vegetation survey over 2,593 ha incorporating reviewed results from 2009-2012 plus additional mapping in 2023. A total of 122 vascular plant taxa were recorded in 2023. No Threatened flora species and two Priority flora were recorded: *Hibbertia hortiorum* (P1) and *Senecio leucoglossus* (P4). No key weed species were recorded. A total of 17 VTs were mapped within the survey area. Vegetation condition was considered to be Excellent, except in rehabilitation areas. No TECs occur in the survey area. Assessments concluded that no PECs occur within the O'Neil Transport Corridor survey area. Potential GDEs were identified using vegetation complexes only. No Old Growth Forest mapped by DBCA occurs in the survey area. (summarised in Appendix 4)
2024d	Mattiske	Huntly and Larego	Summary of Flora and Vegetation values of Huntly and Larego areas undertaken by E.M. Mattiske and Associates (pre-1994) and Mattiske Consulting Pty Ltd (post 1994). Focus on the survey effort and methodologies applied (included in Appendix 4)
2025	Western Environmental	Larego	Targeted vegetation surveys across a 35 ha area at Largeo with the objective to identify the TEC '*Empodisma* Peatland' TEC. Survey findings were compared

Year Range	Author(s)	Study Region(s)	Summary of Methods / Results
			against the four key diagnostic characteristics listed in the Approved Conservation Advice. Based on this assessment 2.289 ha of Very Good Condition '*Empodisma* peatlands' TEC as recorded as present within the Survey Area. Survey Report included in Appendix 17 .
2025	WSP	Larego	An initial hydrological assessment of the '*Empodisma* peatlands' TEC identified at Laregeo. The objective was to confirm connectivity to groundwater, estimate groundwater levels and through-flow rates and understand potential impacts. Study Report included in Appendix 18 .

5.1.2 Regional Vegetation

The Huntly and Willowdale mines are located within the Southwest Botanical Province (J.S. Beard, 1990), within the Jarrah Forest bioregion and NJF subregion as described by the Interim Biogeographic Regionalisation of Australia (IBRA) (Figure 5-1).

The Jarrah Forest is broadly classified as an open forest in its northern extent and as a tall forest in its southern extent (Dell, B. & Havel, J.J, 1989). The NJF subregion comprises a total of approximately 1.90 million ha and is broadly characterised by Jarrah (*Eucalyptus marginata*) forest on ironstone gravels and Marri-Wandoo (*Corymbia calophylla – Eucalyptus wandoo*) woodlands on loamy soils, with sclerophyll understorey.

The NJF subregion retains native vegetation over approximately 1.11 million ha (58% of pre-European extent). Approximately 69% of the remaining vegetation is within DBCA managed lands in the west and south. Substantial clearing has occurred for agriculture in the north and east, as well as urban rural residential in the Perth Hills (e.g. Gidgegannup, Mundaring, Roleystone, Kalamunda). The Huntly and Willowdale mine regions contain 830 ha designated as National Park[47]

5.1.3 Vegetation associations

The pre-European vegetation, mapped at a scale of 1:250,000, is linked to three vegetation associations in the vicinity of the Huntly and Willowdale mine regions (Table 5-2, Figure 5-1):

- Vegetation Association 3: Medium Forest, predominantly Jarrah-Marri.
- Vegetation Association 4: South-West Woodland.
- Vegetation Association 128: Bare Areas, characterized by rock outcrops.

The protection by conservation reserves varies between 15% to 33% protected areas.

Table 5-2: Vegetation Associations

Vegetation Association	Total Pre-European Extent (ha)	Current Extent (ha) within Huntly and Willowdale Regions	Percentage (%) of Total Pre-European Extent Remaining	Percentage (%) of Current Extent protected by conservation reserves
3	908,100	723,446	80%	15%
4	614,201	197,904	32%	20%
128	4,757	4,124	87%	33%

5.1.4 Vegetation complexes

The Huntly and Willowdale regions are comprised of pre-European vegetation categorised as the Darling Plateau (or The Darling System), which primarily consists of a series of vegetation complexes.

[47] Based on Forest Management Plan 2014-2023 (FMP) (DBCA-041) data

These vegetation complexes offer a more granular description of the vegetation across the Northern Jarrah Forest (NJF) subregion compared to the broader state-wide vegetation association mapping.

There are 13 vegetation complexes within the Huntly and Willowdale regions (Ecological Australia, 2023), as detailed in Table 5-3 and shown in Figure 5-1. Overall, all vegetation complexes combined retain 78.1% of their pre-European extents and their conservation is generally at less than 20% of their current extent.

Table 5-3: Vegetation Complexes

Vegetation Complex	Description	Pre-European Extent (ha)	Current Extent (ha)	Percentage (%) of Pre-European Extent Remaining	Percentage (%) of Current Extent Protected for Conservation
Cooke (Ce)	Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* (subhumid zone) and open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* (semiarid and arid zones) and on deeper soils adjacent to outcrops, closed heath of Myrtaceae-Proteaceae species and lithic complex on granite rocks and associated soils in all climate zones, with some *Eucalyptus laeliae* (semiarid), and *Allocasuarina huegeliana* and *Eucalyptus wandoo* (mainly semiarid to perarid zones).	36,805	30,304	82.3%	18.6%
Dwellingup (D1)	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on lateritic uplands in mainly humid and subhumid zones.	208,620	181,039	86.8%	8.3%
Dwellingup (D2)	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones.	86,183	5,918	6.9%	19.3%
Dwellingup (D4)	Open forest to woodland of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on lateritic uplands in semiarid and arid zones.	132,414	115,545	87.3%	12%
Darling Scarp (DS2)	Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla*, with some admixtures with *Eucalyptus laeliae* in the north (subhumid zone), with occasional *Eucalyptus marginata* subsp. *elegantella* (mainly in subhumid zone) and *Corymbia haematoxylon* in the south (humid zone) on deeper soils adjacent to outcrops, woodland of *Eucalyptus wandoo* (subhumid and semiarid zones), low woodland of *Allocasuarina huegeliana* on shallow soils over granite outcrops, closed heath of *Myrtaceae-Proteaceae* species and lithic complex on or near granite outcrops in all climate zones.	32,466	32,466	100.0%	0.26%
Goonaping (G)	Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata* (humid zones) and *Eucalyptus marginata* subsp. *thalassica* (semiarid to perarid zones) on the sandy-gravels, low woodland of *Banksia attenuata* on the drier sandier sites (humid to perarid zones) with some *Banksia menziesii* (northern arid and perarid zones) and low open woodland of *Melaleuca preissiana-Banksia littoralis* on the moister sandy soils (humid to perarid zones).	27,467	21,818	79.4%	50.6%

Vegetation Complex	Description	Pre-European Extent (ha)	Current Extent (ha)	Percentage (%) of Pre-European Extent Remaining	Percentage (%) of Current Extent Protected for Conservation
Helena 1 (He1)	Mosaic of open forest of *Corymbia calophylla-Eucalyptus patens-Eucalyptus marginata* subsp. *marginata* with some *Eucalyptus rudis* on the deeper soils ranging to closed heath and lithic complex on shallow soils associated with granite on steep slopes of valleys in humid and subhumid zones.	15,890	12,045	75.8%	30%
Lowdon (Lo)	Open forest of *Corymbia calophylla-Eucalyptus marginata* subsp. *marginata-Agonis flexuosa* with some *Eucalyptus wandoo* and occasional *Corymbia haematoxylon* on slopes, and woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* on valley floor in the humid zone.	3,560	1,937	54.4%	-
Murray 1 (My1)	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Eucalyptus* patens on valley slopes to woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* on the valley floors in humid and subhumid zones.	68,737	52,296	76.1%	25.7%
Pindalup (Pn)	Open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on slopes and open woodland of *Eucalyptus wandoo* with some *Eucalyptus patens* on the lower slopes in semiarid and arid zones.	167,270	128,685	76.9%	0%
Swamp (S)	Mosaic of low open woodland of *Melaleuca preissiana-Banksia littoralis,* closed scrub of *Myrtaceae* spp., closed heath of *Myrtaceae* spp. and sedgelands of *Baumea* and *Leptocarpus* spp. on seasonally wet or moist sand, peat, and clay soils on valley floors in all climatic zones.	53,696	40,613	75.6%	14.3%
Yarragil 1 (Yg1)	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones.	80,252	64,927	80.9%	9.9%
Yarragil (Yg2)	Open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia* calophylla on slopes, woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.	50,292	46,475	92.4%	10.6%
All Vegetation Complexes		**960,093**	**734,068**	**76.18%**	**11.0%**

Towns
Myara North
Monadnocks East
Monadnocks
Myara
Beryl
Oneil
Duncan
Mccoy
Willard
White
Darling Scarp
Huntly
Del Park
Holyoake
Teesdale
Amphion
Orion
Hotham
Marradong
East Murray
Arundel
Saddleback
Larego
Bednall
Cornwall
Leach

Legend

MLS1SA
Mining Regions
Pre-European Vegetation
3: Forest
4: Woodland southwest
128: Rock

Vegetation Associations
Cooke
Dwellingup 1
Dwellingup 2
Dwellingup 3
Murray 1
Swamp
Yarragil 1
Yarragil 2

Alcoa

N

0 1 2 4 6 8 km

2025 - 2029 Mining and Management Plan

Figure 5-1: Regional Vegetation setting

Scale: 1:230,000

Date Printed: 2/09/2024

5.1.5 Vegetation Types

Mattiske Consulting conducted flora and vegetation surveys over the Huntly and Willowdale mine areas collecting field data between 2008 to 2024, mapping 36 vegetation types (VTs). The VTs were mapped based on a grid survey, using key indicator species and site conditions adapted from the method of Havel (1975a, 1975b), to differentiate vegetation across the continuum of Jarrah-Marri overstorey (Table 5-4, Figure 5-2 to Figure 5-7).

In the Huntly region, the predominant VTs include tall shrublands and open woodlands, such as:

- Vegetation type S, an open forest of *Eucalyptus marginata, Banksia grandis* and *Allocasuarina fraseriana* on gravels and sandy gravels.
- Vegetation type TS, an open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia grandis* on gravelly soils.
- Vegetation type PS, an open forest of *Allocasuarina fraseriana, Eucalyptus marginata*, *Corymbia calophylla* and *Banksia grandis* on sandy gravels.

Additionally, the Huntly region has areas of rehabilitated land, totalling 13,427 hectares, with unsurveyed areas amounting to 10,836 ha of the total mapped extent.

The Willowdale region features a different distribution of vegetation types, such as:

- Vegetation type S, an open forest of *Eucalyptus marginata, Banksia grandis* and *Allocasuarina fraseriana* on gravels and sandy gravels.
- Vegetation type ST, an open forest of *Eucalyptus marginata* and *Corymbia calophylla* on sandy gravelly soils.
- Vegetation type TS, an open forest of *Eucalyptus marginata, Corymbia calophylla* and *Banksia grandis* on sandy loam gravelly to gravelly soils.

Willowdale areas of rehabilitation total 5,046 ha and include unsurveyed areas totalling 35,264 ha of the region.

Table 5-4: Vegetation types recorded

Vegetation Type Code	Description	Total Mapped extent (ha)	Huntly Mine Region		Willowdale Mine Region	
			Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent
A	Tall shrubland of *Melaleuca lateritia, Hakea varia, Melaleuca viminea* and *Melaleuca incana* subsp. *Incana* on clay-loams in seasonally wet valley floors.	809	738	91%	6	1%
AC	Open Woodland of *Eucalyptus rudis – Melaleuca preissiana – Eucalyptus patens – Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on broad swamps and water-courses	3,632	2,883	79%	474	13%
AD	Low open woodland of *Eucalyptus rudis* and *Eucalyptus marginata* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	445	421	95%	0	0%
AW	Low open woodland of *Eucalyptus patens* and *Melaleuca preissiana* over *Banksia littoralis, Hakea prostrata* and *Pericalymma ellipticum* over low shrubs and herbs on leached sands over sandy-gravel on lower slopes.	142	130	91%	4	3%
AW/AX	Localised patchy mosaic of AW and AX.	21	21	100%	0	0%
AX	Localised patchy mosaic of AW and CW.	76	76	100%	0	0%
AY	Wandoo Woodland	34	33	99%	0	0%
B	Dunal sands usually formed when sand from insitu weathering gets trapped in a shallow valley, often forming ridges and swales.	1	0	0%	1	100%
C	Woodland to Open Forest of *Eucalyptus patens – Corymbia calophylla – Banksia littoralis* and *Banksia seminuda* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses.	430	345	80%	6	1%
CA	Woodland to Open Forest of *Eucalyptus patens*, *Corymbia calophylla*, *Banksia littoralis*, and *Banksia seminuda* with mixed understorey species including *Taxandria linearifolia*, *Astartea scoparia*, and *Trymalium floribundum* on loam soils on lower slopes, near creek-lines and water-courses.	34	0	0%	34	100%
CQ	Woodland to Open Forest of *Eucalyptus patens*, *Corymbia calophylla*, *Banksia littoralis*, and *Banksia seminuda* with mixed understorey species including *Taxandria linearifolia*, *Astartea scoparia*, and *Trymalium floribundum* on loam soils on lower slopes, near creek-lines and water-courses.	285	7	3%	272	95%

Vegetation Type Code	Description	Total Mapped extent (ha)	Huntly Mine Region		Willowdale Mine Region	
			Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent
CW	Woodland to Open Forest of *Eucalyptus patens – Eucalyptus megacarpa – Corymbia calophylla – Banksia littoralis* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses	3,240	2,161	67%	768	24%
D	Open Forest of *Eucalyptus marginata – Corymbia calophylla – Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae* and *Acacia extensa* on clay loams to gravelly clay-loams	5,396	4,806	89%	254	5%
DA	Woodland of *Eucalyptus marginata – Banksia littoralis – Hakea prostrata* on lower slopes with mixed low understorey species, including *Babingtonia camphorosmae* and *Acacia extensa* on moister sandy-loams	523	472	90%	2	0%
DB	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Agonis flexuosa* on slopes of the escarpment in the humid zone.	5	5	100%	0	0%
DG	Woodland of E*ucalyptus marginata -Corymbia calophylla* on lower slopes with mixed low understorey species, including *Grevillea bipinnatifida, Hypocalymma angustifolium, Babingtonia camphorosmae* and *Acacia extensa* on sandy-loams over shallow outcropping.	231	230	100%	1	0%
E	Open Forest to Woodland of *Eucalyptus marginata – Corymbia calophylla* with scattered understorey, including *Kingia australis, Adenanthos barbiger* and low shrubs, herbs and sedges on sandy gravels.	512	432	84%	63	12%
G	Mosaic of Open Woodland of *Eucalyptus marginata – Corymbia calophylla* on the fringes of outcrops ranging to open heath communities of *Proteaceae-Myrtaceae* species and lithic complexes on the outcrop areas.	403	330	82%	39	10%
G1	Mosaic of Open Woodland of *Eucalyptus marginata – Corymbia calophylla* on the fringes of outcrops ranging to open heath communities of *Proteaceae-Myrtaceae* species and lithic complexes on the outcrop areas.	408	408	100%	0	0%
G2	Woodland of *Allocasuarina huegeliana* and associated herbs and low shrubs on shallow granite outcrops.	1	1	100%	0	0%
J	Open Woodland to open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Eucalyptus patens* over *Mesomelaena tetragona*, *Leptocarpus scariosus*, *Babingtonia camphorosmae* and *Stirlingia latifolia* on broad sandy-loam flats valley slopes.	46	43	92%	0	0%

Vegetation Type Code	Description	Total Mapped extent (ha)	Huntly Mine Region		Willowdale Mine Region	
			Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent
M	Open woodland of *Eucalyptus wandoo* over *Trymalium ledifolium, Macrozamia riedlei* and *Hakea lissocarpha* on clay loams with some gravel on mid to upper slopes and ridges.	4	2	45%	0	0%
P	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata – Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii*, *Adenanthos barbiger* and low shrubs, herbs and sedges on sandy gravels	1,891	1,355	72%	191	10%
PL	Plantation	210	175	83%	0	0%
PS	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata – Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* on gravels and sandy gravels.	11,079	8,633	78%	1,511	14%
PT	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata – Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus, Pteridium esculentum* and *Bossiaea aquifolium* subsp. *Aquifolium* on sandy-loam gravels	2,129	1,476	69%	599	28%
PW	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata – Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Babingtonia camphorosmae* and *Hypocalymma angustifolium* on sandy gravels	2,094	1,535	73%	294	14%
Q	Open Forest of *Eucalyptus patens – Eucalyptus marginata – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Trymalium odoratissimum* subsp. *Odoratissimum, Hypocalymma angustifolium and Pteridium esculentum* on seasonally moister loamy soils.	446	93	21%	301	67%
R	Open Woodland of *Eucalyptus marginata – Corymbia calophylla* on fringes of granite outcrops or shallow soils over mixed understorey species reflecting shallow soils over granite.	971	867	89%	45	5%
R/G	Localised patchy mosaic of R and G site-vegetation types.	14	5	37%	9	63%
S	Open Forest of *Eucalyptus marginata – Banksia grandis – Allocasuarina fraseriana* with scattered understorey, including *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on gravels and sandy- gravels.	22,080	16,422	74%	4,082	18%

Vegetation Type Code	Description	Total Mapped extent (ha)	Huntly Mine Region		Willowdale Mine Region	
			Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent
SP	Open Forest of *Allocasuarina fraseriana – Eucalyptus marginata – Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger*, *Grevillea wilsonii* and *Leucopogon capitellatus* on sandy-gravels to gravelly soils.	6,170	4,695	76%	962	16%
SP-D	Localized patchy mosaic of SP and D	10	10	100%	0	0%
S-SP	Localized patchy mosaic of S and SP	1	1	100%	0	0%
ST	Open Forest of *Eucalyptus marginata – Corymbia calophylla* with scattered understorey, including *Leucopogon capitellatus*, *Leucopogon verticillatus*, *Pteridium esculentum*, *Lasiopetalum floribundum* and *Styphelia tenuiflora* on sandy-gravelly soils.	7,998	4,242	53%	3,128	39%
SW	Open Forest of *Eucalyptus marginata – Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on seasonally moister sandy-gravelly soils.	3,907	2,935	75%	522	13%
SW-D	Localized patchy mosaic of SW and D.	9	9	100%	0	0%
T	Open Forest of *Eucalyptus marginata – Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus*, *Pteridium esculentum*, *Clematis pubescens* and *Bossiaea aquifolium* subsp. *Aquifolium* on sandy-loam gravelly soils.	6,559	5,212	79%	1,031	16%
TP	Open Forest of *Eucalyptus marginata – Corymbia calophylla – Allocasuarina fraseriana – Banksia grandis* on sandy-loams to sandy- gravels with scattered understorey, including *Clematis pubescens*, *Adenanthos barbiger*, *Leucopogon verticillatus*, *Pteridium esculentum* and *Bossiaea aquifolium* subsp. *Aquifolium* on sandy-loam gravels.	269	15	6%	254	94%
TS	Open Forest of *Eucalyptus marginata – Corymbia calophylla – Banksia grandis* with scattered understorey, including *Leucopogon verticillatus, Pteridium esculentum, Clematis pubescens* and *Bossiaea aquifolium* subsp. *Aquifolium* on sandy-loam gravelly to gravelly soils.	12,442	8,590	69%	3,244	26%

Vegetation Type Code	Description	Total Mapped extent (ha)	Huntly Mine Region		Willowdale Mine Region	
			Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent
W	Open Forest of *Eucalyptus megacarpa – Eucalyptus patens – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Acacia extensa* and *Hypocalymma angustifolium* on seasonally moister sandy-loam gravelly soils.	4,922	3,310	67%	1,445	29%
WA	Open woodland of *Eucalyptus patens – Corymbia calophylla – Eucalyptus marginata – Banksia littoralis* including *Hypocalymma angustifolium* and range of Myrtaceae species on sandy loam lower slopes.	36	33	91%	1	3%
WD	Open Forest of *Eucalyptus patens*, *Corymbia calophylla*, *Eucalyptus megacarpa*, and *Hakea prostrata* on lower slopes with mixed low understorey species, including *Hypocalymma angustifolium*, *Babingtonia camphorosmae*, and *Acacia extensa* on seasonally moister sandy-clay loams.	1	1	100%	0	0%
Y	Woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Allocasuarina fraseriana-Agonis flexuosas* and open woodland of *Corymbia calophylla* on low undulating uplands in the humid zone.	17	17	100%	0	0%
YG	Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones. Woodland of *Eucalyptus patens-Eucalyptus rudis* with *Hakea prostrata* and *Melaleuca viminea* on valley floors in subhumid and semiarid zones.	14	14	100%	0	0%
YS	Combination of Y and S vegetation types	5	5	100%	0	0%
Z	Open forest of *Eucalyptus marginata- Corymbia calophylla* with scattered understorey, including *Macrozamia riedlei, Xanthorrhoea preissii, Hakea lissocarpha* and *Phyllanthus calycinus* on sandy-loam gravelly soils.	96	95	99%	0	0%
Dam		329	329	100%	0	0%
Cleared Areas		5,804	4,036	70%	1,768	30%
Rehabilitated Areas		18,473	13,427	73%	5,046	27%
Unsurveyed Area		59,527	10,836	18%	35,264	59%
Grand Total		**124,654**	**101,917**	**55%**	**56,575**	**38%**

Towns
Myara North
Monadnocks
Myara
Darling Scarp
Willard
McCoy
O'Neil
White
Huntly
Del Park
Holyoake

Legend

Conservaton Significant Flora

- Acacia horridula
- Calothamnus graniticus subsp. leptophyllus
- Grevillea dissectifolia
- Hemigenia microphylla
- Hibbertia ?ambita
- Hibbertia hortiorum
- Senecio leucoglossus
- Stylidium ireneae
- Tetratheca phoenix
- Thysanotus anceps

Legend

- Mining Regions
- 24 Month Clearing Schedule
- National Parks
- Major Dams
- Un-surveyed Area

Lower Slope & Swamp Vegetation Types

- A
- AC
- AD
- AW
- AW/AX
- AX
- C
- CQ
- CW
- D
- DA
- DG
- E
- W
- WA
- WD
- DAM
- Rehabilitation
- Cleared Area

Alcoa

N

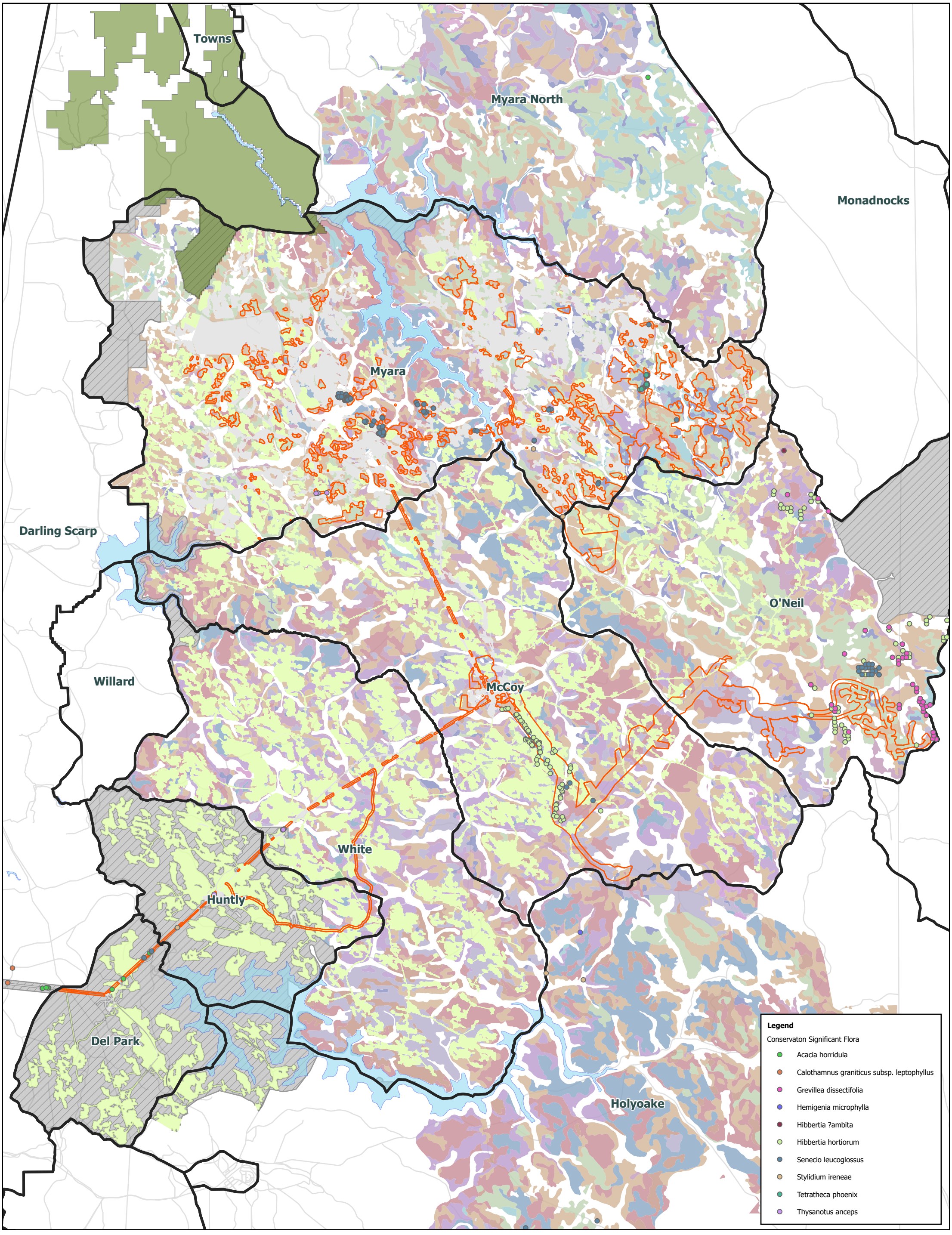
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2025 - 2029 Mining and Management Plan

Figure 5-2: Lower slopes & swamps vegetation types - Huntly

Scale: 1:115,000

Date Printed: 7/10/2024



Legend

Mining Regions
24 Month Clearing Schedule
National Parks
Major Dams
Roads

Upland Area Vegetation Types

J
M
P
PG
PL
PS
PT
PW
Q
S
S-SP
SP
SP-D
ST
SW
SW-D
T
TP
TS
Z
DAM
Rehabilitation
Cleared Areas

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-3: Upland areas vegetation types - Huntly

Scale: 1:115,000

Date Printed: 7/10/2024

Towns
Myara North
Monadnocks
Myara
Darling Scarp
Willard
McCoy
O'Neil
White
Huntly
Del Park
Holyoake

Legend

Conservaton Significant Flora

- Acacia horridula
- Calothamnus graniticus subsp. leptophyllus
- Grevillea dissectifolia
- Hemigenia microphylla
- Hibbertia ?ambita
- Hibbertia hortiorum
- Senecio leucoglossus
- Stylidium ireneae
- Tetratheca phoenix
- Thysanotus anceps

Legend

- Mining Regions
- 24 Month Clearing Schedule
- National Parks
- Major Dams
- Un-surveyed Area

Granite Outcrop Vegetation Types

- G
- G1
- G2
- R
- R/G
- DAM
- Rehabilitation
- Cleared Area

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-4: Granite outcrops vegetation types - Huntly

Scale: 1:115,000

Date Printed: 7/10/2024

Orion

Arundel

Larego

Legend

Conservaton Significant Flora

- Grevillea prominens
- Netrostylis sp. Nannup (P.A. Jurjevich 1133)
- Senecio leucoglossus

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Major Dams
- Un-surveyed Area
- Roads

Lower Slope & Swamp Vegetation Types

- A
- AC
- AW
- B
- C
- CA
- CQ
- CW
- D
- DA
- DG
- E
- W
- WA
- Rehabilitation
- Cleared Area

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-5: Lower slopes & swamps vegetation types - Willowdale

Scale: 1:75,000

Date Printed: 3/10/2024

Orion

Arundel

Larego

Legend

Conservaton Significant Flora

- Grevillea prominens
- Netrostylis sp. Nannup (P.A. Jurjevich 1133)
- Senecio leucoglossus

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Major Dams
- Un-surveyed Area
- Roads

Upland Area Vegetation Types

- J
- M
- P
- PG
- PL
- PS
- PT
- PW
- Q
- S
- S-SP
- SP
- SP-D
- ST
- SW
- SW-D
- T
- TP
- TS
- Z
- DAM
- Rehabilitation
- Cleared Areas

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-6: Upland areas vegetation types - Willowdale

Scale: 1:75,000

Date Printed: 3/10/2024

Orion

Arundel

Laregо

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Major Dams
- Un-surveyed Area
- Roads

Granite Outcrop Vegetation Types
- G
- R
- R/G
- Rehabilitation
- Cleared Area

Conservaton Significant Flora
- Grevillea prominens
- Netrostylis sp. Nannup (P.A. Jurjevich 1133)
- Senecio leucoglossus

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-7: Granite outcrops vegetation types - Willowdale

Scale: 1:75,000

Date Printed: 3/10/2024

5.1.6 Conservation Significant Vegetation

5.1.6.1 Old Growth Forest

Since the 1870s, the NJF subregion has experienced extensive timber harvesting. Alcoa undertook a comparison of historical timber harvesting data (Table 5-5, Figure 5-8 and Figure 5-9) to determine historical harvesting, clearing, and subsequent age and stages of regrowth.

Table 5-5: Forest age across the NJF within Huntly and Willowdale Mine Regions

Structural stage of harvesting regrowth	Time since last harvest (years)	Total Mapped Extent (ha)	Mapped Extent for Mine Regions	Percentage of total Mapped Extent within Mine Region
Establishment to Juvenile	**0-20**	98,258	36,755	37.4%
Immature	**21-70**	573,967	90,890	15.8%
Mature	**70+**	156,643	26,610	17.0%
Old Growth Forest	**N/A**	22,638	825	3.6%
No record of harvesting/Status unknown	**N/A**	15,530	176	1.1%
Total	**N/A**	**867,080**	**155,256**	17.9%

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
Willard
McCoy
O'Neil
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Major Dams
- National Parks

Mature Forest

- Establishment to Juvenile
- Immature
- Mature
- Old Growth Forest

Alcoa

0 1 2 4 km

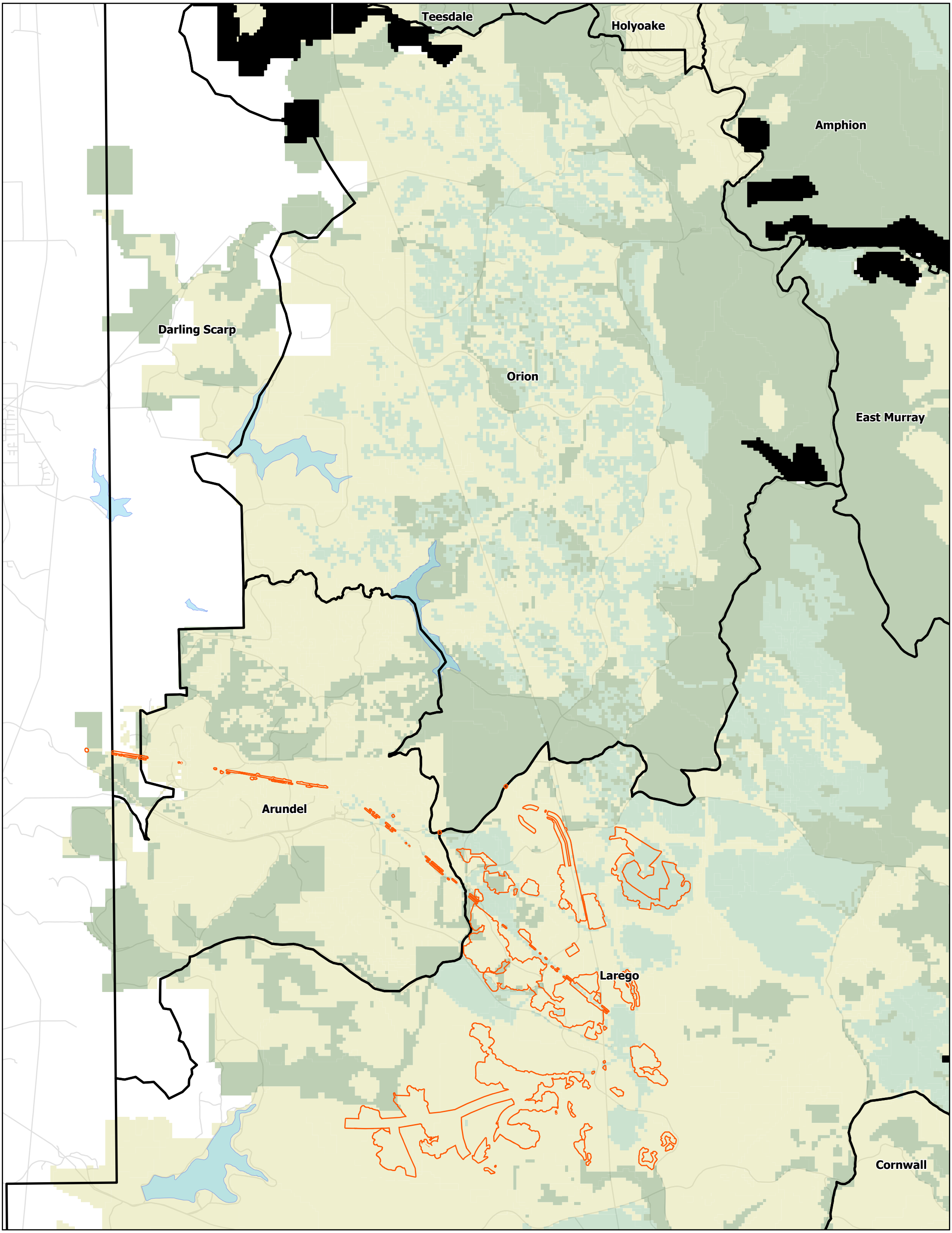
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2025 - 2029 Mining and Management Plan

Figure 5-8: Timber Harvesting Status - Huntly

Scale: 1:115,000

Date Printed: 9/10/2024



Legend

- 24 Month Clearing Schedule
- Mining Regions
- Major Dams

Mature Forest

- Establishment to Juvenile
- Immature
- Mature
- Old Growth Forest

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-9: Timber Harvesting Status - Willowdale

Scale: 1:75,000

Date Printed: 9/10/2024

5.1.6.2 Conservation Significant Flora and Vegetation

The conservation significant flora records from recent pre-clearance flora and vegetation surveys are detailed below. An assessment of likelihood of occurrence was undertaken for conservation significant flora, based on database searches (EPBC Act Protected Matters Search Tool, DBCA and Herbarium). The likelihood of occurrence identified during the desktop assessment were reassessed based on recently completed survey effort, habitat presence, and vegetation condition. A revised likelihood of occurrence is detailed in Table 5-6.

Huntly - Myara

For the Huntly - Myara region, the Huntly Pre-clearance surveys report (Ecologia Environment, 2023), the Alcoa Huntly-Myara Targeted Flora Survey (Biologic Environmental Survey, 2023) and the Summary of Flora and Vegetation Values on the Huntly and Larego Areas (Mattiske 2024d) recorded the following conservation significant flora within the Huntly survey area:

- *Tetratheca phoenix (P2),*
- *Acacia horridula (P3),*
- *Thysanotus anceps (P3),*
- *Senecio leucoglossus (P4), and*
- *Stylidium ireneae (P4).*

Huntly – O'Neil

For the Huntly – O'Neil region, the Assessment of Flora and Vegetation Values at O'Neil (Mattiske 2024c) considered there to be a very low potential of Threatened species occurring, due to the lack of suitable habitat and distance from known distributions. Pre-clearance survey reports (Ecologia Environment, 2024) and vegetation assessments (Mattiske 2024c) recorded four conservation significant flora within the survey area:

- *Hibbertia ambita (P1)*
- *Hibberta hortiorum (P1)*
- *Grevillea dissectifolia (P3)*
- *Senecio leucoglossus (P4)*

Willowdale

For the Willowdale regions, the following conservation significant flora species were recorded (Ecological Australia, 2023):

- *Netrostylis sp. Nannup (P.A. Jurjevich 1133) (P1)*
- *Grevillea prominens (P3)*
- *Senecio leucoglossus (P4)*

One flora species (*Boronia stricta*) was recorded, which represented a northeast range extension of approximately 125 km.

During the field survey, two key weed species were recorded: Blackberry (*Rubus sp.*), listed as a Declared Pest (DP) and a Weed of National Significance (WoNS) and Arum lily (**Zantedeschia aethiopica*) which was only recorded once in the survey area.

The targeted flora reports did not identify any range extensions or new species.

Table 5-6: Conservation significant flora considered likely to occur

Species	State Conservation Code	Federal Conservation Code	Associated Havel Site Types	Huntly	Willowdale
Andersonia sp. *Saxatilis* (F. & J. Hort 3324)	T		G	Low	Low
Anthocercis gracilis	T	VU	G/R	Low	Low
Caladenia leucochila	T	EN	P	Low	Low
Morelotia australiensis	T	VU	G/R/D	Low-Moderate	Low-Moderate
Darwinia hortiorum	P1	-	S/T /A/C /W /D/G/R	Moderate	Moderate
Deyeuxia inaequalis	P1	-	S/T	Low	Low
Hibbertia acrotoma	P1	-	G/R	Very Low	Very Low
Hibbertia ambita	P1	-	S	Recorded	Low
Hibbertia hortiorum	P1	-	S/ST/T/TS/D/SW/DG/YG/AD/A/Y/R/ AC/PT	Recorded	Moderate
Netrostylis sp. *Nannup* (P.A. Jurjevich 1133)	P1	-	AC	Moderate	Recorded
Paracaleana gracilicordata	P1	-	G/R/S	Moderate	Moderate
Paracaleana granitica	P1	-	G/R	High	High
Banksia recurvistylis	P2	-	G/R	Moderate	Moderate
Bossiaea modesta	P2		D	Moderate	Moderate
Grevillea ornithopoda	P2	-	A/C/W/D	Low-Moderate	Low-Moderate
Lepyrodia curvescens	P2	-	A/C/W/D	Low	Low
Schizaea rupestris	P2	-	A/C/W/D	Moderate	Moderate
Tetratheca phoenix	P2	-	G/R/PW/PS/E	Recorded	Moderate
Acacia drummondii subsp. *affinis*	P3	-	D/P/S	Low	Low
Acacia horridula	P3	-	G/R	Recorded	Low
Acacia oncinophylla subsp. *oncinophylla*	P3		G/R	Low	Low
Actinotus repens	P3	-	A/C/W/D	Moderate	Moderate
Adenanthos cygnorum subsp. *chamaephyton*	P3		P	Low	Low
Andersonia sp. *audax* (F. Hort, B. Hort & J. Hort 3179)	P3	-	A/C/D/EG/R/P/PL/S/T/W	Moderate	Moderate

Species	State Conservation Code	Federal Conservation Code	Associated Havel Site Types	Huntly	Willowdale
Conospermum scaposum	P3	-	DA	Low	Low
Cyathochaeta teretifolia	P3	-	CW	Low-Moderate	Low-Moderate
Grevillea dissectifolia	P3	-	A/AC/AD/AY/D/DG/ST/S/G/YG	Recorded	Moderate
Grevillea prominens	P3	-	S/W/T/TS/PS/CW/AC	Moderate	Recorded
Hakea oldfieldii	P3	-	A/C/ /D/E/P/S/T/W	Low	Low
Hemigenia microphylla	P3		S	Low	Low
Lepyrodia heleocharoides	P3	-	A/C/W/D	Very Low	Very Low
Meionectes tenuifolia	P3	-	A/C/W/D	Very Low	Very Low
Netrostylis sp. *Blackwood River*	P3	-	A/C/W/D	Moderate	Moderate
Stackhousia sp. *Red-blotched corolla* (A. Markey 911)	P3	-	P/S/T/G/R	Very Low	Very Low
Tetratheca parvifolia	P3	-	S/T/G/R	Low	Low
Tetratheca pilifera	P3	-	P/S/T	Very Low	Very Low
Thysanotus anceps	P3	-	SP	Recorded	Moderate
Calothamnus graniticus subsp. *leptophyllus*	P4		P/S/T/G/R	Moderate	Moderate
Cyanothamnus tenuis	P4	-	P/S/T/G/R	Moderate	Moderate
Eucalyptus x graniticola	P4	-	G/R	Low	Possible
Grevillea pimeleoides	P4	-	G1	Low	Low
Hemigenia platyphylla	P4	-	P/S/T/G/R	Very Low	Very Low
Lasiopetalum cardiophyllum	P4		D/P/PS/S/TS/DG/R	Low	Low
Parsonsia diaphanophleba	P4	-	A/C/W/D	Low	Low
Pimelea rara	P4	-	P/S/T/A/C/D/E/W	High	High
Senecio leucoglossus	P4	-	P/S/T/G/D/PS/TS/SP/PT/PW/TP/SW	Recorded	Recorded
Stylidium ireneae	P4	-	AC	Recorded	Moderate-High

5.1.6.3 Threatened and Priority Ecological Communities

A targeted vegetation survey has identified 2.3 ha of the 'Empodisma peatlands' TEC at Larego (Western Environmental, 2025a). The 'Empodisma peatlands' TEC is considered to also have potential to occur within the Huntly Mine DE. The 'Empodisma peatland' TEC is likely associated with the Swamp vegetation complex and the swamps and broad valleys SVTs.

A desktop assessment identified one Threatened Ecological Community which may occur in association with the Willowdale region, the Banksia Woodland of the Swan Coastal Plain; however this is restricted to the Swan Coastal Plain and as such does not extend into the Jarrah forest area on the Darling Ranges (Mattiske Consulting Pty Ltd, 2023).

One Priority Ecological Community (PECs, Table 5-7, Figure 5-10, Figure 5-11), as listed at State level by DBCA, does occur:

- Granite communities of the northern Jarrah Forest (P3)

There is a potential that the site-vegetation types associated with granite outcrops (site-vegetation type G, including variant G1 and R) will have associations with this PEC (Mattiske Consulting Pty Ltd, 2023).

Table 5-7: Potential Granite PEC present within the Huntly and Willowdale mine areas

Vegetation Code	Mapped extent (ha)	Huntly mine area		Willowdale mine area	
		Area (ha)	Proportion of Mapped Extent (%)	Area (ha)	Proportion of Mapped Extent (%)
G	403	330	82%	39	10%
G1	408	408	100%	0	0%
G2	1	1	95%	0	0%
R	961	867	90%	45	5%
R/G	14	5	36%	9	65%
Total	**1,788**	**1,611**	**90%**	**93**	**5%**

There is potential for Ecological Community, Litter Dependant Invertebrate Community of the northern Jarrah Forest (P2) to occur in the wider Jarrahdale area, however there is insufficient evidence that this is a discrete community type (Mattiske Consulting Pty Ltd, 2023). The vegetation types associated with this P2 community include D, H, HG, HS, PS, Y, YG and MG.

5.1.6.4 Potential Groundwater Dependent Vegetation

Vegetation mapping conducted by Mattiske in 2012 and 2019 and recent flora and vegetation surveys in the Kingsbury, Warrington, and Spion regions identified potential Groundwater Dependent Vegetation (GDVs). These GDVs are identified using key indicator species that thrive in seasonally moist and wet soils found in swamps, valley floors, and lower slopes (Table 5-8).

The key plant species indicative of potential GDVs include *Banksia littoralis, Hakea varia, Acacia divergens, Boronia molloyae, Thomasia paniculata, Astartea scoparia, Babingtonia camphorosmae,*

Eucalyptus patens, Hypocalymma angustifolium, Melaleuca preissiana, Melaleuca viminea and Taxandria linearifolia (Mattiske 2024).

These potential GDVs are expected to experience seasonal inundation and/or waterlogging due to the influence of groundwater and/or surface water flows.

The '*Empodisma* peatlands' TEC at Larego is considered a Groundwater Dependent Ecosystem (GDE). During the wet season, the groundwater table is expected to interact with surface water, invoking direct hydraulic connection. This suggests the '*Empodisma* peatlands' TEC is a surface expression GDE, with levels of flowthrough discharge reflective of variance in rainfall in-turn affecting groundwater recharge amounts (WSP 2025).

Table 5-8: Groundwater dependent vegetation present within the Huntly and Willowdale mine area

Vegetation Code	Mapped Extent (ha)	Huntly Mine Region		Willowdale Mine Region	
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent
A	809	738	91%	6	1%
AC	3,632	2,883	79%	474	13%
AD	445	421	95%	0	0%
AW	142	130	91%	4	3%
AW/AX	21	21	100%	0	0%
AX	76	76	100%	0	0%
B	1	0	0%	1	100%
C	430	345	80%	6	1%
CA	34	0	0%	34	100%
CQ	285	7	3%	272	95%
CW	3,240	2,161	67%	768	24%
D	5,396	4,806	89%	254	5%
DA	523	472	90%	2	0%
DG	231	230	100%	1	0%
E	512	432	84%	63	12%
PW	2,094	1,535	73%	294	14%
Q	446	93	21%	301	67%
SW	3,907	2,935	75%	522	13%
W	4,922	3,310	67%	1,445	29%
WA	36	33	91%	1	3%
Total	**27,182**	**20,628**	**76%**	**4,448**	**16%**

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
O'Neil
Willard
McCoy
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- Mining Regions
- National Parks
- Major Dams
- Priority Ecological Communities
- Groundwater Dependent Vegetation

Alcoa

0 1 2 4 km

N

2025 - 2029 Mining and Management Plan

Figure 5-10: Potential PECs and GDV – Huntly

Scale: 1:115,000

Date Printed: 9/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Conceptual Clearing Buffer
- Major Dams
- 'Empodisma Peatland' TEC
- Priority Ecological Communities
- Groundwater Dependent Vegetation

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-11: Potential PECs and GDV – Willowdale

Scale: 1:75,000

Date Printed: 14/05/2025

5.1.7 Phytophthora Dieback

Surveys have been conducted in the regions of the Huntly and Willowdale Mines to determine the status of Dieback since 1993 with the most recent surveys completed in 2023 and 2024 (Table 5-9). Areas that are un-interpreted, un-mapped, and free from Dieback are mapped at least 12 months before any clearing activities commence (Figure 5-12 and Figure 5-13).

Table 5-9 Dieback Status within Huntly and Willowdale Regions

Dieback Status	Total Mapped Area (ha)	Total Mapped Area (ha) for years 2023 and 2024
Infested (DB)	59,872	67
Disease Free (DBF)	41,224	132
Not Yet Resolved (NM)	48,792	-
Uninfested (UI)	2,544	33
Unsurveyed Area	6,061	-
Grand Total	**158,492**	**232**

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
O'Neil
Willard
McCoy
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- Mining Regions
- 24 Month Clearing Schedule
- National Parks
- Major Dams

Dieback

- Dieback
- Dieback Free
- Un-Interpretable

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-12: Dieback mapping - Huntly

Scale: 1:115,000

Date Printed: 7/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

- 24 Month Clearing Schedule
- Mining Regions
- Major Dams

Dieback

- Dieback
- Dieback Free
- Un-Interpretable

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 5-13: Dieback mapping - Willowdale

Scale: 1:75,000

Date Printed: 3/10/2024

5.2 Potential Environmental Impacts

Proposed clearing areas have been provided (24 Month Clearing Schedule) for areas of ore bodies and associated mining infrastructure, including haul roads and stockpile locations. Haul road boundaries are conceptual and include bunding, running surface and drainage sumps. Final haul road clearing will be within these boundaries.

The following activities have the potential to impact flora and vegetation:

- Construction of mine access and haul roads, conveyors and facilities.
- Extension of mining and operation of mining and haulage equipment.

The following potential direct and indirect impacts may occur to flora and vegetation:

- Direct impacts to flora and vegetation because of clearing.
- Indirect impacts to flora and vegetation because of:
  - Introduction and/or proliferation of weeds.
  - Introduction and/or proliferation of dieback.
- Spills and/or leaks from storage and handling of hazardous materials and waste.
- Dust emissions.
- Altered hydrology/groundwater regimes.

5.2.1 Direct loss of native vegetation on a local and regional scale

The proposed direct clearing impacts associated with the 24 Month Clearing Schedule are summarised in the following tables:

- Table 5-10 – Potential direct impacts to State-wide vegetation association, which indicates the Huntly and Willowdale Mine Regions have varying degrees of impact on different vegetation associations (Figure 5-1). For example, Vegetation Association 3, with a pre-European extent of 908,100 hectares, retains 79.7% of its original area, but the 24-month clearing schedule will reduce this by 0.3% in the Huntly region and 0.1% in the Willowdale region.
- Table 5-11 – Indicative estimates of direct impacts to vegetation complexes which presents data on vegetation complexes, showing the Huntly and Willowdale regions will experience minor reductions in current extents due to the clearing schedule (Figure 5-1). For example, Complex Ce, which currently retains 82.3% of its pre-European extent, will see a 1.3% reduction in Huntly and 0.3% in Willowdale. Similarly, Complex D1, with 86.8% remaining, will face a 0.8% reduction in Huntly and 0.4% in Willowdale.
- Table 5-12 – Indicative estimates of direct impacts to vegetation types (Figure 5-2 to Figure 5-7), which details vegetation types, highlighting that some types, such as Type A, retain 91.2% of their mapped extent in the Huntly region, with a minimal reduction of 0.8% due to clearing.

The maximum reduction is up to 50% of Type A in Willowdale, however this vegetation type is likely to be widely represented elsewhere with Huntly and Willowdale potentially impacting only 1% of the total mapped extent.

Table 5-10: Potential direct impacts to State-wide vegetation association

Vegetation Association	Total Pre-European Extent (ha)	Current Extent (ha)	Percentage (%) of Total Pre-European Extent Remaining	Huntly Mine Region			Willowdale Mine Region		
				24 Month Clearing Schedule (ha)	Percentage (%) of Pre-European Extent Remaining	Reduction of Current Extent due to 24 Month Clearing Schedule (%)	24 Month Clearing Schedule (ha)	Percentage (%) of Pre-European Extent Remaining	Reduction of Current Extent due to 24 Month Clearing Schedule (%)
3	908,100	723,446	79.7%	2,931	79.4%	0.3%	1,047	79.6%	0.1%
4	614,201	197,904	32.2%	-	-	-	0	32.2%	0.0%
128	4,757	4,124	86.7%	-	-	-	-	-	-

Table 5-11: Indicative estimates of direct impacts to vegetation complexes

Total Extents				Huntly Mine Region			Willowdale Mine Region		
Vegetation Complex	Total Pre-European Extent (ha)	Current Extent (ha)	Proportion of Pre-European Extent Remaining (%)	24 Month Clearing Schedule (ha)	Percentage (%) of Pre-European Extent Remaining	Reduction of Current Extent due to 24 Month Clearing Schedule (%)	Total 24 Month Clearing Schedule (ha)	Percentage (%) of Pre-European Extent Remaining	Reduction of Current Extent due to 24 Month Clearing Schedule (%)
Ce	36,805	30,304	82.3%	485	81.0%	1.3%	102	82.0%	0.3%
D1	208,620	181,039	86.8%	1,681	86.0%	0.8%	868	86.4%	0.4%
D2	86,183	5,918	6.9%	141	6.7%	0.2%	-	-	-
My1	68,737	52,296	76.1%	55	76.0%	0.1%	2	76.1%	0.0%

Total Extents				Huntly Mine Region			Willowdale Mine Region		
Vegetation Complex	Total Pre-European Extent (ha)	Current Extent (ha)	Proportion of Pre-European Extent Remaining (%)	24 Month Clearing Schedule (ha)	Percentage (%) of Pre-European Extent Remaining	Reduction of Current Extent due to 24 Month Clearing Schedule (%)	Total 24 Month Clearing Schedule (ha)	Percentage (%) of Pre-European Extent Remaining	Reduction of Current Extent due to 24 Month Clearing Schedule (%)
Pn	16,7270	128,685	76.9%	47	76.9%	0.0%	-	-	-
S	53,696	40,613	75.6%	31	75.5%	0.1%	0	75.6%	0.0%
Yg1	80,252	64,927	80.9%	137	80.7%	0.2%	48	80.8%	0.1%
Yg2	50,292	46,475	92.4%	356	91.7%	0.7%	26	92.3%	0.1%
Total	**751,856**	**550,257**	**94.2%**	**2,931**	**93.7%**	**0.5%**	**1,047**	**94.0%**	**0.1%**

Table 5-12: Indicative estimates of direct impacts to vegetation types (VT)

VT Code	Total Mapped extent (ha)	Huntly Mine Region				Willowdale Mine Region			
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent
A	809	738	91.2%	6	0.8%	6	0.7%	3	50.0%
AC	3,632	2,883	79.4%	24	0.8%	474	13.1%	1	0.2%
AD	445	421	94.6%	0	0.0%	0	0.0%	-	-
AW	143	130	91.2%	0	0.0%	4	2.8%	-	-

VT Code	Total Mapped extent (ha)	Huntly Mine Region				Willowdale Mine Region			
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent
AW/AX	21	21	99.0%	-	-	0	0.0%	-	-
AX	76	76	100.6%	-	-	0	0.0%	-	-
AY	-	33	-	-	-	0	-	-	-
B	1	0	0.0%	-	-	1	97.5%	-	-
C	430	345	80.3%	6	1.7%	6	1.4%	-	-
CA	34	0	0.0%	-	-	34	99.1%	-	-
CQ	285	7	2.5%	-	-	272	95.5%	-	-
CW	3,240	2,161	66.7%	12	0.6%	768	23.7%	5	0.7%
D	5396	4,806	89.1%	67	1.4%	254	4.7%	34	13.4%
DA	523	472	90.3%	6	1.3%	2	0.4%	-	-
DB	5	5	106.7%	-	-	0	0.0%	-	-
DG	231	230	99.5%	8	3.5%	1	0.4%	-	-
E	511	432	84.5%	14	3.2%	63	12.3%	-	-
G	403	330	81.9%	0	0.0%	39	9.7%	-	-
G1	408	408	100.0%	3	0.7%	0	0.0%	-	-
G2	1	1	100.0%	-	-	0	0.0%	-	-
J	46	43	93.5%	-	-	0	0.0%	-	-
M	4	2	50.0%	-	-	0	0.0%	-	-
P	1,891	1,355	71.7%	110	8.1%	191	10.1%	10	5.2%

VT Code	Total Mapped extent (ha)	Huntly Mine Region				Willowdale Mine Region			
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent
PL	210	175	83.3%	-		0	0.0%	-	
PS	11,079	8,633	77.9%	562	6.5%	1,511	13.6%	175	11.6%
PT	2,129	1,476	69.3%	25	1.7%	599	28.1%	70	11.7%
PW	2,094	1,535	73.3%	138	9.0%	294	14.0%	7	2.4%
Q	446	93	20.9%	-	-	301	67.5%	-	-
R	971	867	89.3%	11	1.3%	45	4.6%	1	2.2%
R/G	14	5	35.7%	-	-	9	64.3%	-	-
S	22,080	16,422	74.4%	770	4.7%	4,082	18.5%	221	5.4%
SP	6,170	4,695	76.1%	301	6.4%	962	15.6%	67	7.0%
SP-D	10	10	100.0%	-	-	0	0.0%	-	-
S-SP	1	1	100.0%	-	-	0	0.0%	-	-
ST	7,998	4,242	53.0%	88	2.1%	3,128	39.1%	41	1.3%
SW	3,907	2,935	75.1%	53	1.9%	522	13.4%	9	1.7%
SW-D	9	9	100.0%	-	-	-	0.0%	-	-
T	6,559	5,212	79.5%	48	0.9%	1,031	15.7%	63	6.1%
TP	269	15	5.6%	2	13.3%	254	94.4%	61	24.0%
TS	12,442	8,590	69.0%	294	3.4%	3,244	26.1%	215	6.5%
W	4,922	3,310	67.2%	47	1.4%	1,445	29.4%	12	0.8%
WA	36	33	91.7%	-	-	1	2.8%	-	-

VT Code	Total Mapped extent (ha)	Huntly Mine Region				Willowdale Mine Region			
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total mapped extent	24 Month Clearing Schedule (ha)	Proportion of mine region extent
WD	1	1	100.0%	-	-	0	0.0%	-	-
Y	17	17	100.0%	-	-	0	0.0%	-	-
YG	14	14	100.0%	-	-	0	0.0%	-	-
YS	5	5	100.0%	-	-	0	0.0%	-	-
Z	512	95	18.6%	-	-	0	0.0%	-	-
Dam	329	329	100.0%	-		0	0.0%	-	-
Cleared Areas	5,804	4,036	69.5%	1	0.0%	1,768	30.5%	37	2.1%
Rehabilitated Areas	18,473	13,427	72.7%	317	2.4%	5,046	-	1	0.0%
Unsurveyed Area	59,527	10,836	18.2%	15	0.1%	35,264.15	-	13	0.0%
Grand Total	**184,563**	**101,917**	**55.2%**	**2,931**	2.9%	**56,575.15**	**30.7%**	**1,047**	1.9%

5.2.2 Direct loss of conservation significant flora and vegetation

5.2.2.1 Conservation significant flora and vegetation

The 24 Month Clearing Schedule considers potential impacts to NJF (Table 5-13) and mapped forest age (Figure 5-8 and Figure 5-9). Most of the clearing in Huntly and Willowdale will potentially impact established forest to immature forests (0 - 70 years since last harvest).

No clearing of Old Growth Forest will occur and the total potential impact to Mature Forest is 488 ha. This represents 3.2% of the mapped extent within the Huntly mine region and 0.3% of the mapped extent within the Willowdale mine region.

Areas with no record of harvesting will be mapped to confirm the regrowth stage. If old-growth forest is identified, it will be avoided.

Table 5-13: Potential clearing impact on Forest

Structural stage of harvesting regrowth	Time since last harvest (years)	Huntly			Willowdale		
		Area (ha) within Mine Region	24 Month Clearing Schedule (ha)	Proportion of mine region extent (%)	Area (ha) within Mine Region	Willowdale 24 Month Clearing Schedule (ha)	Proportion of mine region extent (%)
Establishment to Juvenile	**0-20**	26,747	1,289	4.8%	10,008	101	1.0%
Immature	**21-70**	60,380	1,170	1.9%	30,510	909	3.0%
Mature	**70+**	13,950	451	3.2%	12,659	37	0.3%
Old Growth Forest	**N/A**	114	-	0.0%	711	-	0.0%
No record of harvesting	**N/A**	121	22	18.2%	55	-	0.0%
Total	**N/A**	**101,312**	**2,931**	**2.9%**	**53,944**	**1,046**	**1.9%**

Table 5-14 details the current outcomes of Alcoa's pre-clearance targeted flora surveys in relation to the 24-month clearing schedule. Alcoa's targeted and pre-clearance surveys typically focus on proposed clearing footprints, meaning that these surveys do not provide a comprehensive understanding of conservation significant flora populations outside the clearing areas or across the broader region. No clearing of Threatened flora individuals will occur and direct impacts to Priority-listed individuals will be minimised as per the Flora and Vegetation Management Plan (FVMP) (Appendix 10). Further surveys will occur for Priority-listed species to ensure potential direct impacts are acceptable. It is noted that Alcoa has committed to a Priority-listed species population impact outcome within the Assessments 2384 and 2385:

- No disturbance or adverse impacts to more than 2% of the known population of Priority listed flora species, until it can be demonstrated that more than 100 individuals have been recorded, in which case 10% of the known population.

Table 5-14: Conservation Significant Flora within 24 Month Clearing Schedule

Conservation Significant Flora	Conservation Ranking	Huntly – Recorded individuals					Willowdale – Recorded individuals				
		Within Huntly mine region	Recorded Individuals in FCA endorsed and under assessment	Proportion of Individuals in FCA endorsed and under assessment (%)	Within 24 Months Clearing Schedule	Proportion within 24 months Clearing Schedule (%)	Within Willowdale mine region	Recorded Individuals in FCA endorsed and under assessment	Proportion of Individuals in FCA endorsed and under assessment (%)	Within 24 Months Clearing Schedule	Proportion within 24 months Clearing Schedule (%)
Hibberta hortiorum	P1	95,802	8,957	9.3%	23,930	25.0%	-	-	-	-	-
Tetratheca phoenix	P2	283	10	3.5%	246	86.9%	-	-	-	-	-
Thysanotus anceps	P3	12	4	33.3%	2	16.7%	-	-	-	-	-
Acacia horridula	P3	23	-	-	4	17.4%	-	-	-	-	-
Grevillea dissectifolia	P3	138	-	-	2	1.4%	-	-	-	-	-
Grevillea prominens	P3	-	-	-	-	-	451	5	1.1%	120	26.6%
Senecio leucoglossus	P4	9,054	604	6.7%	7,489	82.7%	3,222	1,068	33.1%	2,574	79.9%
Stylidium ireneae	P4	410	10	2.4%	377	92.0%	-	-	-	-	-

5.2.2.2 Potential Conservation Significant Flora Habitats

The 24 Month Clearing Schedule considers potential impacts to potentially suitable habitats for conservation significant flora (Table 5-15, Figure 5-2 to Figure 5-7).

As there are no recorded Threatened flora populations within the 24 Month Clearing Schedule, it is not anticipated that any impacts, including direct impacts from clearing, will occur to Threatened flora within the 24 Month Clearing Schedule. Targeted surveys will occur in all areas prior to clearing and any Threatened flora species identified through these surveys will be avoided, as detailed in the FVMP (Appendix 10).

Impacts associated with other conservation significant flora will be addressed in FCAs, with consideration of pre-clearance Targeted flora surveys.

Table 5-15: Proposed clearing by flora habitat

Flora Habitat	Potential Conservation Significant Flora	Total Mapped Extent (ha)	Huntly Mine Region		Willowdale Mine Region	
			Proposed Clearing Area	% of Mapped Area	Proposed Clearing Area	% of Mapped Area
Granites (R and G SVTs):	– *Andersonia sp. Saxatilis (F. & J. Hort 3324) (Threatened, Critically Endangered)* – *Anthocercis gracilis (Threatened, Vulnerable)* – *Darwinia hortiorum (P1)* – *Hibbertia acrotoma (P1)* – *Paracaleana gracilicordata (P1)* – *Paracaleana granitica (P1)* – *Tetratheca phoenix (P2)* – *Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179) (P3)* – *Cyanothamnus tenuis (P4)* – *Senecio leucoglossus (P4)*	1,212.3	14	1.2%	1	0.1%
Swamps and creeks (A, B, C, D, E and W SVTs):	– *Darwinia hortiorum (P1)* – *Grevillea ornithopoda (P2)* – *Lepyrodia curvescens (P2)* – *Schizaea rupestris (P2)* – *Actinotus repens (P3)* – *Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179) (P3)* – *Cyathochaeta teretifolia (P3)* – *Grevillea dissectifolia (P3)* – *Hakea oldfieldii (P3)* – *Lepyrodia heleocharoides (P3)* – *Meionectes tenuifolia (P3)* – *Stylidium ireneae (P4)*	12,068.9	193	1.6%	56	0.4%
Lateritic hills and	– *Morelotia australiensis (Threatened, Vulnerable)*		2,391	4.1%	940	1.6%

Flora Habitat	Potential Conservation Significant Flora	Total Mapped Extent (ha)	Huntly Mine Region		Willowdale Mine Region	
			Proposed Clearing Area	% of Mapped Area	Proposed Clearing Area	% of Mapped Area
slopes (P, S and T SVTs):	– *Darwinia hortiorum (P1)* – *Hibbertia hortiorum (P1)* – *Tetratheca phoenix (P2)* – *Acacia drummondii subsp. affinis (P3)* – *Grevillea dissectifolia (P3)* – *Tetratheca pilifera (P3)* – *Cyanothamnus tenuis (P4)* – *Pimelea rara (P4)* – *Senecio leucoglossus (P4)* – *Stylidium ireneae (P4)*	58,961.8				

5.2.2.3 Threatened and Priority Ecological Communities Conservation

The '*Empodisma* Peatland' TEC is located adjacent to previously cleared areas (conveyor belt) within a stream zone. No further direct impact will occur to this TEC or any identified through further surveys.

There is potential for site-vegetation types associated with granite outcrops—specifically types G (including variant G1) and R—to have associations with the PEC, as noted by Mattiske Consulting Pty Ltd in 2023 (Table 5-16, Figure 5-10 and Figure 5-11). All potential impacts are less than 5% of the total mapped extent of the vegetation type.

Table 5-16 Potential Impacts to Priority Ecological Communities within Huntly and Willowdale Regions

Vegetation Code	Mapped extent (ha)	Huntly Mine Region		Willowdale Mine Region	
		24 Month Clearing Schedule (ha)	Proportion of Mapped Extent (%)	24 Month Clearing Schedule (ha)	Proportion of Mapped Extent (%)
G	403	0	0.00%	0	0.00%
G1	408	3.1	0.77%	0	0.00%
R	961	11.0	1.14%	0.7	0.08%
Total	**1,788**	**14.3**	**0.80%**	**0.7**	**0.04%**

5.2.2.4 Potential Groundwater Dependant Vegetation

The 24 Month Clearing schedule considers a detailed overview of the distribution and potential clearing of various GDVs in these regions (Table 5-17). Notably, vegetation type PW, with 2,094 ha mapped in the Huntly region, could have up to 137 ha (8.9%) potentially impacted. Vegetation types A and DA, with 6 ha and 2 ha in the Willowdale region, could have up to 3 ha and 1 ha (50.0%)

potentially impacted, however these vegetation types have mapped extent outside of the Willowdale region.

The '*Empodisma* Peatland' TEC located at Larego is considered a GDE (WSP 2025), however no further direct impact will occur to this TEC or any identified through further surveys.

Table 5-17 Groundwater dependent vegetation present within the Huntly and Willowdale mine area

Vegetation Type Code	Total Mapped extent (ha)	Huntly Mine Region				Willowdale Mine Region			
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total Huntly Mine Region	24 Month Clearing Schedule (ha)	Proportion of mine region extent	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total Willowdale Mine Region	24 Month Clearing Schedule (ha)	Proportion of mine region extent
A	809	738	91%	6	0.8%	6	1%	3	50.0%
AC	3,632	2,883	79%	24	0.8%	474	13%	1	0.2%
AD	445	421	95%	0	0.0%	0	0%	-	-
AW	142	130	91%	0	0.0%	4	3%	-	-
AW/AX	21	21	100%	-	-	0	0%	-	-
AX	76	76	100%	-	-	0	0%	-	-
B	1	0	0%	-	-	1	97%	-	-
C	430	345	80%	6	1.7%	6	1%	-	-
CA	34	0	0%	-	-	34	99%	-	-
CQ	285	7	2%	-	-	272	95%	-	-
CW	3,240	2,161	67%	12	0.6%	768	24%	5	0.7%
D	5,396	4,806	89%	67	1.4%	254	5%	34	13.4%
DA	523	472	90%	6	1.2%	2	0%	1	50.0%
DG	231	230	100%	8	3.5%	1	0%	-	-
E	512	432	84%	14	3.3%	63	12%	-	-
PW	2,094	1,535	73%	137	8.9%	294	14%	7	2.4%
Q	446	93	21%	-	-	301	67%	-	-
SW	3,907	2,935	75%	53	1.8%	522	13%	9	1.7%
W	4,922	3,310	67%	47	1.4%	1,445	29%	12	0.8%
WA	36	33	92%	-	-	1	3%	-	-
Grand Total	**27,181**	**20,628**	**76%**	**385**	**1.9%**	**4,448**	**16%**	**73**	**1.6%**

5.2.3 Indirect impacts

5.2.3.1 Introduction and/or proliferation of weeds

Weeds can potentially impact an area's biodiversity by competing with native understory species and altering the fire regime. The risk of introducing weeds through vehicles and equipment is minimal as commuting by the workforce and deliveries by heavy vehicles will end at the mine facilities. Movements within the mine areas will primarily be carried out by vehicles and equipment that meet mine specifications and will stay within these areas.

Alcoa has developed weed mitigation measures (Section 6.3) for certain habitats that are deemed susceptible to weed invasion, such as:

- Swamps and creeks (A, B, C, D, E and W SVTs) - limited distribution, moisture-retaining soil, and role as habitats for threatened and priority flora.
- Granite outcrops (R and G SVTs) - provide habitat for threatened and priority flora, have a similarly restricted distribution to swamps and creeks.

Clearing will be minimal within swamp and creek vegetation types (with a Huntly and Willowdale cumulative total of less than 2%) and within granite outcrops (less than 2%) (Table 5-14). This suggests a limited direct interaction with swamps, valleys, and granite outcrops, implying that the most significant potential for weed spread into these limited-distribution communities would be through stormwater runoff and creek flow.

5.2.3.2 Introduction and/or proliferation of dieback

Dieback, a condition marked by the progressive death of plant tissues, spreads in a characteristic manner. The infection front is defined by the death and decay of susceptible understorey species from the *Proteaceae, Myrtaceae, Papilionaceae,* and *Epacridaceae* families (Shearer and Tippett 1989, Shearer 1994). *Banksia grandis*, due to its size, widespread distribution, and rapid mortality, serves as a significant indicator of infestations.

Jarrah (*E. marginata*) typically succumbs to dieback following the understorey (especially on poorly drained and infertile soils), but may persist in some areas. Other eucalypt canopy species, such as C*. calophylla, E. patens, E. rudis, and E. megacarpa*, exhibit resistance to dieback.

The impact of dieback on the Jarrah Forest is significant, leading to a loss of floristic diversity and alterations in community structure and function (Shearer 1994). Forests dominated by Jarrah with a diverse understorey are typically replaced by open woodlands with a Marri-dominant canopy and a sedge-dominant understorey. Loss of floristic diversity can result in the disappearance of flora significant for conservation, either through direct vulnerability or loss of community structure/habitat.

Alcoa has also mapped the Dieback status of the mine plan area, categorising the total mapped area and the 24 Month Clearing Schedule area for each dieback status across the Huntly and Willowdale Mine Regions (Table 5-18).

In the Huntly Mine Region, Infested dieback represents 50% of the total 24 Month Clearing Schedule, with unsurveyed areas representing 1% of the total area to be cleared. In the Willowdale Mine Region, Infested dieback represents 98% of the total 24 Month Clearing Schedule.

Table 5-18 Dieback Status

Dieback Status	Total Mapped Area (ha)	Huntly Mine Region		Willowdale Mine Region	
		24 Month Clearing Schedule area (ha)	Percentage (%) of total Mapped Area	24 Month Clearing Schedule area (ha)	Percentage (%) of total Mapped Area
Infested (DB)	59,872	1,465	2.45%	1,022	1.71%
Disease Free (DBF)	41,224	1,402	3.40%	22	0.05%
Not Yet Resolved (NM)	48,792	34	0.07%	3	0.01%
Uninfested (UI)	2,544	30	1.22%	0	0.00%
Total	**158,492**	**2,931**	**1.85%**	**1,047**	**0.66%**

Mining activities pose a potential risk for spreading Dieback throughout the mine pits and haul road network via movement of earthmoving machinery and topsoil between clearing areas (which may be infested with Dieback) and other areas (such as topsoil stockpiles and rehabilitation sites).

Mine pits will be located over uplands, which have a higher proportion of uninfested areas and vegetation vulnerable to Dieback. The progressive development of haul roads and the movement of vehicles and equipment may lead to the spread of Dieback from infested areas in valleys and swamps to uninfested areas in the mine pits.

The spread of Dieback through stormwater runoff to uninfested sites downstream is unlikely, as the majority of creek and swamp areas are already mapped as infested.

Alcoa has developed mitigation measures associated with the risk of the spread of Dieback (Section 6.3).

5.2.3.3 Spills and/or leaks from storage and handling of hazardous materials and waste

Should a spill or leak of environmentally hazardous materials or waste occur, it could potentially cause localised effects on the condition of vegetation and possibly lead to die-off near the area of soil or water contamination.

Several potential sources of spills or leaks have been identified:

- The storage and majority of handling of hazardous materials and wastes – this will take place at the mine infrastructure facilities, within areas that are bunded and sealed.
- The refuelling and maintenance of earthmoving equipment - carried out in the field, which could lead to spills or leaks outside of the bunded areas, most likely at cleared mine pits or haul roads.
- Vehicle accidents.

Alcoa has developed mitigation measures associated with the risk of spills of hazardous materials and waste (Section 6.3).

5.2.3.4 Dust emissions

The deposition of dust has the potential to adversely affect native vegetation, primarily by reducing photosynthesis and increasing leaf temperature (Doley 2006, Doley and Rossato 2010). Farmer (1993) demonstrated that inert mineral dusts can impair plant growth when surface loads exceed 7 g/m².

While Doley (2006) noted that surface loading does not account for the net rate of dust accumulation on leaf surfaces, which is influenced by factors such as leaf orientation, age, roughness, and wettability.

According to Doley (2006), critical dust loads that significantly alter the most sensitive plant functions vary with the particle size distribution and colour of the dust. For instance, the critical load is about 1 g/m-² for carbon black with a median diameter of about 0.15 µm, and about 8 g/m-² for coarse road or limestone dusts with median diameters greater than about 50 µm. The critical loads vary with the plant function, and it is not possible to predict precisely the nature of one plant response from the knowledge of another.

Doley (2013) modelled the potential effects of quarry dust on native vegetation, indicating a greater effect on ground cover species. A predicted 20% reduction in dry matter production occurs at dust deposition of approximately 7 g/m², supporting earlier findings by Farmer (1993). The effects on overstorey and understorey trees/shrubs are predicted to be substantially lower (less than 5% reduction at 7 g/m²) due to more vertically oriented leaves and higher wind exposure that reduces dust accumulation, as well as less sensitivity to shading by dust. Doley (2013) noted that dust is expected to be effectively removed by heavy rain events (> 5 mm) and strong wind events (> 5 m/s).

Dust accumulation is expected to peak during the summer and autumn seasons when high rainfall events are infrequent, though it can be reduced by high wind events. Climatic data for the Dwellingup BOM station (site 009538) indicates that summer and autumn winds exceed 20 kmph (5.6 m/s) approximately 20% of the time, suggesting potential for dust removal during this period.

The net dust deposition on Jarrah Forest vegetation will depend on individual vegetation characteristics, including branching habit and stiffness, foliage density and element size (e.g., needles vs large leaves), and leaf orientation, smoothness, hairs or resin (Doley 2013).

Understorey vegetation is potentially more susceptible to dust accumulation and impact, as predicted by Doley (2013). However, the Jarrah Forest understorey is likely to exhibit lower photosynthetic activity during summer and autumn due to shallower roots and limited access to soil moisture compared to deeper-rooted overstorey species. As a result, dust accumulation that occurs during summer and autumn between wind events may have limited impacts on understorey vegetation. Following winter and spring rains and the recharge of shallow soil moisture, the understorey vegetation will become more active. However, this will coincide with rainfall events that cause dust wash-off and reduce dust accumulation.

Dust emissions, a byproduct of mine development, bauxite mining, and rehabilitation operations, can originate from open mine pits during the period between clearing and the completion of rehabilitation. Alcoa has developed mitigation measures associated with these emissions (Section 6.3).

5.2.3.5 Altered hydrology/groundwater regimes

It is anticipated that groundwater mounding will occur beneath and around mine pits because of the removal of native vegetation and the subsequent increase in rainfall recharge. The most significant rise in groundwater levels is expected to happen near the mining areas, while a more moderate rise is predicted in valleys where potential Groundwater Dependent Ecosystems (GDEs) are situated. The mounding is projected to be more pronounced under wetter climate conditions. Alcoa has developed mitigation measures associated with altered hydrology and groundwater regimes (Section 6.3).

An initial hydrological and hydrogeological assessment of the impacts to the identified '*Empodisma* peatlands' TEC has been undertaken by WSP (2025, Appendix 18). The key outcomes include:

- Changes of modelled climate (i.e., rainfall to represent different seasons) had a greater influence on water balances than changes of land use
- Mining activities are likely to marginally increase the elevation of the groundwater table due to increased groundwater recharge in response to reduced vegetation cover and reduced transpiration rates across the catchment.
- Due to the flow through capacity of the '*Empodisma* peatlands' TEC, any increased groundwater table levels will be surface expressed and flowthrough the '*Empodisma* peatlands' TEC. As such, changes associated with the haul road are unlikely to result in any permanent inundation or change to the '*Empodisma* peatlands' TEC overall health and condition.

5.2.4 Cumulative Impacts

5.2.4.1 Past and present activities

The NJF subregion has been subject to environmental impacts from a range of past and present activities, such as (in order of area of disturbance):

- Agriculture.
- Timber harvesting.
- Prescribed burning.
- Bauxite and gold mining.
- Plantations.
- Water supply reservoirs.

Agriculture and other clearing activities have caused widespread impacts including:

- Loss of biodiversity and habitat from permanent clearing.
- Long term loss of mature trees and associated hollows from timber harvesting.
- Spread of *Phytophthora* Dieback in forested areas from timber harvesting.
- Agricultural impacts to soils including erosion, salinity, compaction and acidification.
- Secondary salinity impacts to the Murray and Avon rivers from permanent clearing.
- Conversion of natural landscape to rural character and conversion of old growth forest to juvenile to immature forest age.

Mining has caused impacts as follows:

- Short to medium term ecological and amenity impacts during operations and until rehabilitation establishes.
- Medium term loss of fauna habitats during operations and until rehabilitation establishes.

- Rehabilitation restoring varying biodiversity, ecological integrity and landscape quality.

Prescribed burning is undertaken to reduce the severity and extent of wildfires, which can have some ecological, water quality and amenity impacts (similar to timber harvesting).

Water supply reservoirs have caused localised loss of incised river valley landforms and vegetation and widespread disruption to aquatic fauna migrations and dispersal; however, they have created perennial waterbodies that provide refuges for aquatic fauna.

5.2.4.2 Reasonably foreseeable future activities

Reasonably foreseeable future activities within the NJF subregion include approved and proposed mining. All Jarrah Forest cleared for mining is expected to be rehabilitated.

Prescribed burning is expected to continue within the subregion in accordance with the WA Government's strategy to reduce fuel loads and minimise the likelihood and severity of large-scale wildfires.

Other future activities within the subregion may include urban or rural residential development, infrastructure development and agriculture, which are expected to be relatively minor and subject to regulation under Part V of the EP Act.

5.2.4.3 Vegetation Cumulative Impacts

Alcoa has considered cumulative impacts of the MMP and other developments and processes to flora and vegetation in the NJF subregion. The NJF subregion is selected as the system boundary for cumulative impact assessment, as it is ecologically distinct from surrounding IBRA subregions. Cumulative impacts on the flora and vegetation within the NJF subregion may be due to the following:

- Mining and rehabilitation.
- Fragmentation.
- Timber harvesting.
- Climate change and wildfire.
- Disease and weed invasions.

Cumulative impacts are considered to include all Alcoa previous and future activities, such as clearing associated with Assessment 2253 and any future Part IV EP Act Referrals. The following cumulative impacts to flora and vegetation are considered:

- Table 5-19 – Indicative estimates of cumulative direct impacts to State-wide vegetation association
- Table 5-20 – Indicative estimates of cumulative direct impacts to vegetation complexes
- Table 5-21 - Indicative estimates of cumulative direct impacts to conservation significant vegetation types
- Table 5-22 - Indicative estimates of cumulative direct impacts to vegetation types

The most widespread impact to flora and vegetation has been historic clearing for agriculture, rural development and timber harvesting, impacting approximately 58% of the subregion and 1% of old

growth forest. Approximately 2% of the subregion has been cleared within DBCA managed lands, and the remaining 39% is cleared outside DBCA managed lands, predominantly for agriculture and rural development.

Wildfires and *Phytophthora* dieback have impacted DBCA managed lands within the subregion by approximately 86% and 34%, respectively. No data is available for wildfire or Dieback impacts outside DBCA managed lands.

There is a lack of data to accurately predict the magnitude of climate change impacts; however, impacts may potentially be widespread given the reduction in rainfall and increased temperatures across the NJF subregion. In addition, there is no information available to address indirect impacts and to the extent and impact from timber harvesting and/or prescribed burns compared to clearing.

Mining and rehabilitation combined comprise approximately 2% of the subregion and additional areas proposed for clearing will increase this to approximately 4% by 2035 (of which 2% is attributed to Alcoa). Alcoa has rehabilitated about 78% of areas cleared for its bauxite mining operations to varying prescriptions and practice.

Alcoa is forecasting a 4.5% decrease in vegetation association 3 over the cumulative ten year mine plan, being impacted at both the Huntly and Willowdale Mine regions (Table 5-19). This vegetation association has a large extent in comparison to the other vegetation association types.

For the vegetation complexes within the region (Table 5-20, including all Alcoa previous and future activities such as clearing associated with Assessment 2253 and any future Part IV EP Act Referrals), the Cooke (Ce) complex retains 75.8% of its original extent, with 2,389 ha planned for future clearing, while the Dwellingup (D1) complex in the Huntly region retains 77.5% of its original extent.

Alcoa has mapped the extent (ha) of the significant vegetation and broken down the future clearing into the respective mines and different categories (Table 5-21, including all Alcoa previous and future activities such as clearing associated with Assessment 2253 and any future Part IV EP Act Referrals) to determine the total area that will be cleared and the percentage of how much will be cleared in comparison to the mapped extent. Swamps and Creeks currently have an extent of 12,069 ha and is expected to be impacted by 6.7%. Likewise, Lateritic Hills and Slopes extend over 58,962 ha and they are projected to be impacted by 23.2%. Conservation significant vegetation, such as Potential GDV and Granites, will also be impacted by future mining, with over 4% and 10% of their respective mapped extents planned for clearing.

Table 5-19: Overview of Alcoa cumulative impacts to vegetation associations within NJF sub-region

Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Pre-European Extent Remaining (%)	Huntly Mine Region (including Assessment 2253)						Willowdale Mine Region (including future Part IV EP Referrals)						Total future mine areas (ha)	Portion of extent remaining (%)	Total decrease in remaining extent (%)
				Cleared Areas (ha)	FCA Endorsed Clearing (ha)	24 Month Clearing Schedule (ha)	Total 5 Year Clearing Schedule (ha)	Total Ten Year Mine Plan (ha)	Percentage (%) of Pre-European Extent Remaining	Cleared Areas (ha)	FCA Endorsed Clearing (ha)	Total 24 Month Clearing Schedule (ha)	5 Year Clearing Schedule (ha)	Ten Year Mine Plan (ha)	Percentage (%) of Pre-European Extent Remaining			
3	908,100	723,446	79.7%	17,246	827	3,804	4,715	2,492	76.7%	6,747	747	1,047	918	2,109	78.6%	40,652	75.2%	4.5%
4	614,201	197,904	32.2%	2	0	-	-	-	32.2%	0	0	-	-	-	32.2%	2	32.2%	0.0%
128	4,757	4,124	86.7%	1	0	-	-	-	86.7%	0	0	-	-	-	86.7%	1	86.7%	0.0%
Total	**1,527,058**	**925,474**	**60.6%**	17,249	**827**	**3,804**	**4,715**	**2,492**	**58.8%**	6,747	**747**	**1,047**	**918**	**2,109**	**60.0%**	**40,655**	**57.9%**	**2.7%**

Table 5-20: Overview of Alcoa cumulative impacts to vegetation complexes

Vegetation Complex	Total Pre-European Extent (ha)	Current Extent (ha)	Pre-European Extent Remaining (%)	Huntly Region (including Assessment 2253)						Willowdale Mine Region (including future Part IV EP Referrals)						Total future mine areas (ha)	Portion of extent remaining (%)	Total decrease in remaining extent (%)
				Cleared Areas (ha)	FCA Endorsed Clearing (ha)	24 Month Clearing Schedule (ha)	5 Year Clearing Schedule (ha)	10 Year Mine Plan (ha)	%of Pre-European Extent Remaining	Cleared Areas (ha)	FCA Endorsed Clearing (ha)	24 Month Clearing Schedule (ha)	5 Year Mine Plan (ha)	10 Year Mine Plan (ha)	% of Pre-European Extent Remaining			
Ce	36,805	30,304	82.3%	763	84	501	192	106	77.9%	410	24	102	96	111	80.3%	2,389	75.8%	6.5%
D1	208,620	181,039	86.8%	13,158	592	2,216	1,549	1,864	77.5%	5,500	588	868	724	1,731	82.3%	28,790	73.0%	16.0%
D2	86,183	5,918	6.9%	244	0	309	1,561	144	4.2%	0	0	0	0	0	6.9%	2,258	4.2%	3.0%
D4	132,414	115,545	87.3%	3	0	0	67	0	87.2%	0	0	0	0	0	87.3%	70	87.2%	0.1%
G	27,467	21,818	79.4%	0	0	0	0	0	79.4%	0	0	0	0	0	79.4%	0	79.4%	0.0%
He1	15,890	12,045	75.8%	0	0	0	0	0	75.8%	9	0	0	0	0	75.5%	9	75.7%	0.1%
My1	68,737	52,296	76.1%	646	36	55	13	0	75.0%	179	23	2	0	0	75.8%	954	74.7%	2.0%
Pn	167,270	128,685	76.9%	17	0	135	369	0	76.6%	0	0	0	0	0	76.9%	521	76.6%	0.3%
S	53,696	40,613	75.6%	31	0	51	78	3	75.3%	11	4	0	0	0	75.6%	178	75.3%	1.7%
Yg1	80,252	64,927	80.9%	1,105	92	146	255	313	78.5%	446	58	48	44	217	79.9%	2,724	77.5%	4.3%
Yg2	50,292	46,475	92.4%	1,284	22	391	633	63	87.7%	193	51	26	54	50	91.7%	2,767	86.9%	6.1%
Total	**960,093**	**732,131**	**76.3%**	**17,462**	**827**	**3,804**	**4,715**	**2,492**	**73.2%**	6,814	**747**	**1,047**	**918**	**2,109**	**75.0%**	**40,935**	**72.0%**	**5.7%**

Table 5-21: Overview of Alcoa cumulative impacts to conservation significant vegetation

Conservation Significant Vegetation	Mapped Extent (ha)	FCA Endorsed Clearing (ha)		24 Month Clearing Schedule (ha)		Five Year Mine Plan (ha)		Ten Year Mine Plan (ha)		Total future mined areas (ha)	Total Proportion of mapped extent (%)
		Huntly	Willowdale	Huntly (including Assessment 2253)	Willowdale (including future Part IV EP Act Referrals)	Huntly (including Assessment 2253)	Willowdale (including future Part IV EP Act Referrals)	Huntly (including Assessment 2253)	Willowdale (including future Part IV EP Act Referrals)		
Maximum clearing area	-	827	747	3,804	1,047	4,715	918	2,492	2,109	16,659	-
Potential GDV	27,181	86	35	450	63	400	60	44	69	1,207	4.4%
Granites	1,212	22	0	46	1	57	0	4	0	130	10.7%
Swamps & Creeks	12,069	34	31	277	56	289	43	44	31	805	6.7%
Lateritic Hills & Slopes	58,962	719	512	3,133	940	4,081	868	2,444	997	13,694	23.2%

Table 5-22 Overview of Alcoa cumulative impacts to vegetation types

Vegetation Type Code	Total Mapped extent (ha)	Huntly Mine Region (including Assessment 2253)								Willowdale Mine Region (including future Part IV EP Act Referrals)								Total future mine areas (ha)	Portion of extent remaining (%)	Total decrease in remaining extent (%)
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total Mapped Extent	Cleared Areas (ha)	FCA Endorsed Clearing (ha)	24 Month Clearing Schedule (ha)	Remaining 5 Year Clearing Schedule (ha)	Remaining Ten Year Mine Plan (ha)	Total Percentage (%) of mapped Extent Remaining	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total Mapped Extent	Cleared Areas (ha)	FCA Endorsed Clearing (ha)	24 Month Clearing Schedule (ha)	Remaining 5 Year Clearing Schedule (ha)	Remaining Ten Year Mine Plan (ha)	Percentage (%) of mapped Extent Remaining			
A	293	292	100%	3	0	2	0	-	99%	1	0%	1	0	-	-	-	15%	5	98%	2%
AC	2,893	2,448	85%	15	2	22	25	0	97%	445	15%	6	5	1	3	-	97%	80	97%	3%
AD	279	279	100%	1	-	-	5	1	98%	-	0%		-	-	-	-	-	6	98%	2%
AW	148	147	99%	9	4	0	-	0	91%	2	1%	0	0	-	-	-	82%	13	91%	9%
C	351	345	98%	7	0	7	-	-	96%	6	2%	1	-	-	-	-	100%	14	96%	4%
CQ	280	7	3%		-	-	-	-	100%	272	97%	4	1	-	-	-	99%	4	99%	1%
CW	2,508	1,883	75%	16	2	17	14	1	97%	625	25%	9	5	1	1	0	97%	68	97%	3%
D	3,060	2,888	94%	79	7	84	106	3	90%	172	6%	19	2	1	7	4	82%	310	90%	10%
DA	293	292	99%	5	1	6	5	-	94%	2	1%	1	-	1	0	-	15%	18	94%	6%
DG	79	78	99%	4	0	-	7	-	86%	1	1%	1	-	-	-	-	100%	11	86%	14%
E	479	419	87%	10	6	8	3	1	93%	60	13%	1	2	-	2	1	90%	34	93%	7%
G	278	243	88%		-	-	0	-	100%	35	12%	1	-	-	-	0	100%	0	100%	0%
G1	435	435	100%	12	5	3	2	-	95%	-	0%	1	-	-	-	-	-	22	95%	5%
J	43	43	100%	0	0	-	-	3	93%	-	0%	1	-	-	-	-	-	3	93%	7%
P	1,493	1,300	87%	127	7	79	73	22	76%	193	13%	5	2	11	-	74	52%	401	73%	27%
PG	1	1	100%	1	0	0	-	-	25%	-	0%	1	-	-	-	-	-	1	25%	75%
PS	9,835	8,541	87%	2627	252	456	1,090	94	47%	1,294	13%	409	31	92	121	120	40%	5,291	46%	54%
PT	1,828	1,254	69%	510	7	83	7	-	52%	574	31%	114	19	60	67	18	52%	885	52%	48%
PW	1,681	1,446	86%	211	34	93	112	0	69%	235	14%	68	4	-	-	36	54%	558	67%	33%
Q	393	93	24%	0	-	-	-	-	100%	300	76%	1	0	-	-	-	100%	1	100%	0%

Vegetation Type Code	Total Mapped extent (ha)	Huntly Mine Region (including Assessment 2253)								Willowdale Mine Region (including future Part IV EP Act Referrals)								Total future mine areas (ha)	Portion of extent remaining (%)	Total decrease in remaining extent (%)
		Mapped VT Area within Huntly Mine Region (ha)	Percentage (%) of total Mapped Extent	Cleared Areas (ha)	FCA Endorsed Clearing (ha)	24 Month Clearing Schedule (ha)	Remaining 5 Year Clearing Schedule (ha)	Remaining Ten Year Mine Plan (ha)	Total Percentage (%) of mapped Extent Remaining	Mapped VT Area within Willowdale Mine Region (ha)	Percentage (%) of total Mapped Extent	Cleared Areas (ha)	FCA Endorsed Clearing (ha)	24 Month Clearing Schedule (ha)	Remaining 5 Year Clearing Schedule (ha)	Remaining Ten Year Mine Plan (ha)	Percentage (%) of mapped Extent Remaining			
R	814	770	95%	62	16	13	21	4	85%	44	5%	0	0	1	-	-	96%	116	86%	14%
S	18,632	15,476	83%	4168	235	740	1,029	27	60%	3,156	17%	702	98	87	66	203	63%	7,354	61%	39%
SP	8,169	7,271	89%	2639	22	521	253	69	52%	898	11%	355	44	54	62	5	42%	4,025	51%	49%
ST	7,471	4,576	61%	1337	27	156	177	15	63%	2,895	39%	731	53	14	18	117	68%	2,646	65%	35%
SW	3,063	2,601	85%	181	13	42	172	6	84%	462	15%	67	14	-	1	4	81%	501	84%	16%
SW-D	13	13	100%	4	0	-	-	-	72%	-	0%		-	-	-	-	-	4	72%	28%
T	3,528	2,681	76%	590	31	54	160	-	69%	847	24%	77	21	69	48	1	75%	1,052	70%	30%
TP	293	39	13%	25	1	2	1	-	25%	254	87%	76	7	72	71	-	11%	255	13%	87%
TS	10,004	7,072	71%	1695	71	342	280	0	66%	2,933	29%	732	113	215	161	77	56%	3,685	63%	37%
W	4,292	3,081	72%	140	7	52	37	-	92%	1,211	28%	61	15	9	14	7	91%	342	92%	8%
WA	34	33	96%	-	-	-	-	1	98%	1	4%	-	-	-	-	-	100%	1	98%	2%

5.3 Mitigation

Alcoa's environmental management approach incorporates the mitigation hierarchy consistent with industry guidance (in order of priority):

- Impact avoidance.
- Impact minimisation.
- Rehabilitation.

A risk-based approach has been taken to align with Alcoa's environmental management system and management plans and incorporating mitigation actions as a risk register (Table 5-23) and risk assessment methodology (Appendix 2).

Key mitigations include:

- Limiting actual clearing to 800 ha of native vegetation per calendar year[48] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[49].
- Implementation of the FVMP[50] (current version is Revision 1 dated 16 December 2024), to the extent practicable
- Undertaking targeted flora surveys in suitable habitat prior to clearing and providing survey outcomes as per Index of Biodiversity Surveys for Assessment (IBSA) program in FCAs (current reports have been included in Appendix 4).
- Undertaking Havel vegetation mapping and providing reports within MMPs (Appendix 4). The Havel vegetation mapping survey methodology is considered a robust baseline assessment methodology as there is a well-defined understanding of flora and vegetation values within the region. Future vegetation mapping will align with EPA Guidelines and consider groundwater dependent vegetation presence and impacts, with survey outcomes will be provided as per IBSA program.
- Field verification of old-growth forest boundaries in accordance with DBCA's '*Procedures for the assessment, identification, and demarcation of old-growth forests' (DBCA 2017*).
- Selecting haul road alignments with consideration to dieback distribution, swamp and stream zone protection.
- Implementation of Mining Avoidance Zones (MAZ) for:
    a. Threatened species.
    b. TECs

[48] 2023-2027 MMP Ministerial Approval Condition 9.
[49] 2023-2027 MMP Ministerial Approval Condition 10.
[50] 2023-2027 MMP Ministerial Approval Condition 13

c. Old growth forest.
d. National Park and formal conservation reserves.

- Implementation of Limited Disturbance Areas (LDAs) for:
  a. Rock outcrops greater than one hectare and biologically diverse areas fringing granite outcrops.
  b. Stream Zone vegetation (vegetation types with dominant 'A' ad 'C') and a 100m buffer.

- Undertaking additional surveys to confirm PEC boundaries, which will include a desktop review with field verification. Findings will inform future updates of the FVMP (Appendix 10), ensuring management measures remain robust, evidence based, and aligned with regulatory expectation and best practices.
- Direct impacts to Priority-listed individuals will be minimised as per the Flora and Vegetation Management Plan (FVMP) (Appendix 10). Further surveys will occur for Priority-listed species to ensure potential direct impacts are acceptable. It is noted that Alcoa has committed to a Priority-listed species population impact outcome within the Assessments 2385:
  - No disturbance or adverse impacts to more than 2% of the known population of Priority listed flora species, until it can be demonstrated that more than 100 individuals have been recorded, in which case 10% of the known population.
- Undertaking additional studies into the indirect impacts on flora and vegetation, including from surface hydrology changes.
- Undertaking additional pre-clearance surveys to confirm the presence of TECs. Based on the results of these surveys, avoidance measures will be refined accordingly, and indirect impacts minimised through the development of TEC Action Plans.

  A framework, outlining the internal process to be undertaken for all potential/ known '*Empodisma* peatland' TEC occurrences, including a biodiversity risk assessment profile, is currently being developed where appropriate management control and actions are being captured to assess potential direct and indirect impacts to '*Empodisma* peatland' TEC. The framework will ensure the implementation of appropriate mitigation and monitoring is undertaken and captured in relevant Action Plan/s.
  Any mine activities including clearing will follow the mitigation and monitoring requirements as captured in the following:
  - The control mechanisms as set out relevant DCMP
  - Drainage Design Manual

- *'Empodisma* peatlands' TEC Action Plan which include the interim management and monitoring provisions. The current TEC Action Plan is included in Appendix 19 .

For any potential occurrences for any future confirmed *Empodisma* peatland occurrences , an assessment will be conducted as outlined in the framework.

Table 5-23: Avoidance and minimisation of potential impacts to flora and vegetation

Risk	Description of Impact	Risk Controls	Residual Risk Rating

Direct loss of conservation significant vegetation, communities and conservation significant flora habitat from clearing	Significant impacts to conservation significant flora habitat, vegetation or communities as a result of clearing activities	Avoid
		• Implement MAZs for:
		  ○ Threatened species
		  ○ TECs
		  ○ DBCA Old growth forest
		  ○ National Park, formal conservation reserves
		• Implement LDAs for:
		  ○ Rock outcrops greater than one hectare and biologically diverse areas fringing granite outcrops.
		  ○ Stream Zone vegetation
		• Mining Avoidance Zones and Limited Disturbance Areas will be demarcated in spatial data to guide construction personnel and included on relevant maps.
		Minimise
		• Actual clearing is limited to 800 ha of native vegetation per calendar year[51] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[52].
		• Clearing activities undertaken as per Vegetation Management Plan (CDS 2053-5517)
		• Minimise infrastructure clearing of stream zone vegetation and rock outcrops.
		• Minimise clearing of mature growth forest.
		• Design and construct haul road creek crossings, perpendicular to the creek flow to minimise the area of habitat impacted.
		• Implement FVMP to the extent practicable[53]
		• Conduct baseline flora surveys as per FVMP (Appendix 10)
		• Conduct pre-clearance surveys in suitable habitat as determined by baseline flora surveys as per FVMP (Appendix 10)
		• Direct impacts to Priority-listed individuals will be minimised as per the Flora and Vegetation Management Plan (FVMP) (Appendix 10). Further surveys will occur for Priority-listed species to ensure potential direct impacts are acceptable.
		• Reduce as far as practicable the creation of vegetation islands <10ha in size.
		• Reduce as far as practicable the creation of vegetation with single connection to larger remnants (peninsulas)
		• Design and construct haul road creek crossings, perpendicular to the creek flow to minimise the area of habitat impacted.
		Rehabilitate
		• Rehabilitation to meet Completion Criteria
		• Rehabilitation to re-instate potential flora habitat
		• Increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[54]
			Medium

Direct loss of conservation significant flora individuals from clearing	Significant impacts to conservation significant flora populations as a result of clearing activities	Avoid
		• Implement MAZs for:
		  ○ Threatened species
		  ○ TECs
		  ○ DBCA Old growth forest
			Medium

[51] 2023-2027 MMP Ministerial Approval Condition 9.
[52] 2023-2027 MMP Ministerial Approval Condition 10.
[53] 2023-2027 MMP Ministerial Approval Condition 13
[54] 2023-2027 MMP Ministerial Approval Condition 15

Risk	Description of Impact	Risk Controls	Residual Risk Rating
	Clearing of threatened flora individuals without regulatory consultation and appropriate approvals	○ National Park, formal conservation reserves • Implement LDAs for: ○ Rock outcrops greater than one hectare and biologically diverse areas fringing granite outcrops. ○ Stream Zone vegetation • Mining Avoidance Zones and Limited Disturbance Areas will be demarcated in construction spatial data to guide construction personnel and included on construction maps. Minimise • Actual clearing is limited to 800 ha of native vegetation per calendar year[55] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[56]. • Clearing activities undertaken as per Vegetation Management Plan (CDS 2053-5517) • Minimise infrastructure clearing of stream zone vegetation and rock outcrops. • Minimise clearing of mature growth forest. • Design and construct haul road creek crossings, perpendicular to the creek flow to minimise the area of habitat impacted. • Implement FVMP to the extent practicable[57] • Conduct baseline flora surveys as per FVMP (Appendix 10) • Conduct pre-clearance surveys in suitable habitat as determined by baseline flora surveys as per FVMP (Appendix 10) • Direct impacts to Priority-listed individuals will be minimised as per the Flora and Vegetation Management Plan (FVMP) (Appendix 10). Further surveys will occur for Priority-listed species to ensure potential direct impacts are acceptable. • Spatial data of conservation significant flora and communities retained and review as Ground Disturbance Procedure to ensure clearing impacts are not significant. • If clearing of threatened species is required, then management options will be developed in consultation with DBCA and DCCEEW with appropriate approval obtained under the Biodiversity Conservation Act 2016 (WA) (BC Act) and EPBC Act. • Design and construct haul road creek crossings, perpendicular to the creek flow to minimise the area of habitat impacted. • Training for all personnel around requirements for licences to handle/remove flora. Rehabilitate • Rehabilitation to meet Completion Criteria • Rehabilitation to re-instate potential flora habitat • Increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 202741[58]	
Rehabilitated areas do not meet relevant completion criteria.	Rehabilitation does not provide flora and fauna habitat that aligns with the Northern Jarrah Forest Rehabilitation does not align with post-mining land use. Rehabilitation erosion impacting on water resources	Minimise • Integrate rehabilitation into mining planning and operational activities. • Prioritise rehabilitation within public drinking water catchments and increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[58] • Undertake rehabilitation activities in a timely and committed way to enable maximisation of progress on rehabilitation areas. • Undertake adaptive management based on research to encourage the return of native species and a self-sustaining forest ecosystem. • Maintain monitoring and assessment to enable rapid responses to invasive weeds and erosion within local areas within the rehabilitation areas. • Maximise the use of all materials used in clearing and rehabilitation practices to minimize waste and utilise resources as available (including overburden/topsoil, native seeds, clearing debris, timber logs and waste)	Low

[55] 2023-2027 MMP Ministerial Approval Condition 9.
[56] 2023-2027 MMP Ministerial Approval Condition 10.
[57] 2023-2027 MMP Ministerial Approval Condition 13
[58] 2023-2027 MMP Ministerial Approval Condition 15

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Maintain regular monitoring program at 9 months, 15 months, and ongoing permanent plots to substantiate progress and respond to any issues that arise that will inform adaptive management choices to continually improve outcomes. • Increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 20024 to 2027 (2023-2027 MMP Ministerial Approval Condition 15). • Conduct ongoing benchmarking against best practice options. • Active research program for continual improvement. • Develop Rehabilitation Design Manual in consultation with ITAG[59] • In consultation with DBCA[60] the revised rehabilitation completion criteria will move to an outcome focused set of requirements to align with industry best practice and mine closure completion guidelines.	
Dust deposition impacting upon flora and vegetation	Loss of biodiversity. Loss of flora individuals and/or communities. Loss of conservation significant flora or communities. Decline in health and/or change in fauna habitat composition. Decline in health and/or change in vegetation composition.	Minimise • Implement FVMP (Appendix 10) to the extent practicable[61] • Undertake dust suppression activities during high level use of haul roads and conveyors as per internal dust management procedure. • Maximise efficiency of loads when transporting ore (including haul trucks and conveyers). • Use dust suppressants on exposed areas where possible. • Investigate alternatives for the wood waste burning of clearing residues to reduce the particulate emissions in the local airshed. • Induction packages – the workforce will be made aware of dust generation and control measures. • Routine housekeeping practices around central facilities and workshops will be implemented to reduce dust generation. • Optimising blast charge sizing and spaces to avoid unnecessary energy releases which has the potential to generate dust. • The location of haul roads, conveyors, mine pits and other infrastructure gives consideration to separation distance from receptors to reduce air quality impacts. • Maximise efficiency of loads when transporting ore or concentrate (including haul trucks and conveyers). Rehabilitate • Minimise open area footprint and rehabilitate or cover (using vegetation, rock, water and/or dust suppressant) exposed areas as soon as practicable.	Medium
Introduction / spread of plant disease to previously un-infested areas outside of approved clearing boundaries, resulting from operations	Loss of biodiversity. Reduction in dieback free soil available for rehabilitation. Decline in health and/or change in vegetation composition. Decline in health and/or change in fauna habitat composition. Impacts to surface water dependent ecosystems (i.e. stream zone vegetation) and	Avoid • Infrastructure design to avoid dieback areas, where possible. Minimise • Implement FVMP (Appendix 10) to the extent practicable[61] • Dieback mapping prior to clearing. • Vehicle clean-down procedures. • Soil Handling procedures - Topsoil, overburden and vegetative material (e.g. coarse woody debris) from uninterpretable or infested areas are not to be moved to uninfected areas. • dieback line (infested, uninfested and uninterpretable areas) demarcation in-field and on GIS and within work packs. • Stockpile signage (demarcating Dieback vs Dieback Free area). • Training for all personnel on Dieback Management System. • Weed and seed checks prior to new machinery mobilisation. • Containment of stormwater runoff from identified Dieback infested areas to prevent discharge into uninfested areas. • Revalidation of Dieback assessment every 12 months where construction or operations planned for greater than a 12-month duration.	Medium

[59] 2023-2027 MMP Ministerial Approval Condition 26
[60] 2023-2027 MMP Ministerial Approval Condition 23
[61] 2023-2027 MMP Ministerial Approval Condition 13

Risk	Description of Impact	Risk Controls	Residual Risk Rating
	water logging sensitive ecosystems. Surface water mechanical impacts on vegetation e.g. surface water runoff washing plants away, turbid water smothering plants etc.	• Rehabilitation plants will only be sourced from nursery suppliers with appropriate dieback control management Rehabilitate • Fallowing of some dieback areas prior to infrastructure construction	
Spread of weeds to previously un-infested areas resulting from operations	Loss of biodiversity. Spread of weed species/impact private residences. Injury from unstable weed management locations. Exposure to weed management chemicals. Decline in health and/or change in vegetation composition. Decline in health and/or change in fauna habitat composition.	Minimise • Implement FVMP (Appendix 10) to the extent practicable47[62] • Weed and seed procedure prior to mobilisation. • Weed monitoring occurs periodically, particularly in high-risk areas (stream zones and existing roads), so that any infestations that establish can be eradicated before the plants can flower and set seed. • All identified Weeds of National Significance (WoNS) and environmental weeds treated according to the weed control management outlined by Weeds Australia with the aim of controlling off-site movement. • Inspection of construction and operational vehicles and equipment for soil and vegetative material prior to entry to undisturbed areas. • Implementation of a vehicle hygiene procedure, dieback management procedure and weed control. • Construction and operational vehicle and equipment movements limited to designated roads, access tracks and cleared areas. • Conceptual Clearing Area will be surveyed for Weeds of National Significance (WoNS), Declared and invasive weeds prior to clearing as part of Targeted surveys. • Weed monitoring will occur periodically, particularly in high-risk areas (stream zones and existing roads) and recorded weed infestations, so that any infestations that establish can be eradicated before the plants can flower and set seed • All identified WoNS and environmental weeds treated according to the weed control management outlined by Weeds Australia with the aim of controlling off-site movement. • Rehabilitation plants will only be sourced from nursery suppliers with appropriate weed control management. Rehabilitate • Management of infested soil after clearing activities	Low
Changes to fire regimes due to accidental fire or impacts DBCA prescribed burns schedule	Reduction in quality of conservation significant flora or communities resulting from changes in fire regime. Loss of biodiversity Loss or decline in fauna habitat quality	Minimise • Implement FVMP (Appendix 10) to the extent practicable[62] • Fire ban procedures - obey local enforcement and legislation. • Clearing around powerlines. • Emergency response process - Fire crews trained and equipment at hand (fire trucks etc.). • All heavy machinery has an in-built fire suppressant system.	Low

[62] 2023-2027 MMP Ministerial Approval Condition 13

5.4 Assessment of impacts

Alcoa proposes avoidance, mitigation and rehabilitation to reduce residual impacts to as low as reasonably practicable. The effectiveness of rehabilitation and of dieback and weed hygiene has been demonstrated through long-term research and operations and is at a high level of confidence. Clearing will occur in areas which have been covered by targeted flora surveys, to ensure impacts to Threatened species are avoided and minimise impacts to other conservation significant flora. Alcoa has developed and implemented an FVMP (Appendix 10), which details key mitigation measures.

The 24 Month Clearing Schedule is considered to have a low impact to threatened flora populations in the NJF subregion. No threatened flora has been recorded within the 24 Month Clearing areas and targeted surveys will occur prior to clearing, with avoidance of any identified individuals.

There are populations of priority species recorded outside the 24 Month Clearing Schedule areas. Whilst direct impacts to potential Priority flora habitat and individuals may occur, the impact is considered medium as potential habitats are widespread and well represented through the sub-region. Further surveys will be undertaken to ensure population impacts are acceptable. Pre-clearance Targeted flora reports will be provided with FCAs.

Impacts to conservation significant vegetation is considered medium, as one TEC has been recorded within the Willowdale mine region – however direct impacts will be avoided, with limited clearing to potential PECs and GDEs. Indirect impacts to potential PECs or GDEs related to hydrological changes, contaminant discharges or the spread of weeds is low.

The 24 Month Clearing Schedule impacts to state-wide vegetation associations would result in a decrease of 0.3% of current extent. Impacts to vegetation complexes in both Huntly and Willowdale mine regions is less than a 1.5% of the current extent. The maximum reduction of vegetation types is up to 50% of Type A in Willowdale, however this vegetation type is likely to be widely represented elsewhere with Huntly and Willowdale potentially impacting only 1% of the total mapped extent.

The potential impacts associated with 24 Month Clearing Schedule represent a lesser portion of current clearing in the context of more widespread cumulative impacts from historic timber harvesting, historic mine rehabilitation, climate change, fire, and dieback. Consideration of the five- and ten-year plan in these cumulative impacts represent an increase of 0.8% of clearing to the NJF subregion, which is considered to have a medium risk.

6 Terrestrial Fauna

6.1 Receiving environment

6.1.1 Baseline studies and surveys

Further to historical fauna studies and surveys (Table 6-1), baseline studies and surveys have been conducted in the O'Neil mine region with preliminary fauna desktop habitat mapping undertaken where baseline data was not available. The extrapolation of habitats was achieved using the available historical site Havel vegetation type mapping, which was undertaken by Mattiske Consulting (Section 6.1.2).

Targeted fauna surveys are undertaken in suitable habitat for Threatened fauna species as per the Fauna Management Plan (FMP)[63] (Appendix 6) submitted to JTSI in June 2024[64], which is publicly available on Alcoa's website.

Targeted pre-clearance Black Cockatoo surveys are undertaken by a suitably qualified consultant through visual inspection for the presence of habitat trees. If the suitability of a hollow cannot be determined from the ground, a pole camera or drone is used to obtain a better visual.

The Long-Term Fauna Monitoring Programme (LTFMP; Terrestrial Ecosystems 2023a, 2023b) (Appendix 8) is implemented to gauge how closely the vertebrate fauna assemblage in rehabilitated areas of 5, 10, and 15 years old is approaching that in the unmined forest. Surveys are conducted every 5 years across the summer and winter seasons at both mines. Permanent monitoring sites incorporating permanent pitfall transects have been established in three rehabilitation areas and the analogue unmined forest, with three replicate sites in each (totalling 12 trapping sites at Myara).There are also eight long term sites with permanent transects established at Orion.

In addition to these sites there are several permanent sites that, while not having permanent transects installed, are revisited each monitoring round:

- Two landscape trapping transects per mine site (one in unmined forest and one in mined landscape), where cage traps baited with chicken are used to target Chuditch.
- Three stream zone sites at Myara and two at Orion, however, only camera traps were used at these sites as they are specifically targeting quokka and Rakali.

Since 2021, active searches and dry pitfall trapping for each LTFMP site has been undertaken for representative specimens of invertebrates from the taxonomic group's mygalomorphs, isopods, diplopods, opiliones, scorpions, and pseudoscorpions. Surveys are conducted in three different ages of rehabilitation (5, 10, and 15 years old), unmined forest reference sites, and stream zones, with three replicates/sites for each category. A detailed Short-Range Endemic (SRE) invertebrate survey was also completed for the O'Neil mine region.

[63] Submitted to JTSI in June 2024 and publicly available on Alcoa's website under 2023-2027 MMP Ministerial Approval Condition 17.
[64] 2023-2027 MMP Ministerial Approval Condition 17

Research on mygalomorph spiders to better understand species diversity has been ongoing since 2021. Genetic samples are taken from spiders across the lease and sent for sequencing to create a database of species and their distribution. Subsequently, an ethical trap was developed to capture mygalomorph spiders in their burrows.

The current surveys are considered adequate to determine impacts to fauna, due to:

- a high level of existing regional knowledge of the Northern Jarrah Forest and associated fauna habitat and species.
- the LTFMP and pre-clearance targeted fauna surveys confirms species considered likely to occur.
- ongoing clearing being contained within mine regions, limiting the level of fragmentation.
- conservation significant fauna species habitat extent and distribution occurring outside of mine regions.
- Targeted pre-clearance surveys for any Threatened fauna species will be undertaken and pre-clearance monitoring as per the FMP (Appendix 6).
- detailed and targeted fauna surveys in new mine regions being completed, where minimal impacts have previously occurred, and previous ecological information is limited.

The recent survey extents are shown in Figure 6-1 and Figure 6-2 for Huntly and Willowdale, respectively, with survey reports included in Appendix 5.

Table 6-1: Terrestrial fauna studies

Year	Author	Area	Study Name	Survey details
2011-2023	Alcoa; Tony Kirkby	Huntly and Willowdale mines	Pre-clearance black cockatoo hollow surveys	Black cockatoo surveys were undertaken within all areas planned for clearing of potential black cockatoo breeding trees.
2013, 2014	Alcoa McGregor et al. 2014	Various	Chuditch survey raw data Myara. Does forest restoration in fragmented landscapes provide habitat for a wide-ranging carnivore?	Trapping transects undertaken in 'Myara west' and 'Myara east'. There were fourteen Chuditch trapping sessions (13 at Huntly, one at Willowdale) across nine trapping transects (eight at Huntly, one at Willowdale) undertaken between June 2009 and Dec 2010
2014; 2016; 2022	Alcoa	Willowdale and Huntly	Culvert Camera Trap Monitoring - Willowdale and Huntly	Monitoring of fauna and creek crossing culverts has been undertaken since 2014 across both the Huntly and Willowdale mines.
2021 – 2022	Alcoa	Orion	LTFMP	A revised LTFMP was conducted within the Orion region over four consecutive nights (5 days), in winter of 2021 (June/July) and summer of 2022 (January/February). Two transects were established at each of the four sites, which included rehabilitation of five-, ten- and 15-year age as well as unmined forest. One stream zone site was also monitored, consisting of targeted monitoring of quokkas and short-range endemics and did not follow the standard transect design. An additional eight transects across four sites, and one stream zone site, were established prior to summer 2021/2022. There were two landscape trapping transects established; one inside the current mine perimeter and close to operations, and one outside the current mine perimeter largely surrounded by unmined forest.
2024b	Biologic	Willowdale (Larego-Region)	Alcoa Willowdale (Larego Region) Targeted Carter's Freshwater Mussel Survey	The targeted survey for Carter's Freshwater Mussel (CFM) (*Westralunio carter*i) was conducted within the Larego region. CFM's conservation status is under review due to range reductions, so existing populations like those found are increasingly important. Seven sites were successfully surveyed via mussel rakes, hand searches, quadrat searches, and sediment sieving to locate juveniles. A total of 9 CFM individuals were recorded - 8 deceased mussels (37-47mm) at site TM3 and 1 live mussel (55mm) at site TM4. Water quality and habitat at TM3 did not explain the cause of deaths as it appeared suitable for CFM at the time.. Following the survey, sites were re-assessed for likelihood of CFM occurrence: HR3 and Conveyor deemed highly unlikely/unlikely, HR1a, TM2, TM5 possible despite no detections, TM3 and TM4 confirmed to support CFM currently. The mortality event at

Year	Author	Area	Study Name	Survey details
				TM3 should be further investigated. TM3 and TM4 are the only confirmed extant populations in the survey area currently. The survey report is included in Appendix 5.
2015, 2017	Burgar et al. 2017	Various	The importance of mature forest as bat roosting habitat within the production landscape Habitat features act as unidirectional and dynamic filters to bat use of production landscapes	Surveys undertaken in forest surrounding Huntly mine site, both unmined and different stages of vegetation succession. Study aimed at identifying roost habitat within restored forest versus unmined forest. Ultrasonic detectors (Anabat Titley Electronics) were set at 64 sites four times per year between October and March 2010/2011 and 2011/2012 for a total of 512 survey nights.
2016, 2019	Doherty et al. 2016 Mastrantonis et al. Craig et al. 2021	Various	Successional changes in feeding activity by threatened cockatoos in revegetated mine sites. Climate change indirectly reduces breeding frequency of a mobile species through changes in food availability	To identify any successional patterns in cockatoo feeding activity within revegetation aged between 4 and 23 years, surveys were conducted across 232 plots in the revegetated forest and 480 plots in the unmined forest. Using a dataset of annual breeding frequency spanning 19 years, in combination with hydrological, climatological, and remotely sensed data, the effects of environmental variation on the annual breeding frequency of Forest Red-tailed Black Cockatoo's (FRTBC) were modelled. Nest selection of FRTBC was examined to identify factors influencing nest hollow selection at multiple spatial scales including interactions between functional resources.
1992, 1995, 1998, 2001, 2003, 2006, 2007	Environmental Management and Research Consultants (EMRC)	Jarrahdale, Huntly, Karney	Long term fauna monitoring program (LTFMP)	The Alcoa LTFMP was designed in 1991. The program is designed to monitor fauna every three years at twenty plots located in rehabilitation and nearby forest at Jarrahdale, Huntly and Karnet (remote from mining). A variety of different survey methods were used including trapping (five successive trap nights in July, August, and September), avifauna (quantitative and inventory surveys in summer and winter), reptile survey (trapping over five consecutive nights in Summer with toenail clippings to indicate recapture) opportunistic survey, nocturnal surveys, and active searches.
2000a	EMRC	Jarrahdale	A survey of the impact of burning on mammals and birds in Alcoa's rehabilitated Bauxite mines at Jarrahdale	To ascertain the impact of burning on birds and mammals, pre burning monitoring took place 1997, and post burn monitoring commenced in 1998 in both burnt and unburnt, rehabilitated, and unmined forest sites.
2003, 2007a, 2013	EMRC	McCoy	LTFMP	The monitoring program involved survey of terrestrial vertebrates (including mammals, birds, and reptiles) and ground invertebrates. Mammals, birds, reptiles,

Year	Author	Area	Study Name	Survey details
				and frogs were surveyed in both winter (July-August) and summer (December-January). Mammal and reptile trapping were undertaken. Birds were surveyed using quantitative methods (transects) and inventory methods (opportunistic recordings). In the 2013 survey additional methods were implemented including a single large trapping transect to sample highly mobile species, remote sensor cameras and all invertebrates collected in pitfall traps were identified to taxonomic order.
2012	Stokes	Keats	Vertebrate fauna survey of planned mining areas at Alcoa's Keats Mining Region 2011/12	Fauna was surveyed between November 2011 and February 2012 using a range of techniques, including trapping (Elliot), remote sensor cameras, tracking tunnels, observational surveys and spotlighting across a diversity of forest types. Five areas were trapped: two diebacks free Jarrah Forest areas and three stream zones. Pitfall traps were not used due to time constraints. Black Cockatoo habitat, feeding and occurrence was surveyed during January 2012 covering approximately 840 ha.
1999 2004, 2011, 2015	EMRC Stokes / EMRC	Orion	A fauna survey of planned mining areas at Alcoa's Orion Mining region. LTFMP	Fauna survey conducted between February and November 1999. The habitats monitored were surveyed in current mining areas, extensive dieback affected areas, small dieback free areas and on sites where mining operations are planned. The LTMFP was reviewed in 2003 which included a recommendation for a similar program to be established at Orion so that any differences in faunal successional processes taking place at Willowdale could be detected. Similar techniques to those used at Jarrahdale, Huntly, and McCoy. Mammals, birds, reptiles, and frogs were surveyed during both summer (March) and winter (July), and ground dwelling invertebrates were sampled in summer only. Survey methods were like those used in the original LTFMP. A single large trapping transect, designed to specifically target Chuditch, was used in the later studies.
2000b, 2007b	EMRC	Huntly	A Vertebrate Fauna Survey of Rehabilitated Areas at Alcoa's Huntly Minesite	Overview of the vertebrate fauna surveys of Alcoa's rehabilitated bauxite mines at Huntly undertaken in 1994, 2000 and 2007. Mammals, birds and reptiles were surveyed in six rehabilitated pits ranging in age from nine to 16 years.
1997 – 2019	WRM	Various	IRZ Streamzone monitoring	Macroinvertebrates and fish were surveyed in the Camerons Intermediate Rainfall Zone (IRZ) area between 1995 and 2007 as part of stream zone monitoring for the Huntly Mine. Further monitoring for macroinvertebrates was conducted in the Camerons, Jayrup and O'Neill areas in 2009, 2011, 2014 and 2019. Long term aquatic biomonitoring during and post-mining aimed to track changes physical and biological attributes in response to mining, particularly in response to secondary salinisation (Croton & Dalton, 2010).

Year	Author	Area	Study Name	Survey details
2019-2020	Tony Kirkby	Myara North	Myara North black cockatoo surveys	Black cockatoo surveys were undertaken along tracks throughout Myara North, with trees 30 m either side of track reviewed.
2021	WRM	Myara North and Holyoake Regions	Aquatic Fauna Desktop Assessment Myara North and Holyoake Regions	Desktop assessment of aquatic fauna.
2021a	GHD	Myara North	Myara North – Terrestrial Fauna Survey and Black Cockatoo Assessment	Desktop assessment and two season detailed and targeted (Forest Red-tailed Black Cockatoo, Carnaby's Cockatoo, Baudin's Cockatoo, Chuditch, Quokka, and other priority species) vertebrate fauna survey.
2021c	GHD	Holyoake	Holyoake – Terrestrial Fauna Survey and Black Cockatoo Assessment	Desktop assessment and two season detailed and targeted (Forest Red-tailed Black Cockatoo, Carnaby's Cockatoo, Baudin's Cockatoo, Chuditch, Quokka, and other priority species) vertebrate fauna survey.
2024b 2024a	GHD	O'Neil region	McCoy Haul Road Fauna Pre-clearance Survey	The survey covered 157 polygons, totalling 501.7 hectares, located about 20 km northeast of Pinjarra, in the Jarrah Forest bioregion of Western Australia. The survey recorded all three southwest black cockatoo taxa: Baudin's Cockatoo and Carnaby's Cockatoo (both Endangered), and Forest Red-tailed Black Cockatoo (Vulnerable). Five known nesting trees were identified, with one newly discovered. Additionally, 10,034 trees were categorised as potential nesting trees, and one Alcoa Significant Tree was identified. The survey report is included in Appendix 5.
2024b	GHD	O'Neil Mine Development	Terrestrial Fauna Assessment	The survey area covers 12,719 ha of State Forest land. A desktop assessment, literature review, basic fauna survey to determine species present, targeted surveys for significant vertebrate fauna species and fauna habitat mapping were conducted. Field surveys were conducted from June 2023 to January 2024 using various techniques like traps, cameras, acoustic recorders, searches. There were 9 broad fauna habitat types identified, 121 vertebrate species recorded, including 12 significant species: 3 endangered black cockatoos, Chuditch, Quokka, Carter's Freshwater Mussel, several priority-listed species by DBCA, five additional significant species likely to occur based on assessment and extensive, and high-quality black cockatoo breeding and foraging habitat were present. Jarrah-Marri Forest is the most extensive habitat in the survey area covering an approximate 74.6%, the remaining 14.73% is made up of cleared and rehabilitation areas. The survey report is included in Appendix 5.
2024c	GHD	Myara	Myara Pre-clearance fauna survey	The survey covered a 185.7 ha Targeted Fauna survey area and a 10.3 ha Targeted Black Cockatoo Assessment area, located in the Huntly mine. The Black Cockatoo Survey Area contained habitat that supports Breeding and Foraging of Black Cockatoo

Year	Author	Area	Study Name	Survey details
				species; however, no signs of roosting were observed within the Survey area, however due to the presence of Forest Red-tailed Black Cockatoo observed, roosting trees are likely to be nearby. In total five significant species were recorded. The targeted significant species, Chuditch was readily recorded via remote camera within all five Survey Areas, with a total of 66 camera events with Chuditch present and two observations of Chuditch scats. Through physical analysis of the Chuditch recorded via remote camera, 17 were identified through spot pattern analysis. Four other significant (but not target) species were recorded within the Survey Areas including Forest Red-tailed Black Cockatoo, Southwestern Brush-tailed Phascogale, Western Brush Wallaby and Quenda. The survey report is included in Appendix 5.
2024d	GHD	O'Neil East	O'Neil East Targeted Woylie Assessment Memo	This memo outlines the results of a targeted Woylie assessment within the O'Neil East study area, covering an area approximately 2,425 ha. In total, approximately 3-6 Woylies were observed within the area. Five other conservation significant species were also recorded within the area, Chuditch, Quokka, Southwestern Brush-tailed Phascogale, Western Brush Wallaby and Quenda. The survey was conducted in accordance with EPA Guidelines. The memo report is included in Appendix 5.
2024g	GHD	O'Neil Mine Development	Terrestrial Fauna Assessment	The survey area covers 12,719 ha of State Forest land. A desktop assessment, literature review, basic fauna survey to determine species present, targeted surveys for significant vertebrate fauna species and fauna habitat mapping were conducted. Field surveys were conducted from June 2023 to January 2024 using various techniques like traps, cameras, acoustic recorders, searches. There were 9 broad fauna habitat types identified, 121 vertebrate species recorded, including 12 significant species: 3 endangered black cockatoos, Chuditch, Quokka, Carter's Freshwater Mussel, several priority-listed species by DBCA, five additional significant species likely to occur based on assessment and extensive, and high-quality black cockatoo breeding and foraging habitat were present. Jarrah-Marri Forest is the most extensive habitat in the survey area covering an approximate 74.6%, the remaining 14.73% is made up of cleared and rehabilitation areas. The survey report is included in Appendix 5.
2024h	GHD	Huntly & Willowdale	Terrestrial Fauna Desktop Assessment – Huntly & Willowdale MMP – EPA Fauna Assessment	Includes a background desktop study of all terrestrial fauna attributes of the Huntly and Willowdale Study Areas, focusing on conservation significant species, including EPBC listed ones, through systematic searches and reviews of databases, literature and survey recordings. The methodology involved a comprehensive desktop assessment

Year	Author	Area	Study Name	Survey details
				to compile fauna records and reports, assess fauna habitats against vegetation mapping and VT codes, and justify the likelihood of occurrence for conservation significant species. In the Huntly study area, 16 species of conservation significance were assessed, with 15 known to occur and 1 likely to occur. The known species include three black cockatoos, Quenda, Chuditch, South-West Brush-tailed Phascogale, Western Brush Wallaby, Quokka, Western False Pipistrelle, Carter's Freshwater Mussel, Peregrine Falcon, Dell's Skink, Rakali, Woylie and Southern Death Adder. The remaining species considered likely to occur was the Masked Owl (South-Western). This assessment is based on literature reviews, recent surveys, and database records. A total of eight broad fauna habitat types were recorded and mapped. In the Willowdale Study Area, 17 species of conservation significance were assessed, with 5 known to occur and 12 likely to occur. The 5 species known to occur include three black cockatoos, Rakali, and Western Brush Wallaby. Likely species include Western False Pipistrelle, Woylie, Southern Death Adder, Dell's Skink, Peregrine Falcon, Masked Owl (South-Western), Quenda, South-West Brush-tailed Phascogale, Western Ringtail Possum, Quokka, and Chuditch. This assessment is based on literature reviews, recent surveys, and database records. A total of eight broad fauna habitat types were recorded and mapped. The survey report is included in Appendix 5.
2021a	Phoenix	Huntly	Short-range endemic invertebrate fauna survey for the Huntly Mine Extension	Desktop assessment and two season short-range endemic (SRE) invertebrate fauna survey of Myara North, Holyoake and Huntly Mine rehabilitation sites. SRE habitat mapping was undertaken based on vegetation mapping prepared for the Proposal (Mattiske, 2021) and considering habitat attributes relevant to SRE invertebrates. Each habitat was rated for its potential to support SREs (potential habitat rating; PHR) as High, Low or None.
2024a	Phoenix	Huntly & Willowdale Mine	Short-range-endemic invertebrate risk assessment for the Huntly and Willowdale Mine	Includes a desktop review of SRE values by identifying areas with and without previous surveys, assessing survey efforts and recorded species, and determining areas likely to have SRE values. The Huntly Mine Footprint covers 39,046 ha in two areas east and northeast of Pinjarra, with 29,323 ha in active mining areas and 9,724 ha in a previously mined area. The Willowdale Mine Footprint covers 2,136 ha east of Wagerup. The assessment resulted in six confirmed SREs, 66 potential SREs owing data deficiency and 28 widespread species within the Huntly Mine Footprint. Surveys focused on areas of remnant vegetation which are considered the highest value habitats for SREs,

Year	Author	Area	Study Name	Survey details
				including a range of SRE habitats available (e.g. granite outcrops, riparian/valley, upper slopes and mid-slopes) with some sampling also undertaken in rehabilitation. The southern portion of the Huntly Mine Footprint has not been adequately sampled for SREs. Within the Willowdale Mine Footprint one SRE was recorded. SREs have not been adequately sampled within the Willowdale Mine Footprint, as no systematic sampling exists there. Approximately one third of the Willowdale Mine Footprint has been previously cleared, but the remaining native vegetation is certain to support SRE invertebrate taxa. The survey report is included in Appendix 5.
2024b	Phoenix	O'Neil region	Short-range endemic invertebrate fauna survey for the O'Neil Mine Development	A two-phase detailed SRE field survey over two seasons, between July and October 2023. The study area for the survey was 10,414.5 ha, of which approximately 1,163.1 ha is currently rehabilitation or cleared land. The survey resulted in three confirmed SREs, five likely SREs and 37 potential SREs. The survey report is included in Appendix 5.
2024a	SLR Consulting Australia Pty Ltd	Myara, Huntly Mine	Alcoa Myara – Carter's Freshwater Mussel Targeted Survey	The survey included desktop assessment and targeted survey for CFM (*Westralunio carteri*) within the Myara region. Six sites were targeted within the proposed survey area with only three sites successfully sampled (Kisler, Rhodes 2, Schou 1) and the remaining three sites being dry (Cable 1, Cable 2 & Cable 5). Monitoring was carried out across inundated channel areas using visual observations, manual hand sorting of benthic sediments, and mussel rakes and wire baskets in shallow waters. No CFM were recorded during the survey. This included live specimens, but also absence of shells of deceased individuals. The habitat's substrate was deemed unsuitable for mussels. Water quality parameters for the only three sites with water identified pH to be outside the ANZG (2018) DGV of 6.5-8.0 and outside the pH range of locations where mussel had been previously recorded in other studies. The remaining three 'dry' sites appeared to potentially hold water on a short-term basis after a heavy rainfall event but not over long periods of time. Locations not holding water for long periods of time will most likely impact any potential mussel population. The survey report has been included in Appendix 5.
2024b	SLR Consulting Australia Pty Ltd	Huntly Mine – Myara Region	Black Cockatoo Habitat Assessment 2023	The survey included desktop assessment and targeted survey. The survey covered a 501.7 ha area and found all three threatened southwest black cockatoo species: Baudin's Cockatoo (*Zanda baudinii*) (endangered), Carnaby's Cockatoo (*Zanda latirostris*) (endangered), and Forest Red-tailed Black Cockatoo (*Calyptorhynchus*

Year	Author	Area	Study Name	Survey details
				banksii naso) (vulnerable). 10,039 potential black cockatoo nesting trees were identified, including nine known nesting trees and 1,494 suitable nesting trees with hollows. The 501.6 ha survey area is of very high-quality night roosting and foraging habitat. Additionally, 11 roosting sites were recorded, with six confirmed as Forest Red-tailed Black Cockatoo roosts. Widespread foraging evidence was found for all three species, especially the Forest Red-tailed Black Cockatoo. No ESAs were within the survey area, however, 34 were within a 5 km radius of the survey area. The survey report is included in Appendix 5.
2024c	SLR Consulting Australia Pty Ltd	Huntly Mine – Myara Region	Desktop Assessment Memo	The desktop assessment, to identify terrestrial vertebrate fauna values, covered 37.7 ha within 73 polygons in the Huntly Mine Myara region. Database searches identified 218 terrestrial vertebrate fauna species previously recorded within 20 km radius of the desktop survey area, including 36 significant (threatened or priority) species. 13 significant fauna species were assessed as having a high likelihood of occurring in the area, including: Woylie (critically endangered), Numbat (endangered), Baudin's Cockatoo (endangered), Carnaby's Cockatoo (endangered), Forest Red-tailed Black Cockatoo (vulnerable), Chuditch (vulnerable), Quokka (vulnerable). Four significant species had a medium likelihood, including Noisy Scrubbird (endangered), Malleefowl (vulnerable) and two priority 4 species. Key fauna habitat type, the Jarrah-Marri Forest, is expected to occur and provide value for conservation significant species like Chuditch, Woylie and Quokka.
2024d	SLR Consulting Australia Pty Ltd	Huntly Mine – Myara Region	Targeted Chuditch, Quokka, and Woylie Survey	The survey covered a 928.6 ha area located in the Jarrah Forest bioregion and targeted Chuditch, Quokka, and Woylie. Survey methods included camera trapping, spotlighting, active searches, and opportunistic observations. Two key fauna habitat types were mapped: Jarrah-Marri Forest and Drainage Lines, with Drainage Lines providing core habitat for the target species. Chuditch was recorded 52 times, with at least 14 individuals identified in the area. Quokka was recorded 18 times in both habitat types. Woylie was not detected, though previously recorded nearby. Six other significant species were recorded: Baudin's Cockatoo, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo, Wambenger Brush-tailed Phascogale, Quenda, and Western Brush Wallaby. Five significant species had a high likelihood of occurrence, five a medium likelihood, and 27 a low likelihood. Five introduced pest species were also recorded: laughing kookaburra, red fox, rabbit, black rat, and pig. The survey report is included in Appendix 5.

Year	Author	Area	Study Name	Survey details
2024e	SLR Consulting Australia Pty Ltd	Willowdale Mine – Larego Region	Targeted Chuditch, Quokka, and Woylie Survey	The survey covered a 451.8 ha area located in the Larego Region, Jarrah Forest bioregion. Survey methods included camera trapping, spotlighting, active searches, and opportunistic observations. Two fauna habitat types were mapped: Jarrah-Marri Forest and Drainage Line habitats, with the Drainage Lines providing core habitat for the target species (Chuditch, Quokka, and Woylie). Chuditch was detected based on scat evidence in the Jarrah-Marri Forest. Quokka and Woylie were not recorded but have previously been found nearby. Four other significant species were recorded: Forest Red-tailed Black Cockatoo, Baudin's Cockatoo, Western Brush Wallaby, and Rakali (water rat). Eight additional significant species were assessed as having a high likelihood of occurrence and six a medium likelihood. Three introduced pest species were also recorded: pig, cat, and black rat. The survey report is included in Appendix 5.
2024	SLR Consulting Australia Pty Ltd	Willowdale Mine – Larego Region	Targeted Significant Fauna Survey Memo	This memo outlines the results of a targeted survey for significant fauna within the Willowdale/Larego survey area undertaken between 15 to 17 July 2024, covering an area of approximately 846 ha. 80 motion sensitive camera traps were installed in suitable habitats targeting Chuditch, Quokka and Woylie. Two spotlighting trips were undertaken on 16 and 30 July 2024. A thermal imagery drone was used for the second night to locate fauna, which were confirmed by personnel on the ground to identify species. A total of five conservation significant species were recorded: Western Ringtail Possum, Forest Red-tailed Black Cockatoo, Quokka, Western Brush Wallaby and Rakali. The survey memo is included in Appendix 5. The Western Ringtail Possum is typically considered at low risk of occurrence within the Jarrah Forest. Its usual habitat range includes near coastal areas of Peppermint woodland and Peppermint/Tuart associations from the Australind/Eaton area to east of Albany at Waychinicup National Park, and in the southern forest near Manjimup within peppermint tree habitats. However, it can also inhabit Jarrah, Marri, Sheoak, and Banksia woodlands.
2024g	SLR Consulting Australia Pty Ltd	Huntly Mine – Myara Region	Alcoa Priority Areas Memo	This memo outlines the results of targeted surveys for significant terrestrial vertebrate fauna within the Huntly/Myara survey area, within 27 individual polygons covering 60.33 ha. Camera traps were placed in areas of suitable habitat with a focus on targeting Chuditch, Quokka and Woylie. A total of 18 fauna species were recorded by ten camera traps within the priority areas. Four significant species were recorded, Chuditch, Wambenger Brush-tailed Phascogale, Quenda and Western Brush Wallaby.

Year	Author	Area	Study Name	Survey details
				Habitat within priority areas is predominantly Jarrah Forest Woodland with most of the significant species occurring within this habitat. The survey memo is included in Appendix 5.
2024	Spectrum	Huntly	Huntly Mine Targeted Fauna Survey Memo	This memo outlines the results of a single season targeted fauna survey within the Huntly – O'Neil survey area, covering an area approximately 650 ha. Targeted searches for secondary evidence of target species, such as scats, tracks, dens/nests, tunnels and remains were conducted at 20 locations within the survey area. Two targeted species, the Chuditch and Woylie were recorded on motion cameras. Based on spot patterns two individual Chuditch were recorded. It is not possible to determine whether the Woylie captured on motion camera is one individual or multiple. Woylie records came from a single location over three nights. All sightings were in Jarrah Forest Habitat. Four additional species were recorded during the survey: Wambenger Brush-tailed Phascogale, Western Brush Wallaby, Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo. Further surveys for Woylies will be undertaken to confirm population extent. The survey memo is included in Appendix 5.
2023a	Terrestrial Ecosystems	McCoy, Myara and White, Huntly Mine	Baseline Monitoring of Rehabilitation Programs – Alcoa's Bauxite Mining Areas – June 2023	Alcoa has established 12 long-term monitoring sites for vertebrate fauna. Terrestrial Ecosystems has undertaken the baseline survey, which will be the first of the long-term monitoring surveys. These survey data indicated that the three unmined sites selected as analogue climax communities for the rehabilitation areas are not similar, and there are appreciable differences among the fauna assemblages within aged classes of rehabilitation. The preliminary data collected in this survey would suggest that conservation significant species are in the unmined areas, but not the rehabilitated areas. The survey report is included in Appendix 5.
2023b	Terrestrial Ecosystems	McCoy, Myara and White, Huntly Mine	Baseline Monitoring of Rehabilitation Programs – Alcoa's Bauxite Mining Areas – October 2023	The second rehabilitation baseline survey undertaken in winter 2023. Outcome was similar to that observed in summer 2023, that being, the current monitoring program requires adjustment, as the analogue sites for the rehabilitated areas appear not to be appropriate given the spatial variability in the vertebrate fauna assemblages in the unmined, and possibly older rehabilitated sites of the northern Jarrah Forest. Many of the vertebrate fauna caught and recorded in the monitoring program are common, widespread and abundant, and given the mosaic disturbance pattern undertaken by Alcoa to mine bauxite in the northern Jarrah Forest, the mining

Year	Author	Area	Study Name	Survey details
				program is unlikely to threaten any of these common species. The survey report is included in Appendix 5.
2024a	Western Environmental	Willowdale Minesite	Black Cockatoo Targeted Assessment 2023	Targeted pre-clearance black cockatoo assessments were completed for Larego region within the Willowdale region. There were 13,267 potential, suitable, or known nesting trees recorded, 97% of which are Bamford Class 4 or 5 trees classified as potential nesting trees. However, these currently do not contain suitable nesting hollows. There were 85 trees identified as Bamford Class 3 with the potential to contain suitable nesting hollows, however, none were identified. There were three Bam Class 2 trees confirmed as known nesting trees based on evidence of chew marks. The survey area contains predominantly high-quality foraging habitat due to prevalence of Jarrah Forest. There was 469.4 ha (0.74% of the 63, 554.92 ha of remnant native vegetation mapped) of foraging habitat (excluding cleared areas). There were six locations which showed evidence of use as roost sites, with one confirmed as an active roost site. Three other sites were considered likely roost sites. The survey report is included in Appendix 5.
2024b	Western Environmental	Larego	Technical Memo Black Cockatoo Targeted Assessment – Larego June – July 2024	This memo outlines the results of pre-clearance surveys undertaken between June and July 2024 (Phase 1) and August to September (Phase 2) within the Larego region, covering approximately 515 ha. Ground-based, drone and camera searches were conducted, using specific government referral guidelines for all three Black Cockatoo species with consideration also given to survey requirements under Alcoa (2024a2024) Fauna Management Plan Version 1. A combined total of 140 suitable or known nesting trees were recorded during Phase 1. There were 114 Bamford Class 3 recorded, making up the vast majority (81%). Phase 1 identified 140 suitable or known nesting trees, including 114 Bamford Class 3 trees (81%), one Bamford Class 1 tree, and 12 Bamford Class 2 trees. Eight previously recorded nesting trees were reassessed, with one found unsuitable. All of the 140 potential suitable or known nesting trees identified in Phase 1 were subject to follow up assessment during Phase 2. Phase 2 recorded four Bamford Class 1 trees, 10 Bamford Class 2 trees, and five Bamford Class 3 trees. Of these, 119 trees were downgraded to potential nesting trees (Bamford Class 4 and 5). 14 known nesting trees were confirmed. The survey report is included in Appendix 5. The survey report is included in Appendix 5.

Year	Author	Area	Study Name	Survey details
2024c	Western Environmental	Myara	Technical Memo Black Cockatoo Targeted Assessment, Myara, May – June 2024	This memo highlighted findings from a targeted species assessment for all three EPBC Act listed Black Cockatoo species in terms of direct observation and recorded feeding, foraging behaviour, as well as identification of suitable roosting, feeding and breeding hollow habitat within the Willowdale Mine and Larego survey area covering 477.7 ha from July to December 2023. Ground-based, drone and camera searches were conducted, using specific government referral guidelines for all three Black Cockatoos species. A combined total of 13,267 potential, suitable or known nesting trees were recorded. The vast majority (97%) of these trees were Bamford Class 4 or 5 trees, defined by DAWE (2022) as potential nest trees, however these do not currently contain suitable nesting hollows. Analysis of regional habitat extent indicates there is 63,554.9 ha of remnant native vegetation mapped within a 12 km buffer of the surveyed area. It is expected that the majority of this vegetation would contain suitable foraging species at the same or greater rate than that present within the surveyed area. Therefore, approximately 470 ha of foraging habitat represents 0.74% of the estimated regional habitat extent. Six locations were recorded that displayed evidence of having been used as a roost site and based on additional mapping and direct evidence of cockatoo species presence, it is considered highly likely that more roosting sites exist within the survey area than the six confirmed locations. The survey report is included in Appendix 5.

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
Willard
McCoy
O'Neil
Duncan
White
Huntly
Del Park
Holyoake
Teesdale

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams

Fauna Surveys

- SRE Invertebrate Fauna Survey
- Pre-clearance Targeted Fauna Survey
- Pre-clearance Targeted Black Cockatoo Survey
- Pre-clearance Targeted Carter's Freshwater Mussel Survey
- Basic and Targeted Fauna Survey

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-1: Fauna survey areas - Huntly

Scale: 1:115,000

Date Printed: 7/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- Major Dams

Fauna Surveys

- Pre-clearance Targeted Fauna Survey
- Pre-clearance Targeted Black Cockatoo Survey
- Pre-clearance Targeted Carter's Freshwater Mussel Survey
- Basic and Targeted Fauna Survey

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-2: Fauna survey areas – Willowdale

Scale: 1:75,000

Date Printed: 7/10/2024

6.1.2 Fauna Habitats

Fauna surveys detailed in Section 6.1.1 have determined key fauna habitat areas and supported fauna species within the Huntly and Willowdale regions. Table 6-2 details the value of fauna habitat for conservation significant fauna, including those for Black Cockatoo habitats (Table 6-4). Alcoa has compiled a desktop baseline report which discusses the significant fauna habitats (GHD 2024h) (Appendix 5).

The methodology to determine the fauna habitats was developed using the 'VT and Fauna Habitat alignment' spreadsheet and supporting Fauna Habitat spatial data initially completed by GHD and utilised in recent surveys. The spreadsheet illustrates the alignment of Fauna Habitat with the Mattiske Site Vegetation Types. For older surveys, the methodology was entirely based on Vegetation Mapping in GIS at that time.

The fauna habitat mapping data has been cross-referenced with surveys conducted in 2023 and 2024. Consultants (SLR) conducted targeted fauna surveys, which included baited camera trapping, at Myara and Larego to verify the fauna habitat mapping. The consultants further refined the fauna habitat types for the target species, as no discernible difference was found between the Blackbutt, Bullich, and Flooded Gum fauna habitats as defined by GHD. Consequently, data records no longer include Flooded Gum fauna habitats, however, Blackbutt and Bullich were retained due to their prevalence. Drainage lines have been introduced as a fauna habitat.

The main habitats in the Huntly and Willowdale mine areas include Blackbutt Forest, Bullich Forest, Granite Outcrop, Jarrah-Marri Forest, and Melaleuca Dampland (Figure 6-3 and Figure 6-4 and detailed in Table 6-2). Alcoa has reviewed its fauna habitat types (refer to GHD 2024h included in Appendix 5) resulting in Blackbutt Forest and Bullich Forest being separated from Drainage Line, with the associated significantly decreasing.

Alcoa's approach focuses on actively identifying and protecting conservation significant fauna and their high value habitats such as stream zones, granite outcrops, and Black Cockatoo nesting trees to ensure that operational impacts are avoided and minimised. Measures like the LDA and MAZ safeguard these areas, particularly for species reliant on water systems (i.e. Quokka, Rakali, Woylie and Chuditch). By retaining intact networks of stream zone and riparian vegetation, the project maintains vital ecological linkages and corridors that support fauna movement and connectivity across the landscape.

Any open water predominately consists of Serpentine Dam or other public drinking water reservoirs. Open water contains aquatic habitats associated with seasonally flowing streams, seasonally waterlogged swamps and downstream artificial perennial water bodies (water reservoirs). Based on available studies and the hydrological regimes, it is expected that the mine regions will support aquatic fauna communities characterised by a high degree of seasonality and high level of species endemicity.

Permanence of water is an overall determinant of aquatic fauna composition within Jarrah Forest ecosystems, such that headwater swamps and tributaries show distinctive communities compared to higher-order streams within the same sub-catchment (ARL 1989; Storey et al. 1990 as cited in WRM 2021). Communities in temporary waterbodies typically comprise a combination of species including those only found in temporary waters and those that periodically recolonise from adjacent permanent refuges (WRM 2021).

Many aquatic invertebrates in south-west WA are found only in temporary waters (Bunn et al. 1989 as cited in WRM 2020). They are specifically adapted to drying and refilling cycles and require a period of desiccation for further development to take place (Balla 1994, Williams & Hynes 1977 as cited in WRM 2021).

Alcoa has considered the direct and cumulative impacts of operations to Terrestrial Fauna (Sections 6.2.1 and 6.2.5).

Table 6-2: Preliminary terrestrial fauna habitats recorded within the mine regions

Description	Mapped extent area (ha)	Huntly mine area		Willowdale mine area	
		Area (ha)	Proportion of Mapped Extent (%)	Area (ha)	Proportion of Mapped Extent (%)
Blackbutt Forest (Mapped at Drainage Line in SLR 2024e) Blackbutt open forest with occasional Bullich (*Eucalyptus megacarpa*), and Marri (*Corymbia calophylla*) over sparse Swamp Banksia (*Banksia littoralis*) over *Trymalium, Macrozamia, Xanthorrhoea preissii*, over *Lepidosperma tetraquetrum*, *Astartea scoparia* and areas of dense Swamp peppermint (*Taxandria linearifolia*). This habitat is limited to localised patches often associated with creeks and drainage lines. **Habitat for conservation significant species:** Western Brush Wallaby, Quenda, Quokka, Woylie, Chuditch and Western False Pipistrelle. Breeding and roosting habitat for all three Black Cockatoo species with moderate foraging to Forest Red-tailed Black Cockatoo	3,713	2,663	71.7%	1,050	28.3%
Bullich forest (Mapped at Drainage Line in SLR 2024e) Valleys and drainage areas dominated by Bullich (*Eucalyptus megacarpa*) and with some Blackbutt (*E. patens*), occasional Marri (*Corymbia calophylla*), over Sheoak (*Allocasuarina fraseriana*), *Banksia littoralis* over Grass trees (*Xanthorrhoea preissii*), Bracken fern, patches of dense *Gahnia trifida* shrubland over *Lasiopetalum floribundum*, sedges and herbs. Substrate is dark clay loam soil. These areas are associated with seasonal creeks and drainage areas. **Habitat for conservation significant species:** Black Cockatoos (all three, breeding and roosting with limited foraging), Chuditch, Quokka, Woylie, Quenda, Western Brush Wallaby, Masked Owl, Brush-tailed Phascogale, Western False Pipistrelle.	8,171	6,252	76.5%	1,919	23.5%
Flooded Gum Woodland Flooded Gum (*E. rudis*) open woodland with occasional Blackbuttover open to open sparse Banksia littoralis over Prickly Moses (*Acacia pulchella*), myrtaceous species such as Swamp peppermint (*Taxandria linearifolia*), Astartea scoparia, *Trymalium odoratissimum*, low shrub/sedgeland. Substrate varies from dark grey to grey, brown sandy clays. Associated with poorly drained broad valleys forming seasonal swamps and occasionally tall open forest along drainage lines.	187	187	100.0%	0	0.0%

Description	Mapped extent area (ha)	Huntly mine area		Willowdale mine area	
		Area (ha)	Proportion of Mapped Extent (%)	Area (ha)	Proportion of Mapped Extent (%)
Habitat for conservation significant species: Chuditch, Western Brush Wallaby, Quokka and Quenda for which it also provides refuge and movement corridors. Black Cockatoos (foraging and roosting) as well as potential foraging habitat for Woylie, Numbat and Western Ringtail Possums. Breeding habitat for Carnaby's Cockatoo, limited for others.					
Granite outcrop Granite outcrops with associated lithic vegetation complexes and adjacent associated fringing open Jarrah and Marri areas with scattered Sheoak, Melaleuca, *Banksia ilicifolia* over occasional Grass trees over mixed open heath communities of Myrtaceous and Proteaceous low shrubs. Soils are pale grey to yellowish fine sand or sandy clay. Granite outcrops often associated with seasonal watercourse and seasonally damp areas. This habitat found as localised patches throughout the Survey Area. Disturbance factors include frequent fire, feral pigs, dieback, damage caused by rock removal, trail bike and 4WD on granite. **Habitat for conservation significant species:** Foraging and denning habitat for Chuditch. Habitat for Western Brush Wallaby, Southern Death Adder, and Dell's Ctenotus. Fringing open forest provides foraging and breeding habitat for Black Cockatoo species.	1,713	1,618	94.5%	94	5.5%
Jarrah – Marri Forest *E. marginata* and *C. calophylla* open forest over Grass trees (*Xanthorrhoea preissi*), *Lasiopetalum floribundum*, Macrozamia mid shrubland. Patches have dominance of understory *Allocasuarina fraseriana* and *Banksia grandis*. Often with complex mosaic of low shrubs such as Fabaceae, *Hibbertia*, *Leucopogon*, *Adenanthos*, and *Pteridium*. This is the most extensive habitat identified and comprises a number of vegetation types dominated by Jarrah on upper, mid and low slopes and broad valleys. Soils range from well drained gravely sand to sandy clay loam. **Habitat for conservation significant species:** Chuditch, Western Ringtail Possum (*Pseudocheirus occidentalis*), Brush-tailed Phascogale, Western Brush Wallaby, Peregrine Falcon, Masked Owl, Western False Pipistrelle, Dell's Skink, Southern Death Adder and Woylie. Foraging and potential roosting habitat for all three locally occurring Black Cockatoo (*Calyptorhynchus*) species. Breeding habitat for all three Black Cockatoo species. Quokka may use dense area of Jarrah Marri forest for foraging and dispersal.	77,498	60,922	78.6%	16,576	21.4%

Description	Mapped extent area (ha)	Huntly mine area		Willowdale mine area	
		Area (ha)	Proportion of Mapped Extent (%)	Area (ha)	Proportion of Mapped Extent (%)
Melaleuca Dampland Paperbark (*Melaleuca preissiana*) over sparse isolated *Banksia littoralis* over open *Hakea*, occasional Woody Pear (*Xylomelum*), Grass trees and over mixed shrub layer of Cyperaceae, Restionaceae, *Babingtonia*, *Jacksonia* and *Acacia*, over low shrubs, sedges and herbs. There are areas of sparse to occasional stunted Jarrah and Marri however these are limited to lowland transitional zones adjacent to slightly higher elevation and drainage open forest areas. Generally limited to areas of poor drainage and subject to winter inundation such as broad valleys and swamps. Substrate is grey gravely clay and clay loam. Disturbance factors include frequent fire and feral pigs. **Habitat for conservation significant species:** Western Brush Wallaby, Western False Pipistrelle. Foraging habitat for all three locally occurring Black Cockatoo (*Calyptorhynchus*) species although Jarrah and Marri are generally stunted and sub-optimal for breeding habitat. Where creek lines or dense vegetation is present Quokka and Quenda reside.	1,532	1,489	97.2%	42	2.8%
Mine rehabilitation Areas of age greater than 8 years provide foraging habitat for Black Cockatoo species but lack trees of suitable age (trunk diameter) to have developed hollows of sufficient diameter and depth to be considered potentially suitable breeding trees for Black Cockatoos. These areas also provide continuity of forest or woodland connectivity allowing fauna movement and foraging habitat for a range of species ground such as terrestrial reptiles, birds, small mammals. **Habitat for conservation significant species:** Research indicates use of mine rehabilitation within 2 years of establishment for Chuditch and Quenda, 4-5 years for Western Brush Wallaby, by Quokka (varying ages) and within 4-7 years for foraging by Black Cockatoos.	12,595	12,533	99.5%	62	0.5%
Pine Plantation These are monocultures of Pine timber tree species (*Pinus*). They represent very high-quality foraging habit for Carnaby's and Baudin's Cockatoos. They tend to be devoid of understory and ground layer vegetation and lack habitat values for most other native vertebrates. The single matching VT code type and values corresponding to this fauna habitat type based on Mattiske data tools and review of surveyed areas across the Huntly mine is PL.	175	175	100.0%	-	0.0%

Description	Mapped extent area (ha)	Huntly mine area		Willowdale mine area	
		Area (ha)	Proportion of Mapped Extent (%)	Area (ha)	Proportion of Mapped Extent (%)
Other (cleared) Cleared areas consist of areas whereby native vegetation has been removed.	4,594	4,591	99.9%	3	0.1%
Total Area	**110,176**	**90,430**	**82.1%**	**19,746**	**17.9%**

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
Willard
McCoy
O'Neil
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams

Fauna Habitats

- Blackbutt Forest
- Bullich Forest
- Flooded Gum Woodland
- Granite Outcrop Association
- Jarrah Marri Forest
- Melaleuca Dampland
- Plantation
- Rehab
- Cleared
- Unsurveyed

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-3: Indicative fauna habitats – Huntly

Scale: 1:115,000

Date Printed: 10/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Major Dams

Fauna Habitats

- Blackbutt Forest
- Bullich Forest
- Granite Outcrop Association
- Jarrah Marri Forest
- Melaleuca Dampland
- Rehab
- Cleared
- Unsurveyed

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-4: Indicative fauna habitats – Willowdale

Scale: 1:75,000

Date Printed: 10/03/2025

6.1.3 Conservation Significant Fauna

Field surveys conducted by SLR Consulting (SLR Consulting Australia, 2024a) (SLR Consulting Australia, 2024b), (SLR Consulting Australia, 2024), GHD (GHD, 2024a) (GHD 2024d) (GHD 2024h) and Spectrum (2024) recorded conservation significant fauna taxa at the Huntly or Willowdale survey areas (Table 6-3).

During the targeted preclearance surveys within the Huntly mine region 15 significant fauna taxa were recorded within the Survey Area which covers approximately 2,010 ha. Similarly, pre-clearance surveys in the Willowdale mine region identified six significant fauna taxa within the 1,783 ha Survey Area (Table 6-3).

Table 6-3 Conservation Significant Fauna

Species	Preferred Habitat	Conservation Status	Likelihood of Occurrence in Huntly	Likelihood of Occurrence in Willowdale
Baudin's Cockatoo *(Zanda baudinii)*	Distributed throughout southwest Western Australia, from the northern Darling Range to Albany. **Huntly -** Secondary evidence of Baudin's Cockatoo recorded, particularly within Jarrah-Marri Forest, Blackbutt Forest and Bullich Forest, which serve as core habitats for breeding, roosting, and foraging. **Willowdale -** recorded within the Jarrah-Marri Forest habitat	Endangered (BC Act; EPBC Act)	Recorded	Recorded
Forest Red-tailed Black Cockatoo *(Calyptorhynchus banksii naso)*	Inhabits dense Jarrah, Karri, and Marri forests in southwest WA. **Huntly -** recorded in large numbers, using Jarrah-Marri Forest for foraging and roosting. **Willowdale -** recorded within Jarrah-Marri Forest	Vulnerable (BC Act; EPBC Act)	Recorded	Recorded
Chuditch *(Dasyurus geoffroii)*	Inhabits sclerophyll forests, woodlands, heath, and mallee shrublands, and is highly mobile. **HUNTLY -** recorded by camera traps within the Jarrah-Marri Forest habitat, with core habitats identified for denning and foraging..	Vulnerable (BC Act; EPBC Act)	Recorded	Likely
Western Brush Wallaby *(Notamacropus irma)*	Primarily found in open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland and is uncommon in karri forest. **HUNTLY -** recorded within Blackbutt Forest, Bullich Forest, Jarrah-Marri Forest, which provides suitable denning/hunting habitat. **WILLOWDALE -** it was recorded 23 times within Bullich Forest, Jarrah-Marri Forest and Melaleuca Dampland habitats.	Priority 4 (DBCA)	Recorded	Recorded
Carter's Freshwater Mussel *(Westralunio carteri)*	Usually found in freshwater river pools. They are most common in areas with muddy, silty and sandy bottoms and flowing permanent water. **HUNTLY -** recorded in the Dardanup region.	Vulnerable (BC Act; EPCA Act)	Recorded	Likely
Rakali *(Hydromys chrysogaster)*	Usually found in the vicinity of permanent bodies of fresh water, brackish or marine water, lakes and farm dams and on sheltered coastal beaches, mangroves and offshore islands. In the south-west they have been seen to	Priority 4 (DBCA)	Recorded	Recorded

Species	Preferred Habitat	Conservation Status	Likelihood of Occurrence in Huntly	Likelihood of Occurrence in Willowdale
	prefer areas with riparian vegetation, better water quality and a degree of complexity. **HUNTLY -** recorded within the Dandalup Dam, Bullich Forest, Granite Outcrop Association, Jarrah Marri Forest and Melaleuca Dampland habitats. **WILLOWDALE -** it was recorded once within the Blackbutt Forest habitat.			
Quenda *(Isoodon fusciventer)*	Prefers dense scrubby, often swampy vegetation with dense cover up to one metre high. However, it also occurs in woodlands and may use less ideal habitat where this habitat occurs adjacent to thicker, more desirable vegetation. **HUNTLY -** The species was recorded within Blackbutt Forest, Bullich Forest, Jarrah Marri Forest and *Malelauca* dampland which provide suitable denning and foraging/hunting habitat.	Priority 4 (DBCA)	Recorded	Likely
Carnaby's Cockatoo *(Zanda latirostris)*	This taxa nests in hollows of various Eucalyptus trees and feeds on seeds, nuts, and flowers from native and exotic plants. **HUNTLY -** recorded in large flocks within the survey area, particularly in Jarrah-Marri Forest, which is crucial for breeding, roosting, and foraging. This species was also recorded within Blackbutt Forest and Bullich Forest habitat. **WILLOWDALE -** recorded within Jarrah Marri Forest habitat.	Endangered (BC Act; EPBC Act)	Recorded	Recorded
Quokka *(Setonix brachyurus)*	Found in dense riparian vegetation and other habitats in southwest WA. **HUNTLY -** The species was recorded by camera traps within Jarrah-Marri Forest habitat. It was also recorded within Blackbutt Forest, Bullich Forest, and Melaleuca Dampland habitats.	Vulnerable (BC Act; EPBC Act)	Recorded	Likely
Wambenger Brush-tailed Phascogale *(Phascogale tapoatafa wambenger)*	Inhabits dry sclerophyll forests and open woodlands. **HUNTLY -** It was recorded by camera traps within the Jarrah-Marri Forest habitat, which provides essential shelter, foraging, and dispersal opportunities.	Conservation Dependant fauna (BC Act)	Recorded	Likely
Dell's skink *(Ctenotus delli)*	Associated with Jarrah Marri woodland that has a shrub dominated understorey, on laterite, sandy or clay soils. It is typically found in the north	Priority 4 (DBCA)	Recorded	Likely

Species	Preferred Habitat	Conservation Status	Likelihood of Occurrence in Huntly	Likelihood of Occurrence in Willowdale
	Darling Range and inhabits dry sclerophyll forest on granite outcrops, stony hills and ranges. **HUNTLY -** recorded within the Jarrah Marri Forest.			
Masked Owl *(Tyto novaehollandiae novaehollandiae)*	Typically found in forests (wet and dry sclerophyll, non-eucalypt dominated), open woodlands, farmlands or scrub with large trees (12-20m) and adjacent cleared country, timbered watercourses, paperbark woodlands and caves. **HUNTLY -** This species was recorded within the Jarrah Marri Forest habitat.	Priority 3 (DBCA)	Recorded	Likely
Western False Pipistrelle *(Falsistrellus mackenziei)*	Typically occurs in wet sclerophyll forest dominated by Karri, and in the high rainfall zones of the Jarrah and Tuart dry sclerophyll forests. **HUNTLY -** recorded within Blackbutt Forest, Granite Outcrop Association, Jarrah Marri Forest and Melaleuca Dampland habitats.	Priority 4 (DBCA)	Recorded	Likely
Woylie *(Bettongia penicillata ogilbyi)*	Dense undergrowth, logs and rock cavities and occasional burrows. Scattered Woylie populations may be found throughout the Jarrah Forest in the southwest of WA. **HUNTLY -** recorded within Jarrah Forest in the O'Neil East region.	Critically Endangered (BC Act) Endangered (EPBC Act)	Recorded	Likely
Peregrine Falcon *(Falco peregrinus)*	Typically found on and near cliffs, gorges, timbered watercourses, riverine environments, wetlands, plains, open woodlands, and pylons and spires of buildings, though less frequently in desert regions. **HUNTLY -** This species was recorded within the Bullich Forest and Jarrah Marri Forest.	Other Specially Protected fauna (DBCA)	Recorded	Likely
Numbat *(Myrmecobius fasciatus)*	Current Numbat populations occupy several different habitat types: upland Jarrah Forest, open Eucalypt woodland, Banksia Woodland, and Tall Closed Shrubland. The only remaining original subpopulations are at Dryandra Woodland and the Upper Warren area (including Tone Perup Nature Reserve, Greater Kingston National Park and adjoining State Forest). In Wa there are nine translocation sites, including Boyagin Nature Reserve, Tutanning Nature Reserve, Batalling block and Karroun Hill Nature Reserve. At Dryandra, numbats inhabit brown mallet (Eucalyptus astringens) plantatiions. Habitats usually have an abundance of termites in the soil, and hollow logs, tree hollows, burrows and branches for shelter.	Endangered (BC Act; EPBC Act)	Potential	Unlikely

Species	Preferred Habitat	Conservation Status	Likelihood of Occurrence in Huntly	Likelihood of Occurrence in Willowdale
Noisy Scrubbird (*Atrichornis clamosus*)	Inhabits areas with dense understorey or lower stratum of sedges and shrubs, dense leaf litter and abundant litter-dwelling invertebrates. It mainly occurs in low closed forests 5-15 m in height that are dominated by Eucalyptus or *Agonis* and *Banksia littoralis* and occur in the steep and wetter gullies, and drainage lines of hills and granite mountains (*Eucalyptus*), and on the margins of freshwater lakes *(Agonis* and *B. littoralis*). It is also common in low closed forests up to 5 m in height that are dominated by Hakea elliptica, Eucalyptus or Agonis and Banksia littoralis and occur around granite outcrops, in shallower and drier gullies and on the margins of freshwater lakes. It mostly occurs at sites that have not been burnt for 10 or more years. It occurs at two locations in the SW; on the mainland in coastal areas from Two Peoples Bay Nature Reserve to Cheyne Beach, and on the Bald Island.	Endangered (BC Act; EPBC Act)	Unlikely	Unlikely
Malleefowl (*Leipoa ocellata*)	Generally occurs in the semi-arid areas of WA, in shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine *Callitris* woodlands, *Acacia* shrublands, paperbark, sheoak, Broombrush (*Melaleuca uncinata*) vegetation, eucalypt woodlands or coastal heathlands. Mostly they are found where there are sandy or gravel soils. The nest is a large mound of sand or soil and organic matter. In WA they are found from the southwest Nullarbor to Albany, north, and then west from Moore River up to Shark Bay, past Cue, across to Wiluna and east to the northern Victoria Desert south of the Blackstone Ranges.	Vulnerable (BC Act; EPBC Act)	Unlikely	Unlikely
Southern Death Adder *(Acanthophis antarcticus)*	Habitat ranges from rainforests to shrubland and heaths. This species is declining in many areas, probably due to habitat destruction and altered fire regimes.	Priority 4 (DBCA)	Likely	Likely
Tammar Wallaby *(Notamacropus eugenii derbianus)*	Preference for dense, coastal heath and scrub, with some sclerophyll forest with significant cover. Their current distribution across WA is limited to Dryandra, Tutanning and Perup forest, and offshore islands of Garden, Middle and Recherche Archipelago.	Priority 4 (DBCA)	Unlikely	Unlikely
Western Ringtail Possum *(Pseudocheirus occidentalis)*	Considered at low risk of occurrence within the Jarrah Forest. Typically, its range is restricted to near coastal areas of Peppermint woodland and Peppermint/Tuart associations from the Australind/Eaton area to east of Albany at Waychinicup National Park, and in the southern forest near	Critically Endangered (BC Act; EPBC Act)	Potential	Recorded

Species	Preferred Habitat	Conservation Status	Likelihood of Occurrence in Huntly	Likelihood of Occurrence in Willowdale
	Manjimup within peppermint tree habitat. However, it can also inhabit Jarrah, Marri, Sheoak, and Banksia woodlands. **WILLOWDALE -** A mature male western ringtail possum was observed during pre-clearance nighttime spotlight surveys within the Larego region. The individual was found in a blackbutt sapling approximately 5 m from the edge of the vegetation in a drainage line habitat.			
Australasian Bittern *(Botaurus poiciloptilus)*	Preferred habitat is wetlands with tall dense vegetation. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. *Phragmites*, *Cyperus*, *Eleocharis*, *Juncus*, *Typha*, *Baumea*, *Bolboschoenus*) or cutting grass (*Gahnia*) growing over a muddy or peaty substrate. In the South-West, the Bittern is largely confined to coastal areas, especially along the south coast. It also occurs around swamps, lakes, pools, rivers and channels fringed with lignum *Muehlenbeckia*, cane grass *Eragrostis* or other dense vegetation (Marchant 1990). They can be found in reed beds near Two Peoples Bay, in lakes near Mt Manypeaks, and the Lake Muir area.	Endangered (BC Act)	Highly Unlikely	Unlikely
Woma Python *(Aspidites ramsayi)*	Habitat preference ranges from sub-humid and arid interior sandy dune systems to spinifex-based woodlands and shrublands with distributions across the Northwest of WA to the interior, and a small, increasingly rare distribution to in the Wheatbelt region of the South-West.	Priority 1 (DBCA)	Highly Unlikely	Highly Unlikely

6.1.3.1 Black Cockatoo Habitat

Black cockatoo foraging habitat was mapped over the Huntly and Willowdale mine areas, based on the fauna habitat derived from the vegetation type mapping completed by Mattiske (2008-2022) and Black Cockatoo Targeted - WE (WDL) 2023 habitat IBSA data (Table 6-4). The high-quality foraging habitats are mainly found in Blackbutt and Jarrah-Marri forests.

Black Cockatoo surveys are undertaken prior to the development of clearing plans for all proposed disturbance areas to identify Black Cockatoo trees (Figure 6-5 to Figure 6-8). Previously all Nest trees and Significant trees are protected irrespective of where they are located, with clearing within 50 m avoided where possible[65] and a minimum ten metre radius Mining Avoidance Zone applied[66]. Habitat trees are avoided for haul road clearing, where possible.

Alcoa is now committed to increasing the Black Cockatoo Nest and Significant tree Mining Avoidance Zone to 30 m upon approval of this MMP. No clearing within 30 m of Black Cockatoo Nest and Significant trees will occur, unless required for critical infrastructure, exploration, groundwater bores or rehabilitation.

[65] Required for Nest Trees under 2023-2027 MMP Ministerial Approval Condition 4
[66] 2023-2027 MMP Ministerial Approval Condition 5

Table 6-4: Black Cockatoo foraging habitat in the Huntly and Willowdale mine areas

Fauna habitat type	Huntly				Willowdale			
	Mine Region Area (ha)	Foraging habitat quality			Mine Region Area (ha)	Foraging habitat quality		
		Forest Red-tailed Black Cockatoo	Baudin's Cockatoo	Carnaby's Cockatoo		Forest Red-tailed Black Cockatoo	Baudin's Cockatoo	Carnaby's Cockatoo
Blackbutt forest	2,663	High	Medium	Medium	1,050	High	Medium	Medium
Bullich forest	6,252	Medium	Medium	Medium	1,919	Medium	Medium	Medium
Flooded Gum Woodland	187	High	High	High	-	High	High	High
Granite outcrop	1,618	Low	Low	Low	94	Low	Low	Low
Jarrah – Marri Forest	60,922	High	High	High	16,576	High	High	High
Melaleuca dampland	1,489	None	Low	Low	42	None	Low	Low
Mine rehabilitation	12,533	Medium	Medium	Medium	62	Medium	Medium	Medium
Pine Plantation	175	High	High	High	-	High	High	High
Other (cleared)	4,591	None	None	None	3	None	None	None
Foraging habitat quality summary								
High		63,947	61,284	61,284	High	17,626	16,576	16,576
Medium		18,785	21,448	21,448	Medium	1,981	3,031	3,031
Low		1,618	3,107	3,107	Low	94	136	136
None		6,080	4,591	4,591	None	45	3	3
Total		**90,430**	**90,430**	**90,430**	**Total**	**19,746**	**19,746**	**19,746**

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
O'Neil
Willard
McCoy
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- 24 Month Clearing Schedule
- Mining Regions
- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams
- Black Cockatoo Protection Zones
- Forest Red-tailed Black Cockatoo Foraging Habitat Quality
  - High
  - Medium
  - Low
- Black Cockatoo Trees
  - Habitat Tree
  - Nest Tree
  - Possible Nest Tree
  - Significant Tree

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-5: Black Cockatoo records and Forest Red-Tailed Black Cockatoo indicative habitat - Huntly

Scale: 1:115,000

Date Printed: 9/10/2024

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
O'Neil
Willard
McCoy
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- 24 Month Clearing Schedule
- Mining Regions
- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams
- Black Cockatoo Protection Zones
- Baudin's & Carnaby's Cockatoo Foraging Habitat Quality
  - High
  - Medium
  - Low
- Black Cockatoo Trees
  - Habitat Tree
  - Nest Tree
  - Possible Nest Tree
  - Significant Tree

Alcoa

0 1 2 4 km

N

2025 - 2029 Mining and Management Plan

Figure 6-6: Black Cockatoo records and Baudin's & Carnaby's Black Cockatoo indicative habitat - Huntly

Scale: 1:115,000

Date Printed: 9/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

- 24 Month Clearing Schedule
- Mining Regions
- Rehabilitation
- Cleared Areas
- Major Dams
- Black Cockatoo Protection Zones

Forest Red-tailed Black Cockatoo Foraging Habitat Quality

- High
- Medium
- Low

Black Cockatoo Trees

- Habitat Tree
- Nest Tree
- Possible Nest Tree
- Significant Tree

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-7: Black Cockatoo records and Forest Red-Tailed Black Cockatoo indicative habitat – Willowdale

Scale: 1:75,000	Date Printed: 9/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall

Legend

- 24 Month Clearing Schedule
- Mining Regions
- Cleared Areas
- Rehabilitation
- Major Dams
- Black Cockatoo Protection Zones
- Baudin's & Carnaby's Cockatoo Foraging Habitat Quality
  - High
  - Medium
  - Low
- Black Cockatoo Trees
  - Habitat Tree
  - Nest Tree
  - Possible Nest Tree
  - Significant Tree

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-8: Black Cockatoo records and Baudin's & Carnaby's Black Cockatoo indicative habitat - Willowdale

Scale: 1:75,000

Date Printed: 9/10/2024

6.1.4 Short Range Endemics

Vegetation units defined by Mattiske, within the baseline study area, have been re-interpreted in relation to Short Range Endemic (SRE) invertebrates, based on factors considered important in defining fauna assemblages, including vegetation type and structure, substrate and position in the landscape. Each fauna habitat was then rated for its potential to support SREs (potential habitat rating; PHR) as follows:

- High – defined/known areas of habitat that contain elements that often give rise to specialisation or dependency in invertebrate fauna, such as aspect (e.g. south-facing slopes, deeply incised gullies), geological features (e.g. granite) and soil types that retain water (e.g. clay, loam).
- Low – areas of largely intact native vegetation that occur broadly across the landscape, are less incised and typically link more restricted habitats. This includes land that was cleared but has since been rehabilitated or is in the process of being rehabilitated.
- None – land that has been previously cleared for other uses that no longer contains native vegetation.

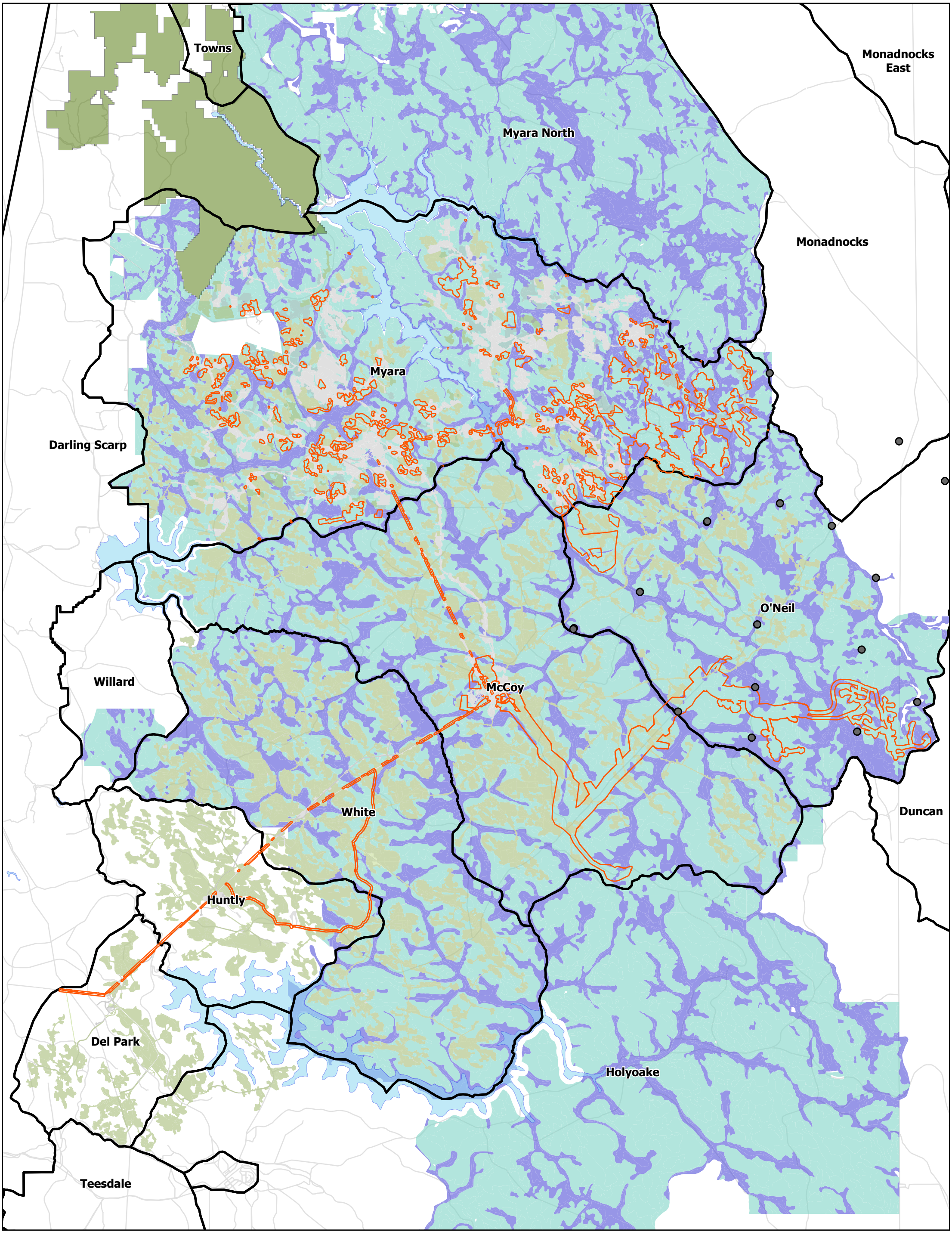
A two-phase detailed SRE invertebrate survey for the O'Neil region (Phoenix, 2024) has been completed. Five habitats were classified as having High PHR, with habitat attributes that often give rise to specialisation or dependency in invertebrate fauna, particularly more mesic habitats on lower slopes and valley floors. These represented 6,624.8 ha (32.1%) of the study area. The remaining four habitats were classified as low PHR.

The survey resulted in three confirmed SREs, five likely SREs and 37 potential SREs (Figure 6-9 and Figure 6-10). The high proportion of taxa collected from representatives of SRE groups that were classified as SREs (70%) was consistent with previous Northern Jarrah Forest subregion SRE surveys.

All but three of the recorded SRE taxa have been collected from outside the study area from either reference sites in the current survey, or from other SRE surveys of the Northern Jarrah Forest subregion.

The three taxa are all Potential SREs, known only from sites within O'Neil. All three were collected from only a single site; however, broader distributions are inferred for each taxon based on habitat of the collected specimens and/or wider distributional records of other (related) SREs from those locations.

The SRE surveys align with the LTFMP sites and transects. Pitfall trapping and hand foraging was carried out at each of these sites. There are currently 12 long term monitoring sites at Myara and eight at Orion. There are three stream zone sites at Myara and two at Orion where hand foraging for SRE's was undertaken.



Legend

- SRE Sample Sites
- 24 Month Clearing Schedule
- SRE Habitats
  - Low
  - High
- Mining Regions
- Rehabilitation
- Cleared Areas
- National Parks
- Major Dams

Alcoa

0 1 2 4 km

N

2025 - 2029 Mining and Management Plan

Figure 6-9: Indicative SRE habitat - Huntly

Scale: 1:115,000

Date Printed: 9/10/2024

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Laregо
Cornwall

Legend

- 24 Month Clearing Schedule
- SRE Habitats
  - Low
  - High
- Mining Regions
- Rehabilitation
- Cleared Areas
- Major Dams

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 6-10: Indicative SRE habitat – Willowdale

Scale: 1:75,000

Date Printed: 9/10/2024

6.2 Potential Environmental Impacts

Mining activities may result in potential direct and indirect impacts to terrestrial fauna:

- Direct impacts of clearing.
- Direct impacts due to injury/mortality from fauna entrapment or vehicle/equipment collisions.
- Indirect impacts to fauna due to:
  - Introduction and/or spread of weeds.
  - Introduction and/or spread of dieback.
  - Attraction of feral animals.
  - Light emissions from infrastructure.
  - Noise emissions from construction and operational equipment.
  - Spills and/or leaks from storage and handling of hazardous materials and waste.

6.2.1 Direct impacts due to clearing of habitat

The proposed 24 Month Clearing Schedule will directly impact fauna habitat (Table 6-5).

The Jarrah-Marri Forest habitat, which is used by conservation significant fauna species, is associated with lateritic soils with potential economic bauxite that may be subject to mining. This habitat type is widely distributed across the NJF, with the 24 Month Clearing areas impacting the current mapped extent at 3.2% in the Huntly Mine Region and 1.3% of the Willowdale Mine Region.

Portions of Melaleuca dampland, which provide valuable habitat for species like Quokka, Woylie, Rakali, and Quenda, will be subject to limited clearing, predominantly for haul road or conveyor crossings. These activities have the potential to cause fragmentation of riparian and swamp habitats by disrupting fauna movements along these corridors.

Table 6-5: Proposed clearing by fauna habitat

Fauna Habitat	Mapped extent (ha)	Huntly Mine Region			Willowdale Mine Region		
		Region Area (ha)	24 Month Clearing Schedule Area (ha)	% of Mapped extent	Region Area (ha)	24 Month Clearing Schedule Area (ha)	% of Mapped extent
Blackbutt Forest	3,713	2,663	18.8	0.5%	1,050	4.9	0.1%
Bullich forest	8,171	6,252	70.2	0.9%	1,919	13.4	0.2%
Flooded Gum Woodland	187	187	2.6	1.4%	0	-	-
Granite outcrop	1,713	1,618	14.3	0.8%	94	0.7	0.0%
Jarrah – Marri Forest	77,498	60,922	2,480.3	3.2%	16,576	1,011.6	1.3%
Melaleuca Dampland	1,532	1,489	12.1	0.8%	42	3.7	0.2%
Mine Rehabilitation	12,595	12,533	307.8	2.4%	62	0.0	0.0%
Other (Cleared)	4,594	4,591	10.2	0.2%	3	0.0	0.0%
Unsurveyed	-	-	-	-	-	7.1	-
Total	**110,001**	90,430	**2,916.4**	**2.7%**	**19,746**	**1,041.4**	**0.9%**

6.2.2 Direct loss of Conservation Significant fauna habitat

The proposed 24 Month Clearing Plan will directly impact fauna habitat suitable for a number of conservation significant species. However, avoidance measures will be taken for Black Cockatoo nest and significant trees, with clearing within 50 m avoided where possible[67] and a minimum ten metre radius Mining Avoidance Zone applied[68]. Habitat trees are avoided for haul road clearing, where possible.

The foraging habitat area for the Black Cockatoos is compared to the mapped extent of each of the mine regions and their foraging habitat quality (Table 6-4). The table separates the habitat area by type, ranking its quality from high (a very suitable habitat) to none.

Data for the Willowdale Mine was taken from the "Willowdale Minesite Black Cockatoo Targeted Assessment 2023" report (Western Environmental, 2023). Known roosting sites for Carnaby's Black Cockatoos are approximately 10 km west of the Survey Area. While not identified, the presence of high-quality foraging habitats, water sources, and numerous bird records suggest that roosting likely occurs within the Willowdale mine region (Western Environmental, 2023).

The "Black Cockatoo Habitat Assessment Huntly Mine – Myara Region" (SLR, 2024e) survey and the previous MMP report data were used for the Huntly mine region. Habitats for three black cockatoo species have been identified: Baudin's Cockatoo (*Zanda baudinii*) and Carnaby's Cockatoo (*Zanda latirostris*), both listed as Endangered, and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), listed as Vulnerable.

A total of 2,502 ha of very high-quality night roosting and foraging habitats were identified, with eleven roosting sites recorded—six confirmed for Forest Red-tailed Black Cockatoos. Foraging evidence for all three black cockatoo species was widespread, particularly for the Forest Red-tailed Black Cockatoo.

Locations of Black Cockatoo nest trees within the 24 Month Clearing Schedule are confirmed prior to clearing and avoidance measures are implemented. Alcoa has identified impacts to potential foraging habitat for Black Cockatoos (Table 6-6), potential impacts from the 24 Month Clearing Schedule (Figure 6-5 to Figure 6-8) and potential impacts to Black Cockatoo trees (Table 6-7).

Future avoidance within 30 m Mining Avoidance Zone of Black Cockatoo nest and significant trees will be implemented upon approval of this MMP, with the exception of exploration, critical infrastructure, groundwater bores and rehabilitation activities. In the meantime, clearing will be minimised as per 2023-2027 MMP Approval Condition 4.

Analysis of the 24 Month Clearing Schedule for the combined Huntly and Willowdale mine regions identified that a total of 4,991 Black Cockatoo trees has been identified across all categories (nest, significant and habitat trees). Of these, a total of 3,940 habitat trees, of which 456 are located within the 10 m Mining Avoidance Zone may be directly affected by clearing.

Based on the combined data from the Huntly and Willowdale regions, there are a total 456 habitat trees (263 at Huntly and 193 at Willowdale) within the 10 m MAZ that could be directly impacted. However, nest trees (44 at Huntly and 26 at Willowdale) and significant trees (19 at Huntly and 6 at

[67] 2023-2027 MMP Ministerial Approval Condition 4
[68] 2023-2027 MMP Ministerial Approval Condition 5

Willowdale) located within this MAZ are avoided during clearing activities, preserving their essential role in supporting Black Cockatoo breeding and roosting habitats (Table 6-7).

Specifically, when considering the future implementation of an enhanced 30 m MAZ, analysis of the 24 Month Clearing Schedule for the combined Huntly and Willowdale mine regions identified a total of 4,991 Black Cockatoo trees across all categories (nest, significant and habitat trees). Of these a total of 589 habitat trees (347 at Huntly and 242 at Willowdale) could be directly impacted. However, nest trees (71 at Huntly and 29 at Willowdale) and significant trees (21 at Huntly and 7 at Willowdale) will be avoided during clearing activities (Table 6-7).

Pre-clearance surveys typically cover the proposed clearing footprint, so the outcomes of the surveys do not provide information on the number of Black Cockatoo habitat trees outside of the clearing footprint.

Table 6-6: Indicative estimates of direct impacts of 24 months clearing plan to Black Cockatoo foraging habitat – Huntly / Willowdale

Fauna habitat type	Foraging habitat area (ha) Huntly Mine Region			Foraging habitat proportion of mapped extent Huntly Mine Region			Foraging habitat area (ha) Willowdale Mine Region			Foraging habitat proportion of mapped extent Willowdale Mine Region		
	Forest Red-tailed Black Cockatoo	Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo	Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo	Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo	Baudin's Cockatoo	Carnaby's Cockatoo
High	2,502	2,483	2,483	3.9%	4.1%	4.1%	1,017	1,012	1,012	5.8%	6.1%	6.1%
Medium	378	397	397	2.0%	1.9%	1.9%	13	18	18	0.7%	0.6%	0.6%
Low	14	26	26	0.9%	0.8%	0.8%	0.7	4.4	4.4	0.7%	3.2%	3.2%
None	22	10	10	0.4%	0.2%	0.2%	4	0	0	8.2%	0.0%	0.0%
Total	**2,916**	**2,916**	**2,916**	**3.2%**	**3.2%**	**3.2%**	**1,034**	**1,034**	**1,034**	**5.2%**	**5.2%**	**5.2%**

Table 6-7: Indicative estimates of Black Cockatoo trees within proximity to Clearing Schedule – Huntly / Willowdale

Black Cockatoo Trees	Referral guideline for 3 WA threatened Black Cockatoos species (DAWE, 2022) classification	Bamford Class classification	Huntly 24 Month Clearing Schedule Area				Willowdale 24 Month Clearing Schedule Area			
			Number of trees located within the Mine Region	Number of trees within 10m radius of the MMP	Number of trees within 30m radius of the MMP	Number of trees within 50m radius of the MMP	Number of trees located within the Mine Region	Number of trees within 10m radius of the MMP	Number of trees within 30m radius of the MMP	Number of trees within 50m radius of the MMP
Nest	Known and suitable nesting trees and suitable nest hollows.	1 2 3	715	44	71	100	262	26	29	35
Significant	-		51	19	21	25	23	6	7	7
Habitat	Potential nest trees	4 5	1,848	263	347	411	2,092	193	242	282
Total			**2,614**	**326**	**439**	**536**	**2,377**	**225**	**278**	**324**

6.2.3 Direct impacts of injury/mortality from fauna entrapment or vehicle/equipment collisions

Fauna are at risk of injury or mortality due to encounters with vehicles (involved in activities such as vegetation clearing, transportation or mining) and from entrapment within mining structures (such as water storage facilities or excavation sites).

The likelihood of interactions between vehicles or machinery and fauna is highest during vegetation clearing, as the resident fauna could potentially be struck by the vehicles involved in the operation. However, the gradual process of mining usually leaves similar native vegetation intact, offering refuge or alternative habitats for fauna, provided they can displace.

While fauna-vehicle interactions could also happen along transport routes, fauna tend to stay away from areas of mining activity and transport routes due to the associated disturbances like noise, vibrations and dust.

6.2.4 Indirect impacts

Alcoa has identified indirect impacts to terrestrial fauna and developed and deployed detailed mitigation measures for each (Section 6.3).

6.2.4.1 Introduction and/or proliferation of weeds

Granite outcrops, while typically higher in the landscape, can still be located near, downhill, or downstream of areas prone to weed invasion, which could then spread to the outcrops. Outcrops can also retain moisture through seepage faces at their base and provide important habitats for Chuditch, priority fauna, and reptiles.

Weed interactions with swamps, valleys, and granite outcrops are minimised through mitigation measures. The most significant potential for weeds to invade these limited distribution habitats is through stormwater runoff and creek flow. The invasion of weeds into swamps and creeks could alter the vegetation composition by competing with native species. The impact on fauna is uncertain, however weeds are not listed as a threatening process to any of the threatened fauna that are known or likely to occur.

6.2.4.2 Introduction and/or proliferation of dieback

Dieback is recognised as a threatening process for species such as Carnaby's Cockatoo and the spread into uninfested areas can transform a diverse, Jarrah-dominant Forest into open woodlands with a Marri canopy and sedge understorey, impacting fauna like Black Cockatoos by reducing their foraging resources.

In addition, dieback is listed as threatening process for Quokkas due to changes to floristic composition and vegetation structure favoured by Quokka. Other herbivorous fauna may also be affected by the loss of flora diversity and vegetation structure caused by Dieback.

6.2.4.3 Introduction of feral animals

The Laughing Kookaburra (*Dacelo novaeguineae*), Red Fox (*Vulpes vulpes*), Rabbit (*Oryctolagus cuniculus*), Cat (*Felinus catus*), Black Rat (*Rattus rattus*), and Pig (*Sus scrofa*) were recorded during the SLR targeted surveys in the Huntly or Willowdale survey areas, or both. The feral Pig, Cat, Fox, and

Rabbit are identified as key threats to fauna species listed under the EPBC Act and pose significant threats to the three Black Cockatoo species, Chuditch, and Quokka, which were recorded or likely to be found in the Huntly and Willowdale survey areas.

6.2.4.4 Spills and/or leaks from storage and handling of hazardous materials and waste

Most spills and leaks, especially those resulting from major incidents and involving substantial volumes, are promptly identified and contaminated soils excavated and disposed of at a licensed off-site waste facility. Minor spills of diesel and oil that go undetected and un-remediated will primarily result in in-situ soil contamination rather than migration into streams. Following mining, all mine pits and haul roads will undergo rehabilitation. Any unidentified minor soil contamination resulting from small spills and leaks will be covered with overburden, topsoil, and native vegetation during this process. Over time, any pockets of soil contamination remaining in the rehabilitated areas are expected to biodegrade.

6.2.4.5 Noise and light emissions

Noise and light emissions from construction and mining operations can disturb or displace fauna, leading them to avoid habitats in the affected areas. Although mining, haulage, and mine facilities operate 24 hours a day, construction activities are limited to daytime operations, where possible. Construction sites operating at night are lit by mobile towers, while permanent lighting is used for mine facilities, mobile towers for mine pits, and headlights for haul trucks operating at night. Nocturnal fauna, including species like Chuditch, Quokka, Western False Pipistrelle, and Masked Owl, may be disturbed by nighttime noise and light emissions.

The impact of noise and light emissions on fauna is expected to be localised and temporary, lasting for the duration of construction or mine pit operations in a specific area. After these operations, sensitive fauna species are expected to recolonise the area. However, mine facilities and primary haul roads, which operate over a longer timeframe, may cause a prolonged period of disturbance to highly sensitive fauna..

6.2.5 Cumulative Impacts

6.2.5.1 Past and present activities

The NJF subregion has been subject to environmental impacts from a range of past and present activities, with the key activities in order of area of disturbance as follows:

- Agriculture.
- Timber harvesting.
- Prescribed burning.
- Bauxite and gold mining.
- Plantations.
- Water supply reservoirs.

Agriculture has caused widespread impacts including:

- Loss of biodiversity and habitat from permanent clearing.
- Long term loss of mature trees and associated hollows from timber harvesting.

- Spread of *Phytophthora* Dieback in forested areas from timber harvesting.
- Agricultural impacts to soils including erosion, salinity, compaction, and acidification.
- Secondary salinity impacts to the Murray and Avon rivers from permanent clearing.
- Conversion of natural landscape to rural character and conversion of old growth forest to juvenile to immature forest age.

Mining has caused impacts as follows:

- Short to medium term ecological and amenity impacts during operations and until rehabilitation establishes.
- Long term loss of fauna habitats.
- Rehabilitation restoring varying biodiversity, ecological integrity, and landscape quality.

Prescribed burning is undertaken to mitigate the intensity and spread of wildfires, which can have some impacts on ecology, water quality, and local amenities (similar to timber harvesting).

While water supply reservoirs have led to localised loss of incised river valley landforms and vegetation and caused widespread disruption to the migration and dispersal of aquatic fauna, they have also resulted in the creation of perennial water bodies that serve as refuges for aquatic wildlife.

6.2.5.2 Reasonably foreseeable future activities

Both approved and proposed mining can be reasonably anticipated within the NJF subregion in future. It is expected that all of the Jarrah Forest that will be cleared for mining will undergo rehabilitation.

In 2024, the WA Government ceased native forest logging, except for timber harvesting in approved mining areas or for ecological thinning purposes.

As part of the WA Government's strategy to reduce fuel loads and minimize the likelihood and severity of large-scale wildfires, prescribed burning is expected to continue within the subregion.

Other potential future activities within the subregion may include urban or rural residential development, infrastructure development, and agriculture. Any clearing associated with these activities will be subject to regulation under either Part IV or Part V of the EP Act.

6.2.5.3 Fauna Cumulative Impacts

Cumulative impacts on the fauna within the NJF subregion may be due to the following:

- Mining and rehabilitation.
- Fragmentation.
- Timber harvesting.
- Climate change and wildfire.
- Disease and weed invasions.

The scale of cumulative impacts of the MMP and other developments and processes to flora and vegetation in the NJF subregion (Table 5-19) is analogous to the impact to fauna habitat. Although there is no information available to address indirect impacts, fragmentation and hydrological impacts or to separate the impacts from timber harvesting, prescribed burns and clearing.

The cumulative effects (including all Alcoa previous and future activities such as clearing associated with Assessment 2253 and any future Part IV EP Act Referrals) of Alcoa's mining operations on fauna habitats in the Huntly and Willowdale areas (Table 6-8 and Table 6-9) indicate that the Jarrah-Marri Forest will be the most affected. Apart from the Granite outcrops and the Jarrah Marri Forest in the Huntly Region, all other fauna habitats are expected to have less than 5% of their current mapped extents cleared. Over the course of the 10-year mining plan, it is anticipated that 7.7% of Granite outcrops and 17.9% of Jarrah Marri Forest will be cleared in the Huntly Mine region. In the Willowdale Mine region, two fauna habitats, (Jarrah Marri Forest and Melaleuca Dampland), are expected to have greater than 10% of their current mapped extents cleared. Over the course of the 10-year mining plan, it is anticipated that 20.1% Jarrah Marri Forest, 12.1% Melaleuca Dampland, will be cleared in the Willowdale Mine region.

Table 6-8: Overview of Alcoa cumulative impacts to fauna habitat (Huntly Mine Region)

Description	Total Mapped extent area (ha)	Huntly Mine Region Area (ha)	Proportion of Mapped Extent (%)	FCA Endorsed (ha)	24 Month Clearing Schedule (including Assessment 2253) (ha)	5 Year Clearing Schedule (including Assessment 2253) (ha)	10 Year Mine Plan (including Assessment 2253) (ha)	Proportion of Mapped Area remaining (%)
Blackbutt Forest	3,713	2,663	71.7%	5.8	24.1	13.6	2.2	98.3%
Bullich forest	8,171	6,252	76.5%	9.1	74.4	65.7	4.2	97.5%
Flooded Gum Woodland	187	187	100.0%	-	5.3	3.0	-	95.6%
Granite Outcrop	1,713	1,618	94.5%	23.3	46.5	51.0	3.8	92.3%
Jarrah Marri Forest	77,498	60,922	78.6%	839.1	3,286.2	4,273.8	2,480.7	82.1%
Melaleuca Dampland	1,532	1,489	97.2%	0.8	19.8	11.2	0.6	97.8%
Cleared	4,594	4,591	99.9%	46.9	10.3	67.0	0.0	97.3%
Rehabilitation	12,595	12,533	99.5%	0.1	322.1	221.0	-	95.7%
Total Area	**110,001**	**90,430**	**82.2%**	**925.1**	**3,788.7**	**4,706.1**	**2,491.5**	**86.8%**

Table 6-9 Overview of Alcoa Cumulative impacts to fauna habitat (Willowdale Mine Region)

Description	Total Mapped extent area (ha)	Willowdale Mine Region (ha)	Proportion of Mapped Extent (%)	FCA Endorsed (ha)	24 Month Clearing Schedule (ha)	5 Year Clearing Schedule (including future Part IV EP Act Referrals) (ha)	10 Year Mine Plan (including future Part IV EP Act Referrals) (ha)	Proportion of Mapped Area remaining (%)
Blackbutt Forest	3,713	1,050	28.3%	6.5	4.9	2.2	6.8	98.1%
Bullich forest	8,171	1,919	23.5%	21.4	13.4	23.7	16.0	96.1%
Flooded Gum Woodland	187	0	0.0%	-	-	-	-	100.0%
Granite Outcrop	1,713	94	5.5%	0.3	0.7	-	0.0	98.9%
Jarrah Marri Forest	77,498	16,576	21.4%	423.8	1,011.6	883.3	1,004.9	79.9%
Melaleuca Dampland	1,532	42	2.8%	0.0	3.7	1.7	-	87.1%
Cleared	4,594	3	0.1%	-	-	1.0	-	63.5%
Rehabilitation	12,595	62	0.5%	0.2	-	-	-	99.6%
Total Area	**110,001**	**19,746**	**18.0%**	**452.3**	**1,041.4**	**911.9**	**1,027.7**	**82.6%**

6.3 Mitigation

Alcoa's environmental management approach incorporates the mitigation hierarchy consistent with industry guidance (in order of priority):

- Impact avoidance.
- Impact minimisation.
- Rehabilitation.

A risk-based approach has been taken to align with Alcoa's environmental management system and management plans incorporating mitigation actions as a risk register (Table 6-10) and risk assessment methodology (Appendix 2).

Key mitigations include:

- Limiting actual clearing to 800 ha of native vegetation per calendar year[69] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[70].
- Implementation of the FMP[71] (Appendix 6), to the extent practicable, as provided to JTSI and publicly available on Alcoa's website. In addition, Alcoa is committed to undertaking systematic or regular monitoring for feral animals, which will be considered for incorporation into the next FMP revision.
- Undertaking targeted pre-clearance fauna and Black Cockatoo surveys are in suitable habitat, prior to clearing. Survey outcomes will be provided as per Index of Biodiversity Surveys for Assessment (IBSA) program in FCAs (current reports included in Appendix 5).
- Undertaking baseline fauna surveys for new mine regions (O'Neil) where previous disturbance has not occurred. Survey outcomes will be provided as per Index of Biodiversity Surveys for Assessment (IBSA) program in MMPs (current reports included in Appendix 5).
- Designing and constructing all stream crossings (within Quokka habitat) to minimise ecological and hydrological impact.
- Implementing mining avoidance zones (MAZ) for:
    - Any Black Cockatoo nest and significant tree/s with a 30 m radius MAZ, with the exception of exploration, critical infrastructure, groundwater bores and rehabilitation activities. [72].
    a. DBCA old growth forest.

[69] 2023-2027 MMP Ministerial Approval Condition 9.
[70] 2023-2027 MMP Ministerial Approval Condition 10.
[71] 2023-2027 MMP Ministerial Approval Condition 13
[72] 2023-2027 MMP Ministerial Approval Condition 5 stipulated within 10 m of a Black Cockatoo nesting tree or a Black Cockatoo significant tree or; on or after 1 January 2027 within 50 m of a Black Cockatoo nesting tree (in accordance with the Compliance Assessment Plan prepared in accordance with Clause 9 of SL 2023/200). If clearing within 50 m of a Black Cockatoo nest tree, a report is required as per 2023-2027 MMP Ministerial Approval Condition 4.

b. 71 National Park and formal conservation reserves.
c. Known Woylie population/s.
d. Identified active Chuditch den/s.

- Implementation of Limited Disturbance Areas (LDA) for:
  a. Mapped streamzone vegetation.
  b. Major granite outcrops (>1 ha + 50 m buffer).
- Undertaking additional pre-clearance surveys to confirm the presence of PECs and TECs. Based on the results of these surveys, avoidance measures will be refined accordingly.
- Implementation of pre-clearance displacement, monitoring and trapping to minimise impacts to conservation significant fauna, in particular the Chuditch and Quokka.
- Alcoa commits to conducting pre-clearance surveys for the WRP in the Larego area to ensure appropriate mitigation measures are in place.
- Undertaking additional studies into the indirect impacts on fauna, including from surface hydrology changes.

Table 6-10: Avoidance and minimisation of potential impacts to terrestrial fauna

Risk	Description of Impact	Risk Controls	Residual Risk Rating
Direct loss to fauna habitat through vegetation clearing	Decrease in fauna population sizes and extent	Avoid • Provision of MAZs and LDAs as per the FMP (Appendix 6). • Black Cockatoo Protection Zones may be established, whereby no mining activities will occur. Protection Zones may include high quality foraging habitat, high density of nest and/or habitat trees or permanent water sources. • Avoid all Black Cockatoo nest trees and significant trees with a 30 m radius MAZ, with the exception of exploration, critical infrastructure, groundwater bores and rehabilitation activities. [73]. Minimise • Actual clearing is limited to 800 ha of native vegetation per calendar year[74] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[75]. • Implement FMP to the extent practicable[76] (Appendix 6), including survey requirements. • Detailed infrastructure and mine plans minimise clearing where possible and are designed to minimise impacts to breeding habitat. • Clearing procedures/process (clearing boundary for approved clearing areas). • Clearing lines in work pack and GIS (tablet within dozer, procedures to ensure clearing in approved areas). Rehabilitate • Rehabilitation to meet Completion Criteria. • Rehabilitation to re-instate potential fauna habitat, including installation of constructed fauna habitat as per 'Build Fauna Habitat' (Doc no. AUSCDS02053-223).	Medium

[73] 2023-2027 MMP Ministerial Approval Condition 5 stipulated within 10 m of a Black Cockatoo nesting tree or a Black Cockatoo significant tree or; on or after 1 January 2027 within 50 m of a Black Cockatoo nesting tree (in accordance with the Compliance Assessment Plan prepared in accordance with Clause 9 of SL 2023/200). If clearing within 50 m of a Black Cockatoo nest tree, a report is required as per 2023-2027 MMP Ministerial Approval Condition 4.
[74] 2023-2027 MMP Ministerial Approval Condition 9.
[75] 2023-2027 MMP Ministerial Approval Condition 10.
[76] 2023-2027 MMP Ministerial Approval Condition 13

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027.2027[77]	
Direct loss to suitable breeding habitat for threatened fauna	Loss of breeding habitat for threatened fauna	Avoid • Provision of MAZs and LDAs as per the FMP (Appendix 6). • Avoid all Black Cockatoo nest trees and significant trees with a 30 m radius MAZ, with the exception of exploration, critical infrastructure, groundwater bores and rehabilitation activities [78]. • Black Cockatoo Protection Zones may be established, whereby no mining activities will occur. Protection Zones may include high quality foraging habitat, high density of nest and/or habitat trees or permanent water sources. Minimise • Actual clearing is limited to 800 ha of native vegetation per calendar year[79] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[80]. • Implement FMP to the extent practicable[81] (Appendix 6), including survey requirements. • Infrastructure crossings over stream zones are minimised. • Conduct pre-clearance surveys for Black Cockatoo and implement avoidance as per 'Survey and Management of Black Cockatoo Habitats' (Doc no. AUACDS-2053-3273) and FMP (Appendix 6). • Black Cockatoo habitat trees will be avoided for haul roads, where possible. • Conduct pre-clearance survey for to identify breeding habitat for other conservation significant fauna. • Detailed infrastructure and mine plans minimise clearing where possible and are designed to minimise impacts to breeding habitat. Rehabilitate	High

[77] 2023-2027 MMP Ministerial Approval Condition 15
[78] 2023-2027 MMP Ministerial Approval Condition 5 stipulated within 10 m of a Black Cockatoo nesting tree or a Black Cockatoo significant tree or; on or after 1 January 2027 within 50 m of a Black Cockatoo nesting tree (in accordance with the Compliance Assessment Plan prepared in accordance with Clause 9 of SL 2023/200). If clearing within 50 m of a Black Cockatoo nest tree, a report is required as per 2023-2027 MMP Ministerial Approval Condition 4.
[79] 2023-2027 MMP Ministerial Approval Condition 9.
[80] 2023-2027 MMP Ministerial Approval Condition 10.
[81] 2023-2027 MMP Ministerial Approval Condition 13

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Rehabilitation to meet Completion Criteria. • Installation of constructed fauna habitat as per 'Build Fauna Habitat' (Doc no. AUSCDS02053-223) to supplement breeding habitat for Chuditch. • Increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027.2027[82]	
Mortality and injury to conservation significant fauna individuals as a result of clearing activities	Loss of conservation significant fauna individual	Avoid • Avoid construction during night-time hours as far as practicable, to avoid peak nocturnal animal activity. • Provision of MAZs and LDAs as per the FMP (Appendix 6), which will be demarcated in construction spatial data to guide mine planning personnel. • Avoid all Black Cockatoo nest trees and significant trees with a 30 m radius MAZ, with the exception of exploration, critical infrastructure, groundwater bores and rehabilitation activities. [83]. • Black Cockatoo Protection Zones may be established, whereby no mining activities will occur. Protection Zones may include high quality foraging habitat, high density of nest and/or habitat trees or permanent water sources. Minimise • Implement FMP to the extent practicable[84] (Appendix 6), including survey requirements. • Haul road construction to only occur during the day. • Where disturbance to a recorded Carter's Freshwater Mussel population/s cannot be avoided, consult with DBCA to determine if permanent translocation of population/s, in accordance with a Translocation Management Plan approved under the *Biodiversity Conservation Act 2016* can be undertaken. • Pre-clearing displacement, monitoring and trapping for conservation significant fauna to be undertaken as per FMP (Appendix 6).	Medium

[82] 2023-2027 MMP Ministerial Approval Condition 15
[83] 2023-2027 MMP Ministerial Approval Condition 5 stipulated within 10 m of a Black Cockatoo nesting tree or a Black Cockatoo significant tree or; on or after 1 January 2027 within 50 m of a Black Cockatoo nesting tree (in accordance with the Compliance Assessment Plan prepared in accordance with Clause 9 of SL 2023/200). If clearing within 50 m of a Black Cockatoo nest tree, a report is required as per 2023-2027 MMP Ministerial Approval Condition 4.
[84] 2023-2027 MMP Ministerial Approval Condition 13

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Where a pre-clearance survey or pre-clearing monitoring identified Western Ringtail Possum, further surveys will be undertaken to determine core habitat or population extent. The population will be avoided and periodic monitoring will occur. • Conduct clearing activities in consistent direction towards native vegetation to avoid fauna becoming trapped against multiple clearing fronts or 'dead ends'. • Inductions for construction personnel in native fauna presence, risks and management/reporting requirements. • Clearing procedures/process (clearing boundary for approved clearing areas). • Clearing lines in work pack and GIS (tablet within dozer, procedures to ensure clearing in approved areas). • Native fauna interactions reported in register. • Training for all personnel around requirements for licences to handle/remove flora/fauna. • Injured Animal Procedure includes agreements with organisations to undertake care for injured animals. • Injured conservation significant fauna to be cared in accordance with DBCA guidance and advice provided via the Wildcare Helpline.	
Mortality and injury to listed threatened fauna species as a result of vehicle movements (light vehicle and heavy vehicle fauna strikes)	Mortality and injury to listed threatened fauna	Avoid • Provision of MAZs and LDAs as per the FMP (Appendix 6), which will be demarcated in construction spatial data to guide mine planning personnel. • Black Cockatoo Protection Zones may be established, whereby no mining activities will occur. Protection Zones may include high quality foraging habitat, high density of nest and/or habitat trees or permanent water sources. Minimise • Implement FMP to the extent practicable[85] (Appendix 6) • Construct fauna underpasses where conservation significant fauna populations may become isolated by haul roads. • Establish speed limits appropriate for location and commensurate with fauna strike risk, with Speed limit audits/checks. • Inductions for vehicle users in native fauna presence, risks and avoidance, including fatigue management.	Medium

[85] 2023-2027 MMP Ministerial Approval Condition 13

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Roadside vegetation is controlled to minimise fauna interactions. • Fauna sightings reported in register, providing information on fauna hotspots. • Training for all personnel around requirements for licences to handle/remove flora/fauna. • Injured animal and handling training undertaken for key personnel. • Injured Animal Procedure includes agreements with organisations to undertake care for injured animals. • Injured conservation significant fauna to be cared in accordance with DBCA guidance and advice provided via the Wildcare Helpline.	
Increase in feral predator populations as a result of exploration, construction and mining activities	Direct loss of, or injury to, individual fauna Competition of food resources Destruction of habitat/s	Minimise • Implement FMP to the extent practicable[85] (Appendix 6). • Maintain current contributions to feral control programs. • No domestic animals are to be brought onsite by mining personnel or contractors. • All construction and operational food wastes stored in containers with secured lids and disposed off-site at a licensed waste facility. • Exploration, construction and operations personnel trained in feral animal presence, risk and management/reporting requirements. • Feral animal sightings recorded by all personnel (Alcoa/contractors) to improve understanding and improve monitoring programmes. • Potential water sources that may attract feral animals are minimised or interactions limited.	Medium
Fragmentation of habitat (multi) [disruption of geneflow, movement though disruption of transport] (however able to transverse the forest)	Disruption to geneflow Reduced habitat size Reduced connectivity between habitat and populations	Avoid • No mining pits are located within stream zones (MAZ). • Provision of MAZs and LDAs as per the FMP (Appendix 6), which will be demarcated in construction spatial data to guide mine planning personnel. • Black Cockatoo Protection Zones may be established, whereby no mining activities will occur. Protection Zones may include high quality foraging habitat, high density of nest and/or habitat trees or permanent water sources. Minimise	Medium

Risk	Description of Impact	Risk Controls	Residual Risk Rating
Decline in health and/or change in habitat composition		• Actual clearing is limited to 800 ha of native vegetation per calendar year[86] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development Minister for State Development[87]. • Implement FMP to the extent practicable[88](Appendix 6). • Pre-clearing displacement, monitoring and trapping for conservation significant fauna to be undertaken as per FMP (Appendix 6). • Conduct clearing activities in consistent direction towards native vegetation to avoid fauna becoming trapped against multiple clearing fronts or 'dead ends'. • Construct fauna underpasses or reduce isolation and to maintain connectivity between areas of significant habitat. • Infrastructure crossings over stream zones are minimised. • Undertake study to determine effectiveness of fauna underpasses for each species of conservation significant fauna. • Undertake targeted feral animal control and monitoring at fauna underpasses to verify or guide management effectiveness. • All captured fauna moved into nearby suitable habitat within likely home range. Rehabilitate • Rehabilitation to meet Completion Criteria. • Rehabilitation Plan to minimise the timeframe of areas open.	
Loss of individual from entrapment	Loss of fauna individual	Minimise • Implement FMP to the extent practicable[89](Appendix 6). • Drill holes are capped when not in use and rehabilitated (including plugging) when no longer required. • Open holes, sumps and trenches are to be minimised. If required, egress options (ramps or egress netting) will be installed or inspections undertaken.	Medium

[86] 2023-2027 MMP Ministerial Approval Condition 9.
[87] 2023-2027 MMP Ministerial Approval Condition 10.
[88] 2023-2027 MMP Ministerial Approval Condition 13
[89] 2023-2027 MMP Ministerial Approval Condition 13

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Lined sumps will have fencing or egress options installed. • Training for all personnel around requirements for licences to handle/remove flora/fauna. • Injured Animal Procedure includes agreements with organisations to undertake care for injured animals. • Injured conservation significant fauna to be cared in accordance with DBCA guidance and advice provided via the Wildcare Helpline. Rehabilitate • Drill holes are rehabilitated when no longer required.	
Increased light spill, noise or vibration resulting in disruption to breeding cycles of conservation significant fauna or displacement	Disruption to breeding cycles of conservation significant fauna. Behavioural changes in individuals to avoid areas previously used for foraging and/or breeding.	Minimise • Implement FMP to the extent practicable71[89] (Appendix 6). • Avoid construction during night-time hours as far as practicable, to avoid peak nocturnal animal activity. • Restricted use of forest tracks at night to avoid peak nocturnal animal activity. • In-pit lighting towers to be directed away from uncleared areas. (Tow and Set up Lighting Plant procedure includes details on where/how to set up lighting with minimal forest disturbance). • Undertake studies to determine the medium and long-term impacts of mining operations on the breeding cycles of conservation significant fauna.	Medium

6.4 Assessment of impacts

Alcoa has implemented significant measures for avoidance, mitigation, and rehabilitation to reduce the residual impacts to as low a level as reasonably possible. While the 24 Month Clearing Schedule is expected to reduce the quality and extent of habitat for conservation significant fauna species, the risk is considered medium due to proposed mitigation measures, and the small proportion of impact to the current mapped extent.

Fauna habitats are deemed to be widespread and well represented throughout the sub-region. Black Cockatoo nest and significant trees will be preserved, and habitat trees will be avoided for haul roads. In addition, Alcoa's rehabilitation practices will minimise impacts. The key mitigation measures are detailed in the FMP (Appendix 6).

The potential impacts associated with 24 Month Clearing Schedule represent a lesser portion of current clearing in the context of more widespread cumulative impacts from historic timber harvesting, historic mine rehabilitation, climate change, fire, and dieback. Consideration of the five- and ten-year plan in these cumulative impacts represent an increase of 0.8% of clearing to the NJF subregion, which is considered to have a medium risk.

7 Inland Waters

7.1 Receiving environment

7.1.1 Baseline studies

Several key water studies have been used in the environmental impact assessment (Table 7-1) (Appendix 11). Relevant surface and groundwater baseline data will be presented in relevant FCAs.

Table 7-1: Water baseline studies

Year	Author	Study Name	Study details
2007	Croton & Reed	Hydrology and bauxite mining on the Darling Plateau	A published review of the interaction between bauxite mining, restoration and Darling Plateau hydrology based on Alcoa's mining operation in Perth water supply catchments. It focussed on three hydrological issues – turbidity, stream yields and stream salinity.
2013	Croton, Dalton, Green and Dalton	Hydrological response of the O'Neil to McCoy mining area	A study was undertaken to assess the hydrological responses associated with mining the O'Neil-to-McCoy mine area. It consisted of a review of water data in combination with estimate stream inflow and water storage volume for the Serpentine Reservoir, to estimate the effect of mining on the reservoir salinity.
2017	Grigg	Hydrological response to bauxite mining and rehabilitation in the Jarrah Forest in southwest Australia	A published review of the hydrological response to bauxite mining in the Jarrah Forest, which is considered to differ from other land uses due to the excavation of the regolith. The review consisted of monitoring three catchments for streamflow, rainfall, groundwater and leaf area index over a 36-year period.
2019	Dixon, Grigg, Alam	Modelling long-term flow and salinity response to bauxite mining in the Upper Serpentine catchment	Investigation into the potential effects of bauxite mining on stream flows and stream salinity into the Serpentine Reservoir, using the semi-distributed conceptual catchment hydrology model, LUCICAT, to consider possible long-term mine plans and a projected changing climate over a 40-year planning horizon.
2022	GHD	Drinking Water Risk Assessment Serpentine, Serpentine Pipehead, South Dandalup, and Wungong Brook Catchments	Surface hydrology model development over the Myara North and Holyoake mine regions, which covered the Serpentine, Serpentine Pipehead and South Dandalup Public Drinking Water Source Areas. A Drinking Water Risk Assessment was completed to determine impacts to reservoirs from mining activities.
2024a	GHD	Bore Completion Report, O'Neil	The scope of works completed as part of this study included drilling, installation, and development of 15 bores screened in water-bearing units, installed over 14 locations. At ONMB02, two monitoring bores were installed approximately one meter apart. Completion of in-situ falling/rising head tests at all installed monitoring bores with sufficient water levels.

Year	Author	Study Name	Study details
2024	WSP	Baseline Inland Water Assessment – Huntly and Willowdale	This report describes existing (baseline) hydrological and hydrogeological conditions for the two Mine Development Envelopes where mining operations are planned (Huntly and Willowdale).

7.1.2 Public Drinking Water Source Area

Alcoa's mining lease is located within drinking water catchments which are classified as a Priority 1 Public Drinking Water Source Area (PDWSA) and assigned under "*values directly protected under State and /or Commonwealth legislation*".

The Water Corporation (WC) has a responsibility for controlling access within PDWSAs and Reservoir Protection Zones (RPZs). RPZs are defined in the *Metropolitan Water Supply, Sewerage, and Drainage By-laws 1981*, and generally extend to 2 kilometres from the top water level of any reservoir, back into the defined PDWSA. RPZs are located within both mine sites, surrounding the Serpentine Main Dam, Serpentine Pipehead Dam, North Dandalup Dam, South Dandalup Dam, Samson Dam and Stirling Dam.

At Huntly, the mining areas intercept Serpentine and North Dandalup PDWSAs (Figure 7-1). The two water supply dams (Serpentine and North Dandalup) release limited flows (<10% of inflow) to maintain downstream beneficial uses. Alcoa has some minor infrastructure located within the South Dandalup PDWSA.

The Willowdale mine region intercepts the catchments of Harvey Dam, Stirling Dam, Logue Brook Dam and Sampson Brook Dam (Figure 7-2). Two of these dams, Stirling and Sampson Brook, are used for drinking water and their catchments comprise PDWSAs.

Desalination inputs from the Integrated Water Supply Scheme (IWSS) to Serpentine Dam for eventual discharge to Pipehead Dam are substantial and are projected to make up an increasing proportion of the source water in the future. Catchment access is restricted, with permissible activities listed in Source Water Protection plans for each PDWSA. The PDWSAs at Huntly and Willowdale are predominantly managed as Priority 1 with small areas of private land managed as Priority 2. The source water is treated with chlorine and then transferred to the Integrated Water Supply Scheme (IWSS) for distribution to downstream customers.

The Water Working Arrangements between Alcoa, DWER and WC, provide the framework under which Alcoa manages its mining operations within the drinking water catchments with respect to catchment protection.

Gooralong Brook Water Reserve

Wungong Brook Catchment Area

Canning River Catchment Area

Serpentine Pipehead Dam

Serpentine Pipehead Dam Catchment Area

Serpentine Dam

Karnup-Dandalup Underground Water Pollution Control Area

Dirk Brook Water Reserve

Karnup-Dandalup Water Reserve

Yamba

Serpentine Dam Catchment Area

North Dandalup Dam

North Dandalup Pipehead Dam Catchment Area

Conjurunup Dam

Conjurunup Creek Pipehead Dam Catchment Area

South Dandalup Pipehead Dam

South Dandalup Pipehead Dam Catchment Area

South Dandalup Dam

South Dandalup Dam Catchment Area

South Dandalup Dam Catchment Area

Dwellingerup Catchment Area

Legend

- Catchments
- 24 Month Clearing Schedule
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservoir Protection Zone (RPZ)
- Streams
- National Parks
- Reservior Top of Water Line (TWL)
- Rehabilitation
- Cleared Areas
- Roads

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-1: Public Drinking Water Source Areas - Huntly

Scale: 1:115,000

Date Printed: 7/10/2024

Waroona Dam

Drakesbrook Dam

Samson Brook Catchment Area

Samson Brook Pipehead Dam

Samson Dam

Samson Brook Catchment Area

Bancell Brook Catchment Area

Samson Brook Catchment Area

Stirling Dam Catchment Area

Logue Brook Dam

Legend

- 24 Month Clearing Schedule
- Catchments
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservoir Protection Zone (RPZ)
- Streams
- Reservior Top of Water Line (TWL)
- Rehabilitation
- Cleared Areas

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-2 Public Drinking Water Source Areas - Willowdale

Scale: 1:75,000

Date Printed: 3/10/2024

7.1.3 Hydrology

7.1.3.1 Regional hydrology

The Huntly and Willowdale mine regions are located within the basins of the Serpentine, Murray and Harvey rivers. The Serpentine, Murray and Harvey River Basins have their headwaters in the Darling Plateau, an undulating lateritic regolith over Archaean granite with dolerite intrusions that retains extensive forested land of the NJF.

The Darling Plateau generally lies at elevations of approximately 250 to 350 metres Australian Height Datum (mAHD), interspersed by isolated granite hills or 'monadnocks' that can exceed 400 mAHD. Rainfall is greatest in the western edge of the plateau near the Darling Scarp, decreasing to the north and east. The Serpentine and Murray rivers run in a characteristic north-west direction influenced by underlying granite and dolerite structures.

The Serpentine, Murray and Harvey rivers flow west off the Darling Plateau, via incised valleys through the Darling Scarp, and onto the Swan Coastal Plain (SCP). The SCP comprises deep sediments deposited from the ocean or washed down from the Darling Scarp, with a series of sandy dunes to the west and the relatively flat Pinjarra Plain to the east. The SCP lies at elevations from sea level on the coast up to 50 mAHD near the Darling Scarp with higher elevations in larger dune landforms. The SCP has been extensively developed for urban land uses over the sandy dunes, and for agricultural land use on the heavier soils of the Pinjarra Plain.

The Serpentine, Murray and Harvey rivers meander through the SCP towards the coast. The Serpentine River adopts a southerly direction due to the influence of north-south coastal dunes, before discharging into the Peel Inlet. The extensive agricultural development of the Pinjarra Plain has resulted in high nutrient loads and eutrophication of the Peel-Harvey Estuary (Hale and Butcher 2007). Along with river diversions, agricultural land use poses a key threat to the environmental values of the Peel-Yalgorup Ramsar site (Hale and Butcher 2007).

7.1.3.2 Local Hydrology – Huntly

The majority of the Serpentine River within and upstream of the Huntly mine region is regulated by Serpentine Dam (constructed in 1961), which supplies the Serpentine Pipehead Dam (constructed in 1957). Releases to the Serpentine River downstream of the Pipehead Dam are managed according to the Serpentine allocation statement (DWER, 2017a). The statement allows for the release of 0.8 GL/year for 'low-inflow' years (inflow to dam less than 30 GL) and 0.86 GL/year for 'standard' years (inflow to dam greater than 30 GL). For average inflows of approximately 14 GL/year, as recorded over 2008-2015 (DWER 2017a), Serpentine Dam would divert more than 94%, with less than 6% released downstream. For average inflows of approximately 33 GL/year, as recorded over 1975-2008 (DWER 2017a), the dam would divert more than 97%, with less than 3% released downstream.

Within the Huntly mine region, the Serpentine Dam is supplied by seasonal streams, with major tributaries being the Serpentine River and Big Brook. The seasonal streams are interspersed by headwater swamps that occupy colluvial and alluvial sediments in valley floors. The swamps comprise seasonally waterlogged wetlands with distinct vegetation types.

The Huntly mine region lies partially in the catchment of the North Dandalup River, which is regulated by North Dandalup Dam. North Dandalup Dam was constructed in 1994 and supplies the IWSS. Releases from the dam to North Dandalup River downstream are managed according to the North

Dandalup allocation statement (DWER 2017b). The statement allows for the release of 0.46 GL/year for 'low-inflow' years (inflow to dam less than 30 GL) and 0.51 GL/year for 'standard' years (inflow to dam greater than 30 GL). For average inflows of approximately 8 GL/year, as recorded over 2008-2015 (DWER 2017b), North Dandalup Dam would divert more than 95%, with less than 5% released downstream. For inflows exceeding 30 GL/year, the dam would divert more than 98%, with less than 2% released downstream. A stream gauging station is located approximately 1 km upstream of the reservoir at North Road (614036). The station has recorded declining annual flows (DWER 2017b) in the North Dandalup River and North Dandalup Dam attributable to a reduction in average annual rainfall of approximately 20% over the same period:

- Average of 37.6 GL/year over 1960-1974.
- Average of 17.1 GL/year over 1975-2007.
- Average of 8.4 GL/year over 2008-2015.

The North Dandalup River is interspersed by a series of headwater swamps that occupy colluvial and alluvial sediments in valley floors.

7.1.3.3 Surface Water Quality - Huntly

Historic water quality monitoring over the Huntly mine region is available from the 1970s to present, subject to periods of discontinuity, with parameters comprising salinity, pH, and some turbidity data.

Monitoring of surface water locations within sub-catchments intersecting the Huntly mine region have recorded mildly acidic to mildly alkaline (pH ranging from 3.6 to 8.0) and fresh (<1000 µS/cm since 2000) water quality. All records since 2010 (except MBF11) are below the Australian Drinking Water Guidelines (NHMRC, NRMMC 2018) aesthetic limit for TDS of 600 mg/L (EC equivalent of 937.5 µS/cm).

MBF11 is located within the O'Neil region within a sub catchment mined between 2011 and 2013 and rehabilitated between 2013 and 2021. The recorded exceedance at MBF11 occurred 12 July 2022 (1342 µS/cm) with other historical peaks greater than 900 µS/cm recorded on 17 June 2018 and 12 July 2019.

7.1.3.4 Local hydrology – Willowdale

The Willowdale mine area lies in the catchments of the Murray and Harvey rivers. The Murray River catchment intersects the north-eastern portion of the Willowdale mine area within the Middle Murray and Lower Murray, unregulated sub-catchments of the Murray River. The Murray River is perennial, however very low flows (< 10 ML/month) were recorded in autumn in 2011 and 2020 following record low rainfalls in 2010 and 2019.

Middle Murray and Lower Murray flow through shallow valleys of Yarragil landform transitioning to moderately incised valleys of Murray landform as they approach the Murray River. The Murray River flows through deeply incised valleys of the Murray landform and transitions to the steep, rocky Helena landform as it dissects the Darling Scarp.

The Harvey River catchment intersects with the majority of the Willowdale mine regions and is regulated by five dams, two of which (Stirling and Sampson Brook) supply the IWSS.

The Stirling Dam catchment has an area of 254 km^2. Elevation in the catchment is 80 m Australian Height Datum (mAHD) at the reservoir to 320 mAHD at the head of the catchment. Water inflow to

the reservoir is mostly from surface runoff over the winter months. However, there is subsurface flow year-round due to the gravelly nature of the geology in the Darling Range.

Samson Brook Dam (completed in 1941) is 31 m high and impounds a reservoir of 8 GL volume and 104 ha surface area at a top water level of 245 mAHD. The estimated average annual streamflow into the reservoir is 16.6 GL from a catchment area of 64 km^2.

7.1.3.5 Surface Water Quality - Willowdale

Historic water quality monitoring over the Willowdale mine area is available from the 1970s to 2010, subject to periods of discontinuity, with parameters comprising salinity, pH and some turbidity data.

Monitoring of surface water locations within sub-catchments intersecting the Willowdale mine area have identified mildly acidic to neutral (pH ranging from 5.4 to 6.7) and fresh (<7000 µS/cm) water quality. All records since 1980 are below the Australian Drinking Water Guidelines (NHMRC, NRMMC 2018) aesthetic limit for TDS of 600 mg/L (EC equivalent of 937.5 µS/cm).

7.1.4 Hydrogeology

7.1.4.1 Regional hydrogeology

The Huntly and Willowdale mine regions lie within the Darling Plateau, an undulating lateritic regolith over Archaean granite with dolerite intrusions. The regional hydrogeology comprises aquifers predominantly within weathered and fresh Archaean basement rocks, as well as superficial aquifers within more recent sediments incised in the basement, coincident with existing and paleo drainage lines (Table 7-2).

Table 7-2: Main aquifer units within Darling Plateau geology

Aquifer unit	Description
Shallow weathered zone	Shallow gravely and sandy sediments, lateritic caprock and friable upper saprolite. The lateritic caprock and friable saprolite can contain economic bauxite and be subject to mining. Seasonal aquifer with significant storage, infiltration and flow capability.
Deep weathered zone	Lower saprolite layer. Aquifer of some storage potential, but limited bulk permeability, comprising clays. Clayey nature of this zone can be interspersed by macropore features developed along deep root systems which were subsequently filled with more clastic material.
Transition zone	Transition zone between fresh basement and saprolite, referred to as saprock, which typically has enhanced permeability
Fractured bedrock	Permeability and yields are dependent on facture development and connectivity of fractures

Groundwater has been an active part of lateritisation across the Darling Plateau, particularly in the development of the duricrust or caprock which lies above the weathered saprolite clays. The formation of caprock has been driven by groundwater flow and capillary action which led to the precipitation of iron minerals leached from the weathered bedrock. Caprock can also form in valley floors due to the accumulation of iron brought by groundwater flow and its precipitation due to evapotranspiration or exposure to the surface.

The caprock layer is discontinuous and of varying thickness, being found on slopes but generally being absent in valley floors, as well as where the basement rock outcrops. Of hydrological significance, root channels penetrate vertically via fissures and discontinuities in the caprock and deep into the saprolite clays are a consistent feature in the lateritic profiles. These channels create preferential flow paths which are understood to enable significant vertical fluxes from the shallow weathered zone into the deeper aquifers of weathered saprolite and saprock.

In addition to the main aquifer units (Table 7-2), aquifers are present in alluvial and colluvial sediments accumulated in drainage lines, where these are sufficiently developed and have eroded the basement. The permeability of the alluvial and colluvial sediments is variably distributed and related to lithology, depth and degree of weathering.

Broadly, groundwater levels within all aquifers appear to follow topography, such that groundwater level is highest in areas of highest topography and lowest in areas of lowest topography. Where groundwater levels intersect the base of streams, groundwater discharges provide baseflow following winter rains (topped up aquifer storage and groundwater levels).

Flow within the shallow aquifer (subsurface flow) immediately near and within stream zones can express as streamflow. Jarrah forest streamflow generation is not induced by catchment wide overland surface flow but is primarily a consequence of rainfall infiltration and groundwater discharge. In lower slopes there is the potential for shallow subsurface flow to express as streamflow.

7.1.4.2 Groundwater levels

Given the variability of the local hydrological and hydrogeological setting, Alcoa engaged WSP to develop an estimated maximum groundwater level based on recent groundwater monitoring data. Data includes likely worst-case scenario, to assess the vertical distance between depth of the mining and sumps relative to the estimated maximum (highest) groundwater level.

A geological model was developed using geological data to inform the hydrogeology of the area. Depth to groundwater and seasonal fluctuations in groundwater are evaluated through analysis of existing groundwater monitoring bore data where the depth to groundwater was extrapolated between bores to form an estimated maximum groundwater level in the geological profile. Further control points from observed groundwater level data, geology and stream channels and any known groundwater expressions at surface are integrated into the data set. The statistical analysis, or spline method, is enhanced using support Vector Machines/Regression (SVM) derived from monitoring data.

To provide qualitative insight into depth to groundwater in areas with no groundwater monitoring, an advanced statistical method combining monitoring data in combination with selected aggravated risk factors is used.

The resultant continuous groundwater surface and interpretation has provided a base level tool for the assessing the risk of groundwater intercepting the base of the mine void.

7.1.4.3 Local Hydrogeology – Huntly

The key observations related to baseline groundwater conditions (Table 7-3 and Table 7-4) were derived from the Alcoa bore data set which provides groundwater level and groundwater quality data from 1989 until present. The distribution of bores relevant to the Huntly mine area (within surface

water sub-catchments intersecting the mined areas) is concentrated in the south-east, west and north-east of the Myara and O'Neil regions and surrounds (Figure 7-14).

Table 7-3: Groundwater level key observations

Sub catchment	Data Availability	Information
Dirk/Karnet/Punrack	2008 until present.	• Bores within unmined areas show stable groundwater levels since 2008. • Bores within mined areas show a slight increase in groundwater levels from June 2017.
North Dandalup Dam	2013 until present (one bore within historical rehabilitation has data from 2001).	• Bores within mined areas show a slight increase in groundwater levels from June 2017. • One bore (MF450315R) located within historical rehabilitation, to the south of the Huntly mine area, demonstrates a reduction in groundwater levels between 2004 and 2013 when stabilisation occurs.
North Dandalup Below Dam	2013 with single bore present.	• Stable groundwater levels
Serpentine Dam	1989 until present.	• General trend of decreasing groundwater levels in unmined areas • Bores within mined areas showing a general trend of increasing groundwater levels
Serpentine Pipehead	2021 until present.	-

Table 7-4: Groundwater quality key observations

Sub catchment	Data Availability	Information
Serpentine Dam	1989 until present	• Salinity is moderately variable for each bore and between bores, but consistently less than 1000 µS/cm (equivalent to around 600 mg/L TDS) • Seven bores have highly variable salinities with changes between 2500 and 7000 µS/cm. Six of these bores are outside of the Huntly mine area, to the north.
North Dandalup Dam	2001, from one data point	• Low salinity from one recording (217.6 µS/cm)

7.1.4.4 Local Hydrogeology – Willowdale

The bore dataset serves as the primary resource for understanding baseline groundwater conditions, including groundwater levels and quality.

Data analysis has been conducted on data obtained from groundwater monitoring bores relevant to the Willowdale mine area (within surface water sub-catchments intersecting the mined areas) (Figure 7-15). Analysis confirms that groundwater levels mimic topography within the mine regions such that

groundwater levels are highest (further from surface) in areas of highest elevation and lowest (closest to surface) in areas of low elevation.

7.1.5 Water Supply

Alcoa's WA mining operations use approximately 1 GL of water per year, primarily for use in dust suppression on haul roads and conveyors.

7.1.5.1 Huntly Mine

The Huntly mine is licenced by DWER to abstract water from four surface water sources (Table 7-5):

- Banksiadale Dam supplies water to the Huntly Central offices, McCoy facilities, White Road facilities and the Myara facilities, via a header tank on Radio Hill.
- Boronia Waterhole supplies water to the Del Park facilities and conveyor belt transfer station.
- Pig Swamp and Marrinup Nursery (Lot 908 on Marrinup Brook) supplies have been disconnected from the main water supply network; however, they are both being maintained for emergency water supply purposes or potential future use.

Table 7-5: Huntly surface water licences

Water source	Surface water licence	Annual water entitlement (kL)
Banksiadale Dam	SWL63409	500,000
Pig Swamp Waterhole	SWL153635	30,000
Boronia Waterhole on Marrinup Brook	SWL83356	70,000
Lot 908 on Marrinup Brook	SWL68893	45,000

The Huntly mine region also has a Bulk Water Agreement with the WC to purchase water from the South Dandalup Dam. Consultation with WC has commenced on a potential increase in abstraction of up to 2.6 GL per year to supply construction and operational water for the O'Neil mine region (pending approvals).

The Alcoa-managed McCoy and Myara Reservoirs are used to store water abstracted from Banksiadale Dam, site stormwater runoff and treated wastewater. Treated wastewater from the McCoy wastewater treatment facility must achieve the water quality standards identified in the Huntly Part V licence (L6210/1991/10) prior to release. This water is then released directly to the environment or transferred to the McCoy and Myara reservoirs for re-use on site.

The Myara reservoir is currently considered affected by minor detections of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) below the PFAS National Environmental Management Plan (NEMP) V2 95% Species Protection limit. Water from the Myara reservoir is treated via the temporary PFAS treatment plant and must be confirmed non-detect for 28 PFAS species to ultra-trace levels prior to use on the site. Reservoir water is used for haul road dust suppression, crusher dust suppression, vehicle wash down, and workshop hose down.

7.1.5.2 Willowdale Mine

The Willowdale mine region is licenced by DWER to abstract water from the Samson Dam (Table 7-6) and has a Bulk Water Agreement with the WC for the purchase of this water. Samson Dam supplies water to the Orion, Arundel and Larego facilities.

Table 7-6: Willowdale surface water licence

Water source	Surface water licence	Annual water entitlement (kL)
Samson Dam	SWL61024	450,000

The Alcoa-managed Larego Reservoir is used to store water abstracted from Samson Dam, as well as site stormwater runoff and treated wastewater. Treated wastewater from the Larego wastewater treatment facility must achieve the water quality standards identified in the Willowdale Part V licence (L6465/1989/10) prior to release. This water is then released to the Larego reservoir for re-use on-site. Reservoir water is used for haul road dust suppression, crusher dust suppression and wash down, conveyor belt wash and workshop hose down.

7.2 Potential Environmental Impacts

An Environmental Risk Assessment has been undertaken and the following activities have the potential to impact inland waters:

- Clearing of native vegetation.
- Water use for construction and mining activities.
- Waste disposal.
- Storage and handling of contaminants.
- Closure and decommissioning.
- Mining activities within PDWSAs and RPZs.
- Application of chemicals (fertilizers and pesticides) and use of explosive materials.
- PDWSAs.
- Alteration of hydrological regimes.

The activities listed above may result in the following potential impacts to inland waters:

- Increased sediment due to erosion from disturbance.
- Increased sediment due to erosion of post-mining landforms.
- Increased stream salinity because of mining-induced saline groundwater discharge.
- Changes to hydrological regimes.
- Contamination from spills and/or leaks from storage and handling of hazardous materials and waste.
- Contamination from pathogens.

The potential impacts could influence public drinking water supply quality through the following:

- Generation and discharge of pathogenic microorganisms from increased human activity.

- Increases in turbidity from erosion during mining and rehabilitation activities.
- Increases in stream salinity from mining-induced saline groundwater discharge.
- Contamination from spills, leaks, and/or emissions from the storage, handling and use of hazardous materials and waste.

7.2.1 Direct impacts from mine disturbance

Mine disturbance to surface water catchments due to the Huntly 24 Month Clearing Schedule (Table 7-7) is expected to predominantly occur in the Serpentine Dam catchment (up to 3.9% of the catchment area). Potential impacts to the Conjurunup Creek Pipehead Dam Catchment Area, Dirk Brook Water Reserve, North Dandalup Pipehead Dam Catchment Area, South Dandalup Dam and South Dandalup Pipehead Dam Catchment Area are all less than 3%.

Mine disturbance to surface water catchments due to the Willowdale 24 Month Clearing Schedule (Table 7-7) is expected to predominantly occur in the Stirling and Samson Brook catchments with up to 2.6% and 1.9% of the catchment area potentially impacted.

Table 7-7: Indicative estimates of mining disturbance to surface water catchments

Public Drinking Water Source Areas	Catchment Area (ha)	Open Area (ha)	Proportion of catchment (%)	Rehabilitation Area (ha)	Proportion of catchment (%)	FCA Endorsed Areas (ha)	Proportion of catchment (%)	24 Month Clearing Schedule (ha)	Proportion of catchment (%)
Conjurunup Creek Pipehead Dam Catchment Area	3,922	56	1.4%	1,607	41.0%	18	0.5%	7	0.2%
Dirk Brook Water Reserve	3,116	245	7.9%	601	19.3%	115	3.7%	83	2.7%
North Dandalup Dam Catchment Area	15,165	532	3.5%	3,920	25.8%	135	0.9%	228	1.5%
Serpentine Dam Catchment Area	66,490	2,984	4.5%	3,813	5.7%	532	0.8%	2,574	3.9%
South Dandalup Dam Catchment Area	31,675	8	0.0%	2,118	6.7%	13	0.0%	25	0.1%
South Dandalup Pipehead Dam Catchment Area	3,854	41	1.1%	560	14.5%	10	0.3%	13	0.3%
Huntly Subtotal	**124,222**	**3,938**	**3.2%**	**12,619**	**10.2%**	**823**	**0.7%**	**2,930**	**2.4%**
Samson Brook Catchment Area	7,755	585	7.5%	1,388	17.9%	172	2.2%	147	1.9%
Stirling Dam Catchment Area	25,366	660	2.6%	22	0.1%	264	1.0%	657	2.6%
Outside PDWS Areas	-	-	-	-	-	310	-	-	-
Willowdale Subtotal	**33,121**	**1,245**	**3.8%**	**1,410**	**4.3%**	**746**	**2.3%**	**804**	**2.4%**

7.2.2 Increased sediment from mining activities

Turbidity can reduce the efficacy of treatment to inactivate or remove pathogens, as it poses a risk to residential water quality. Turbidity is measured by nephelometric turbidity units (NTU) and the Australian Drinking Water Guidelines (ADWG) notes that where the turbidity of a source exceeds 1 NTU, adequate disinfection may be difficult to maintain but may still be achievable. High turbidity (20 NTU) waters containing organic particles generated from wastewater could be effectively disinfected for chlorine-resistant viruses but require longer chlorine contact times to factor in the chlorine demand from wastewater particulates.

Alcoa has identified an increase in turbidity flow to reservoirs as a water quality risk and refined the 24 Month Clearing Schedule accordingly. The following actions have been taken to minimise risk of mining related sediment flow to the PDWSA RPZs:

- Limiting actual clearing to 800 ha of native vegetation per calendar year[90] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[91].
- Not undertaken any clearing or mining[92] within:
  - 1 km of the top water level of any water reservoir.
  - Serpentine Pipehead Dam Catchment.
  - Areas with an average pit slope greater than 16% within any RPZ.
- Prioritisation of rehabilitation within the Serpentine Dam RPZ.
- Minimisation of clearing inside of the RPZ through move to O'Neil mine region.
- Prioritisation of rehabilitation within public drinking water catchments.
- Increasing rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[93].

The potential direct impacts to public drinking water catchments are detailed in Table 7-8 and Table 7-9 for Huntly and Willowdale, respectively. Potential direct impacts to RPZs are shown in Figure 7-3.

DWER and WC have highlighted that areas with a Topographical Wetness Index of greater than 9 (TWI>9) have the potential for shallow groundwater. Groundwater investigations (groundwater bores with at least 12 months of monitoring) are utilised to confirm shallow groundwater and ensure avoidance or management occurs. The direct impacts to TWI>9 are detailed in Table 7-10 and shown in Figure 7-4 and Figure 7-5 for Huntly and Willowdale respectively. On average, approximately 24% of each catchment consists of areas which are TWI>9.

[90] 2023-2027 MMP Ministerial Approval Condition 9.
[91] 2023-2027 MMP Ministerial Approval Condition 10.
[92] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.
[93] 2023-2027 MMP Ministerial Approval Condition 15

Areas with slope greater than 16% are considered to be higher risk, as detailed in Table 7-11 and shown in Figure 7-6 and Figure 7-7. The majority of catchments have less than 12% of the total area with slopes greater than 16%. The exception is South Dandalup Pipehead Dam Catchment Area (32%), of which a minor (3 ha) amount of clearing will occur for conveyor protection in bushfire events. The 24 Month Clearing Schedule areas which are greater than 16% slope consist of 6% or less of any catchment.

The 24 Month Clearing Schedule contributions to the proportion of sub-catchment clearing are detailed in Table 7-12 and shown in Figure 7-8 and Figure 7-9. Sub-catchment clearing proportions include rehabilitated areas, which are considered to have lower likelihood of drainage failures, therefore sub-catchment clearing after open areas should be considered. 29 of the sub-catchments could have clearing greater than 30%. In particular, the Conjurunup 04 sub-catchment could have 66% of clearing. However, 63% of the sub-catchment areas have already been cleared and rehabilitated.

Table 7-8: Indicative estimates of mining disturbance within the RPZs – Huntly

Area	Area (ha)	Open Area (ha)	Proportion of catchment (%)	Rehabilitated Area (ha)	Rehabilitated areas Proportion of catchment (%)	FCA Endorsed Areas (ha)	Proportion of catchment (%)	24 Month Clearing Schedule Area (ha)	Proportion of catchment (%)
Conjurunup									
OCA1 Top Water Line 200m Buffer	51	0	0.00%	0	0.00%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	154	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Reservoir Protection Zones (RPZ)	488	0	0.00%	57	11.71%	2	0.41%	0	0.00%
Top Water Line 1km Buffer	496	0	0.00%	0	0.00%	0	0.00%	0	0.00%
North Dandalup									
OCA1 Top Water Line 200m Buffer	995	0	0.00%	9	0.89%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	1,860	12	0.64%	160	8.59%	0	0.00%	0	0.00%
Reservoir Protection Zones (RPZ)	3,938	132	3.34%	652	16.57%	19	0.48%	0	0.00%
Top Water Line 1km Buffer	2,669	43	1.61%	306	11.45%	2	0.07%	0	0.00%
Serpentine									
OCA1 Top Water Line 200m Buffer	2,393	6	0.24%	0	0.00%	2	0.08%	6	0.25%
OCA2 Water Resource Sensitivity Zones	4,958	116	2.35%	74	1.49%	10	0.20%	17	0.34%
Reservoir Protection Zones (RPZ)	11,298	1419	12.56%	583	5.16%	210	1.86%	179	1.59%
Top Water Line 1km Buffer	6,879	502	7.30%	309	4.49%	22	0.32%	18	0.26%
Serpentine Pipehead									
OCA1 Top Water Line 200m Buffer	296	0	0.00%	0	0.00%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	928	0	0.00%	0	0.04%	0	0.00%	0	0.00%
Reservoir Protection Zones (RPZ)	2,161	7	0.34%	76	3.52%	1	0.05%	0	0.00%
Top Water Line 1km Buffer	1,498	0	0.00%	5	0.32%	0	0.00%	0	0.00%
South Dandalup									
OCA1 Top Water Line 200m Buffer	3,459	0	0.00%	55	1.59%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	6,363	0	0.00%	473	7.43%	3	0.05%	0	0.00%
Reservoir Protection Zones (RPZ)	11,341	8	0.07%	1,269	11.19%	9	0.08%	13	0.11%
Top Water Line 1km Buffer	8,534	7	0.08%	861	10.09%	4	0.05%	3	0.04%

Table 7-9: Indicative estimates of mining disturbance within the RPZs - Willowdale

Area	Area (ha)	Open Area (ha)	Open areas proportion of catchment (%)	Rehabilitated Area (ha)	Rehabilitated areas Proportion of catchment (%)	FCA Endorsed Areas (ha)	Proportion of catchment (%)	24 Month Clearing Schedule Area (ha)	Proportion of catchment (%)
Samson Brook									
OCA1 Top Water Line 200m Buffer	278	8	2.55%	1	0.53%	3	0.95%	0	0.00%
OCA2 Water Resource Sensitivity Zones	756	40	3.44%	228	12.29%	7	0.87%	0	0.00%
Reservoir Protection Zones (RPZ)	1,960	97	4.95%	421	21.49%	30	1.53%	0	0.00%
Top Water Line 1km Buffer	1269	52	5.29%	93	17.95%	19	1.47%	0	0.00%
Samson Brook Pipehead									
OCA1 Top Water Line 200m Buffer	36	0	0.00%	0	0.00%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	145	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Reservoir Protection Zones (RPZ)	438	1	0.23%	70	15.98%	1	0.23%	0	0.00%
Top Water Line 1km Buffer	195	2	1.03%	36	18.46%	0	0.00%	0	0.00%

Table 7-10: Clearing impacts to areas with TWI>9

Catchment	Catchment area (ha)	Catchment area TWI>9		FCA Endorsed Area TWI>9		24 Month Clearing Schedule Area TWI>9		
		Area (ha)	Proportion of catchment (%)	Area (ha)	Proportion of catchment (%)	Area (ha)	Proportion of 24 Month Clearing Area (%)	Proportion of catchment (%)
Serpentine Dam Catchment Area	66,490	16,023	24.1%	89.2	0.6%	470	18.3%	2.9%
South Dandalup Dam Catchment Area	31,675	8,914	28.1%	2.0	0.0%	6	24.1%	0.1%
South Dandalup Pipehead Dam Catchment Area	3,854	633	16.4%	1.9	0.3%	1	7.7%	0.2%
Conjurunup Creek Pipehead Dam Catchment Area	3,922	962	24.5%	4.1	0.4%	2	26.9%	0.2%
Dirk Brook Water Reserve	3,116	784	25.2%	13.5	1.7%	15	18.2%	1.9%
North Dandalup Pipehead Dam Catchment Area	15,165	3,990	26.3%	22.0	0.6%	45	19.8%	1.1%
Huntly Subtotal	**124,222**	**31,306**	**25.2%**	**132.7**	**0.4%**	**539**	**18.4%**	**1.7%**
Samson Brook Catchment Area	7,755	1,843	23.8%	37.3	2.0%	22	14.9%	1.2%
Stirling Dam Catchment Area	25,366	6,269	24.7%	40.7	0.6%	92	14.0%	1.5%
Willowdale Subtotal	**33,121**	**8,113**	**24.5%**	**78.0**	**1.0%**	**114**	**14.2%**	**1.4%**
Total	**157,343**	**39,419**	**25.1%**	**210.7**	0.5%	**653**	**17.5%**	**1.7%**

Table 7-11: Clearing impacts to slopes greater than 16%

Catchment	Catchment area (ha)	Catchment area >16%		Open Area >16%		Rehabilitation Area >16%		FCA Endorsed Area >16%		24 Month Clearing Schedule Area >16% slope		
		Area (ha)	Proportion of catchment (%)	Area (ha)	Proportion of catchment (%)	Area (ha)	Proportion of catchment (%)	Area (ha)	Proportion of catchment (%)	Area (ha)	Proportion of 24 Month Clearing Area (%)	Proportion of catchment (%)
Serpentine Dam Catchment Area	66,490	7,773	11.7%	381.4	4.9%	311.7	4.0%	157.2	2.0%	499.3	19.4%	6.4%
South Dandalup Dam Catchment Area	31,675	1,418	4.5%	0.2	0.0%	138.2	9.7%	0.8	0.1%	1.0	4.2%	0.1%
South Dandalup Pipehead Dam Catchment Area	3,854	1,249	32.4%	5.5	0.4%	90.3	7.2%	1.4	0.1%	3.2	24.7%	0.3%
Conjurunup Creek Pipehead Dam Catchment Area	3,922	287	7.3%	1.2	0.4%	104.4	36.4%	1.8	0.6%	0.2	2.4%	0.1%
Dirk Brook Water Reserve	3,116	168	5.4%	2.3	1.4%	14.6	8.7%	0.3	0.2%	0.8	1.0%	0.5%
North Dandalup Pipehead Dam Catchment Area	15,165	890	5.9%	20.5	2.3%	162.6	18.3%	11.0	1.2%	4.2	1.9%	0.5%
Huntly Subtotal	**124,222**	**11,785**	**9.5%**	**411.1**	**3.5%**	**822.0**	**7.0%**	**172.6**	**1.5%**	**508.7**	**17.4%**	**4.3%**
Samson Brook Catchment Area	7,755	1,067	13.8%	28.1	2.6%	98.3	9.2%	5.7	0.5%	29.1	19.8%	2.7%
Stirling Dam Catchment Area	25,366	2,136	8.4%	13.9	0.6%	9.7	0.5%	6.1	0.3%	27.0	4.1%	1.3%
Willowdale Subtotal	**33,121**	**3,203**	**9.7%**	**41.9**	**1.3%**	**108.0**	**3.4%**	**11.8**	**0.4%**	**56.1**	**7.0%**	**1.8%**
Total	**157,343**	**14,988**	**9.5%**	**453.0**	**3.0%**	**930.0**	**6.2%**	**184.4**	**1.2%**	**564.8**	**15.1%**	**3.8%**

Table 7-12: Clearing impacts to sub-catchments

Sub-Catchment	Sub-Catchment area (ha)	Open areas		Rehabilitated areas		FCA Endorsed areas		24 Month Clearing Schedule Areas		Proportion of sub-catchment clearing following 24 Month Clearing Schedule Areas			Remaining Five Year Clearing Schedule Areas		Maximum proportion of sub-catchment clearing following total future mined areas (%)
		Area (ha)	Proportion of sub-catchment (%)	Area (ha)	Proportion of sub-catchment (%)	Area (ha)	Proportion of sub-catchment (%)	Area (ha)	Proportion of sub-catchment (%)	After open areas (%)	After open (%)	After open areas, rehabilitation and FCA Endorsed clearing (%)	Area (ha)	Proportion of sub-catchment (%)	
CONJURUNUP 04	364.9	7.4	2.0%	229.8	63.0%	3.0	0.8%	0.4	0.1%	2.2%	65.1%	66.0%	0.0	0.0%	66.0%
BIG BROOK 03	821.0	330.4	40.2%	85.2	10.4%	49.8	6.1%	26.3	3.2%	43.5%	53.8%	59.9%	3.1	0.4%	60.3%
HARVEY RIVER 37	1,322.1	209.9	15.9%	48.0	3.6%	65.1	4.9%	332.6	25.2%	41.0%	44.7%	49.6%	129.9	9.8%	59.4%
SERPENTINE RIVER 50	348.3	30.6	8.8%	-	0.0%	8.7	2.5%	139.7	40.1%	48.9%	48.9%	51.4%	0.0	0.0%	51.4%
CONJURUNUP 06	773.2	15.2	2.0%	414.2	53.6%	2.7	0.3%	1.9	0.2%	2.2%	55.8%	56.1%	0.0	0.0%	56.1%
BIG BROOK 13	574.4	104.3	18.2%	57.7	10.0%	19.2	3.3%	56.0	9.7%	27.9%	38.0%	41.3%	3.0	0.5%	41.8%
SERPENTINE RIVER 40	999.5	259.4	26.0%	143.3	14.3%	65.8	6.6%	23.0	2.3%	28.3%	42.6%	49.2%	30.4	3.0%	52.2%
FOSTER BROOK	1,601.8	211.4	13.2%	445.1	27.8%	62.7	3.9%	30.4	1.9%	15.1%	42.9%	46.8%	46.4	2.9%	49.7%
BIG BROOK 09	1,829.0	306.1	16.7%	348.9	19.1%	44.1	2.4%	45.5	2.5%	19.2%	38.3%	40.7%	178.1	9.7%	50.5%
CONJURUNUP 05	1,096.6	28.9	2.6%	511.1	46.6%	5.8	0.5%	4.4	0.4%	3.0%	49.6%	50.2%	0.0	0.0%	50.2%
MOUNT SOLUS	1,416.7	172.8	12.2%	226.4	16.0%	33.0	2.3%	220.7	15.6%	27.8%	43.8%	46.1%	30.4	2.1%	48.2%
BIG BROOK 14	1,160.0	70.3	6.1%	373.9	32.2%	0.1	0.0%	5.1	0.4%	6.5%	38.7%	38.7%	130.7	11.3%	50.0%
SERPENTINE RIVER 45	615.6	182.7	29.7%	9.2	1.5%	36.2	5.9%	46.9	7.6%	37.3%	38.8%	44.7%	33.2	5.4%	50.1%
LANG BROOK	1,412.9	282.3	20.0%	236.6	16.7%	71.1	5.0%	95.9	6.8%	26.8%	43.5%	48.5%	11.6	0.8%	49.4%
BIG BROOK 15	1,661.7	68.3	4.1%	540.3	32.5%	2.8	0.2%	103.6	6.2%	10.3%	42.9%	43.0%	79.4	4.8%	47.8%
SERPENTINE RIVER 56	1,003.1	6.0	0.6%	111.6	11.1%	1.8	0.2%	219.2	21.8%	22.4%	33.6%	33.8%	45.7	4.6%	38.3%
SOUTH DANDALUP RIVER 05	387.4	25.3	6.5%	151.3	39.1%	2.7	0.7%	2.8	0.7%	7.3%	46.3%	47.0%	0.0	0.0%	47.0%
BIG BROOK 07	749.9	178.1	23.8%	64.8	8.6%	33.7	4.5%	50.5	6.7%	30.5%	39.1%	43.6%	9.6	1.3%	44.9%
NULLBIG BROOK 08	270.5	63.4	23.5%	37.9	14.0%	3.4	1.3%	12.8	4.7%	28.2%	42.2%	43.4%	3.3	1.2%	44.6%
SERPENTINE RIVER 36	729.9	133.2	18.3%	85.8	11.8%	34.4	4.7%	62.7	8.6%	26.8%	38.6%	43.3%	5.4	0.7%	44.1%
CRONIN BROOK 07	2,030.5	112.6	5.5%	638.8	31.5%	32.6	1.6%	48.7	2.4%	7.9%	39.4%	41.0%	48.9	2.4%	43.4%
SERPENTINE RIVER 49	356.3	22.8	6.4%	-	0.0%	27.5	7.7%	77.4	21.7%	28.1%	28.1%	35.8%	11.5	3.2%	39.1%
SERPENTINE RIVER 57	775.4	0.0	0.0%	105.8	13.6%	0.0	0.0%	0.0	0.0%	0.0%	13.6%	13.6%	103.3	13.3%	27.0%
SERPENTINE RIVER 48	40.8	13.0	31.9%	-	0.0%	1.1	2.7%	2.5	6.0%	37.9%	37.9%	40.6%	0.0	0.0%	40.6%
O'NEILL BROOK 02	1,893.9	0.0	0.0%	333.1	17.6%	0.0	0.0%	0.0	0.0%	0.0%	17.6%	17.6%	70.3	3.7%	21.3%
BIG BROOK 05	504.0	147.1	29.2%	25.0	5.0%	16.2	3.2%	1.8	0.4%	29.5%	34.5%	37.7%	0.9	0.2%	37.9%
NORTH DANDALUP RIVER 15	3,968.7	109.2	2.8%	1,285.8	32.4%	20.2	0.5%	74.0	1.9%	4.6%	37.0%	37.5%	11.2	0.3%	37.8%
NORTH DANDALUP RIVER 14	852.9	11.6	1.4%	302.6	35.5%	0.1	0.0%	1.9	0.2%	1.6%	37.1%	37.1%	0.0	0.0%	37.1%
MOUNT WILLIAM	1,158.4	100.5	8.7%	255.9	22.1%	19.8	1.7%	47.2	4.1%	12.7%	34.8%	36.5%	0.0	0.0%	36.5%
HARVEY RIVER 34	1,033.3	84.8	8.2%	-	0.0%	12.6	1.2%	169.5	16.4%	24.6%	24.6%	25.8%	82.1	7.9%	33.8%
BIG BROOK 02	250.7	57.6	23.0%	23.8	9.5%	4.7	1.9%	0.8	0.3%	23.3%	32.8%	34.7%	0.0	0.0%	34.7%

Sub-Catchment	Sub-Catchment area (ha)	Open areas		Rehabilitated areas		FCA Endorsed areas		24 Month Clearing Schedule Areas		Proportion of sub-catchment clearing following 24 Month Clearing Schedule Areas			Remaining Five Year Clearing Schedule Areas		Maximum proportion of sub-catchment clearing following total future mined areas (%)
		Area (ha)	Proportion of sub-catchment (%)	Area (ha)	Proportion of sub-catchment (%)	Area (ha)	Proportion of sub-catchment (%)	Area (ha)	Proportion of sub-catchment (%)	After open areas (%)	After open (%)	After open areas, rehabilitation and FCA Endorsed clearing (%)	Area (ha)	Proportion of sub-catchment (%)	
O'NEILL BROOK 03	867.6	0.0	0.0%	25.9	3.0%	0.0	0.0%	149.3	17.2%	17.2%	20.2%	20.2%	75.9	8.8%	29.0%
LAKE KABBAMUP 05	763.2	72.5	9.5%	3.8	0.5%	21.3	2.8%	63.6	8.3%	17.8%	18.3%	21.1%	95.4	12.5%	33.6%
MIA MIA CREEK	336.1	10.0	3.0%	101.8	30.3%	0.1	0.0%	0.2	0.1%	3.0%	33.3%	33.4%	0.0	0.0%	33.4%
LAKE KABBAMUP 07	856.3	84.0	9.8%	57.2	6.7%	25.6	3.0%	32.9	3.8%	13.7%	20.3%	23.3%	75.1	8.8%	32.1%
DRIVERS HILL	1,436.3	211.6	14.7%	-	0.0%	28.3	2.0%	106.3	7.4%	22.1%	22.1%	24.1%	68.8	4.8%	28.9%
BIG BROOK 10	24.2	3.3	13.7%	2.2	9.1%	0.2	0.8%	1.1	4.6%	18.3%	27.4%	28.2%	0.0	0.0%	28.2%
HARVEY RIVER 38	1,178.1	100.4	8.5%	48.1	4.1%	22.4	1.9%	43.6	3.7%	12.2%	16.3%	18.2%	82.6	7.0%	25.2%
SOUTH DANDALUP RIVER 11	2,303.1	0.0	0.0%	623.5	27.1%	2.9	0.1%	4.7	0.2%	0.2%	27.3%	27.4%	0.0	0.0%	27.4%
BIG BROOK 12	635.1	0.3	0.0%	140.4	22.1%	0.0	0.0%	0.0	0.0%	0.0%	22.1%	22.1%	31.7	5.0%	27.1%
O'NEILL BROOK 01	1,647.2	6.7	0.4%	335.1	20.3%	3.9	0.2%	88.3	5.4%	5.8%	26.1%	26.3%	5.3	0.3%	26.7%
BIG BROOK 01	214.5	16.7	7.8%	23.0	10.7%	3.4	1.6%	6.5	3.0%	10.8%	21.5%	23.1%	0.0	0.0%	23.1%
BIG BROOK 18	1,708.9	0.0	0.0%	223.7	13.1%	0.1	0.0%	65.5	3.8%	3.8%	16.9%	16.9%	0.0	0.0%	16.9%
NORTH DANDALUP RIVER 11	923.9	2.0	0.2%	192.6	20.8%	0.1	0.0%	1.0	0.1%	0.3%	21.2%	21.2%	0.0	0.0%	21.2%
SERPENTINE RIVER 58	2,342.7	0.0	0.0%	113.9	4.9%	0.1	0.0%	0.0	0.0%	0.0%	4.9%	4.9%	154.7	6.6%	11.5%
SERPENTINE RIVER 55	1,208.2	45.5	3.8%	-	0.0%	9.2	0.8%	104.4	8.6%	12.4%	12.4%	13.2%	71.2	5.9%	19.1%
TURNER HILL	862.3	10.0	1.2%	145.3	16.8%	1.5	0.2%	4.7	0.5%	1.7%	18.6%	18.7%	0.0	0.0%	18.7%
BIG BROOK 16	1,355.5	0.0	0.0%	199.2	14.7%	0.1	0.0%	52.7	3.9%	3.9%	18.6%	18.6%	0.0	0.0%	18.6%
SOUTH DANDALUP RIVER 13	2,418.4	0.0	0.0%	191.4	7.9%	0.1	0.0%	0.3	0.0%	0.0%	7.9%	7.9%	0.0	0.0%	7.9%
LAKE KABBAMUP 06	296.5	15.9	5.3%	15.7	5.3%	7.9	2.7%	0.0	0.0%	5.3%	10.6%	13.3%	4.5	1.5%	14.8%
BOOMER BROOK UPPER	606.5	9.6	1.6%	73.5	12.1%	0.0	0.0%	3.9	0.6%	2.2%	14.3%	14.3%	0.0	0.0%	14.3%
KIMBERLING HILL	2,835.7	0.0	0.0%	-	0.0%	-	0.0%	131.4	4.6%	4.6%	4.6%	4.6%	4.0	0.1%	4.8%
NULLBIG BROOK 17	1,991.5	0.0	0.0%	198.1	9.9%	0.1	0.0%	61.4	3.1%	3.1%	13.0%	13.0%	0.0	0.0%	13.0%
SERPENTINE RIVER 62	4,248.0	0.0	0.0%	-	0.0%	-	0.0%	96.3	2.3%	2.3%	2.3%	2.3%	96.6	2.3%	4.5%
LUCY BROOK	274.3	12.2	4.4%	9.7	3.5%	0.7	0.3%	1.3	0.5%	4.9%	8.5%	8.7%	0.0	0.0%	8.7%
SERPENTINE RIVER 51	277.4	2.0	0.7%	-	0.0%	9.4	3.4%	5.0	1.8%	2.5%	2.5%	5.9%	0.0	0.0%	5.9%
HOFFMANS MILL	793.2	23.3	2.9%	-	0.0%	4.5	0.6%	8.3	1.0%	4.0%	4.0%	4.5%	3.0	0.4%	4.9%
SERPENTINE RIVER 61	3,715.9	0.0	0.0%	-	0.0%	-	0.0%	0.0	0.0%	0.0%	0.0%	0.0%	28.1	0.8%	0.8%

Gooralong Brook Water Reserve

Serpentine Pipehead

Serpentine Pipehead Dam Catchment Area

Serpentine

Serpentine Dam Catchment Area

Dirk Brook Water Reserve

North Dandalup Pipehead Dam Catchment Area

Legend

- OCA1
- OCA2
- 1km Radius from Reservior TWL
- FCA Endorsed
- National Parks
- Reservior Top of Water Line (TWL)
- Reservoir Protection Zone (RPZ)
- Streams
- Roads
- Cleared Areas
- Rehabilitation
- Proposed Clearing Schedule
  - 2025
  - 2026
  - 2027
  - 2028
  - 2029

Alcoa

N

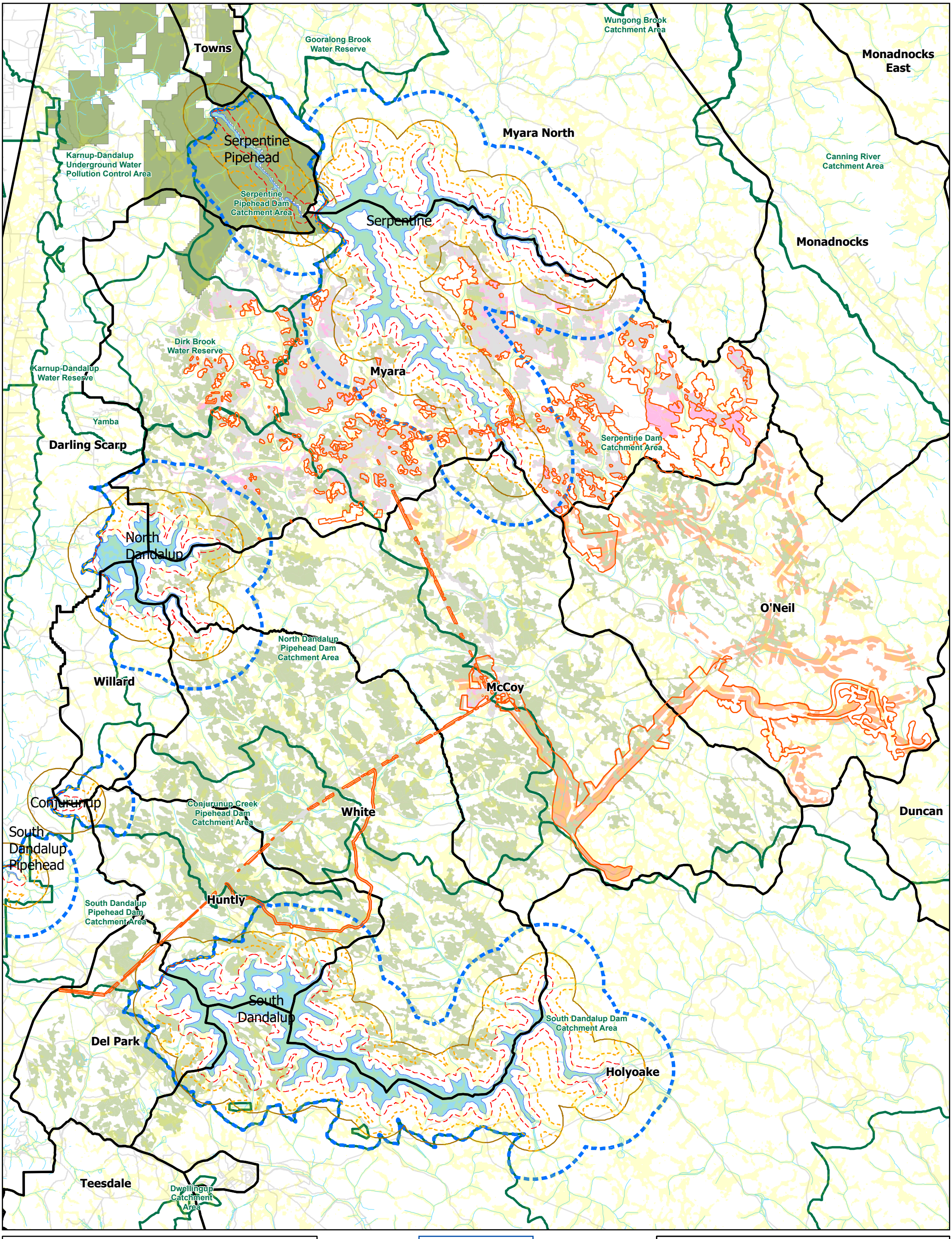
0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-3: RPZ indicative estimates of mining disturbance - Huntly

Scale: 1:45,000

Date Printed: 9/10/2024


Towns
Gooralong Brook Water Reserve
Wungong Brook Catchment Area
Monadnocks East
Myara North
Serpentine Pipehead
Karnup-Dandalup Underground Water Pollution Control Area
Serpentine Pipehead Dam Catchment Area
Serpentine
Canning River Catchment Area
Monadnocks
Dirk Brook Water Reserve
Karnup-Dandalup Water Reserve
Myara
Yamba
Darling Scarp
Serpentine Dam Catchment Area
North Dandalup
O'Neil
North Dandalup Pipehead Dam Catchment Area
Willard
McCoy
Conjurunup
Conjurunup Creek Pipehead Dam Catchment Area
White
Duncan
South Dandalup Pipehead
South Dandalup Pipehead Dam Catchment Area
Huntly
South Dandalup
South Dandalup Dam Catchment Area
Del Park
Holyoake
Teesdale
Dwellingup Catchment Area
Legend
24 Month Clearing Schedule
Mining Regions
FCA Endorsed
Conceptual Clearing Buffer
TWI >9
Reservior Top of Water Line (TWL)
1km Radius from Reservior TWL
OCA1
OCA2
Reservoir Protection Zone (RPZ)
Catchments
National Parks
Rehabilitation
Cleared Areas
Streams
Alcoa
0 1 2 4 km
N
2025 - 2029 Mining and Management Plan
Figure 7-4: Clearing impacts to TWI greater than 9 - Huntly
Scale: 1:115,000
Date Printed: 12/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Samson Brook Catchment Area
Arundel
Bancell Brook Catchment Area
Larego
Stirling Dam Catchment Area
Cornwall

Legend

- Mining Regions
- 24 Month Clearing Schedule
- FCA Endorsed
- Conceptual Clearing Buffer
- TWI >9
- Reservior Top of Water Line (TWL)
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservoir Protection Zone (RPZ)
- Catchments
- National Parks
- Rehabilitation
- Cleared Areas
- Streams

Alcoa

N

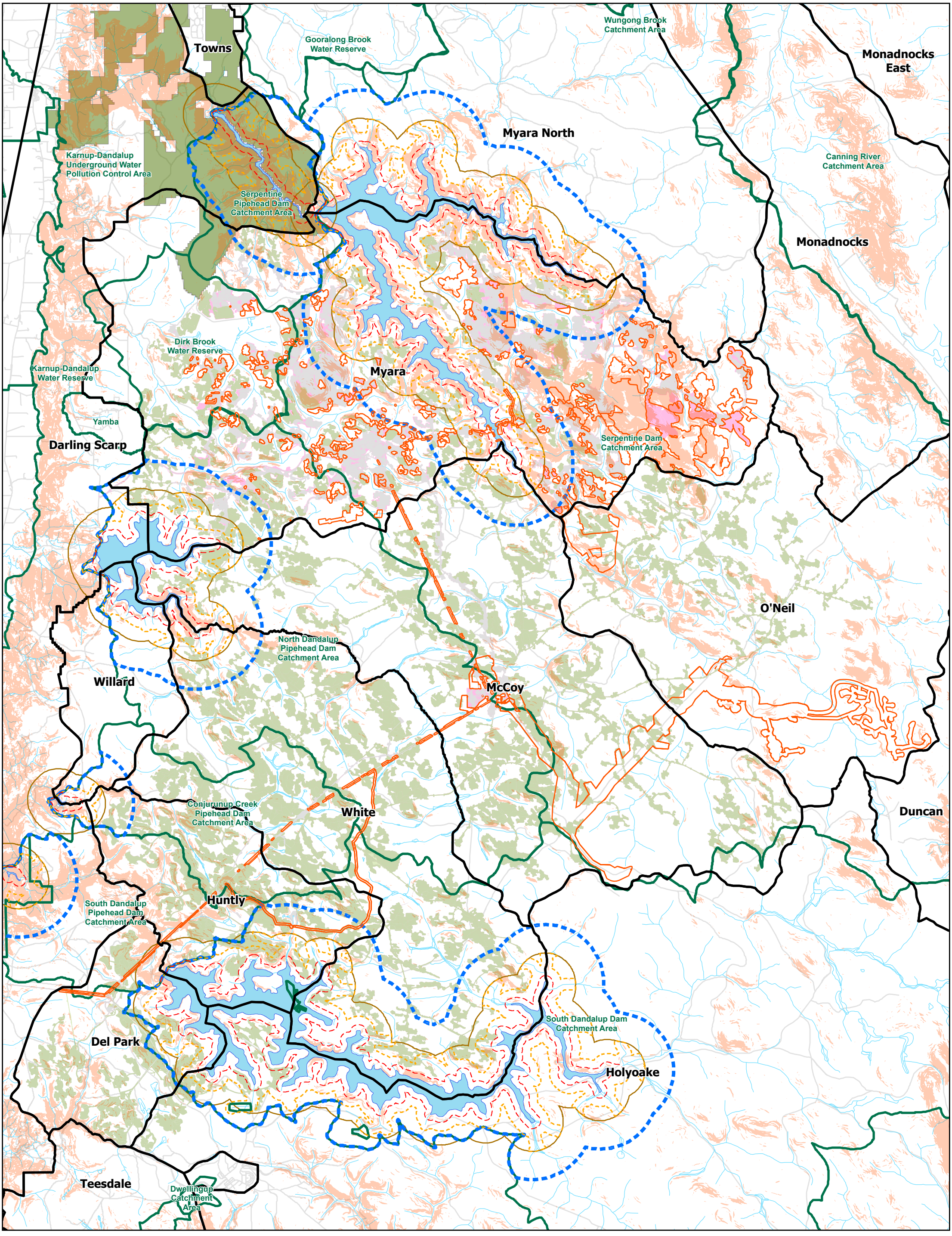
0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-5: Clearing impacts to TWI greater than 9 - Willowdale

Scale: 1:75,000

Date Printed: 12/03/2025



Legend

- Mining Regions
- 24 Month Clearing Schedule
- FCA Endorsed
- Government (DOLA) Slope >=16%
- Reservior Top of Water Line (TWL)
- 1km Radius from Reservior TWL
- OCA1
- OCA2
- Reservoir Protection Zone (RPZ)
- Catchments
- National Parks
- Rehabilitation
- Cleared Areas
- Streams

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-6: Clearing impacts to slopes greater than 16% - Huntly

Scale: 1:115,000

Date Printed: 12/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Samson Brook Catchment Area
Arundel
Bancell Brook Catchment Area
Larego
Stirling Dam Catchment Area
Cornwall

Legend

- Mining Regions
- 24 Month Clearing Schedule
- FCA Endorsed
- Government (DOLA) Slope >=16%
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservior Top of Water Line (TWL)
- Reservoir Protection Zone (RPZ)
- Catchments
- Rehabilitation
- Cleared Areas
- Streams

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-7: Clearing impacts to slopes greater than 16% - Willowdale

Scale: 1:75,000

Date Printed: 12/03/2025

Towns
Monadnocks East
Myara North
Monadnocks
Myara
Darling Scarp
Willard
McCoy
O'Neil
White
Duncan
Huntly
Del Park
Holyoake
Teesdale

Legend

- 24 Month Clearing Schedule
- Mining Regions
- Rehabilitation
- Cleared Areas
- FCA Endorsed
- Subcatchments
- Reservoir Protection Zone (RPZ)
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservior Top of Water Line (TWL)
- Streams
- National Parks

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-8: Clearing impacts to sub-catchments - Huntly

Scale: 1:115,000

Date Printed: 5/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Arundel
Larego
Cornwall
SAMSON BROOK 01
SAMSON BROOK 02
SAMSON BROOK 03
SAMSON BROOK 04
SAMSON BROOK 05
SAMSON BROOK 06
SAMSON BROOK 07
SAMSON BROOK 08
SAMSON BROOK 09
SAMSON BROOK 10
SAMSON BROOK 11
SAMSON BROOK 12
SEYMOUR FALLS
LAKE KABBAMUP 01
LAKE KABBAMUP 02
LAKE KABBAMUP 03
LAKE KABBAMUP 04
LAKE KABBAMUP 05
LAKE KABBAMUP 06
LAKE KABBAMUP 07
MOUNT WILLIAM
HARVEY RIVER 33
HARVEY RIVER 34
HARVEY RIVER 35
HARVEY RIVER 36
HARVEY RIVER 37
HARVEY RIVER 38
DRIVERS HILL
HOFFMANS MILL

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- FCA Endorsed
- Subcatchments
- Reservoir Protection Zone (RPZ)
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservior Top of Water Line (TWL)
- Streams

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-9: Clearing impacts to sub-catchments - Willowdale

Scale: 1:75,000

Date Printed: 5/03/2025

7.2.2.1 Catchment Turbidity Data Statistical Correlation

Recognising that catchment water runoff turbidity targeted modelling required data calibration, Alcoa engaged *Data Analysis Australia* (DAA 2023) to statistically evaluate turbidity data with catchment and mining characteristics, in particular sub-catchment clearing and terrain slope. The aim was to develop a data-based understanding on high turbidity event correlations and determine what mitigation, in addition to existing controls, may be required through:

- Understanding the relationship between catchment features, including mining and rehabilitation, and turbidity events.
- Understanding the relationship between drainage failures and contributing factors, including characteristics of sub-catchments and the wider catchment in which they occur.
- Investigating any differences between mined and rehabilitated areas and undisturbed areas in relation to their susceptibility to drainage failures.

Data was obtained from 27 turbidity monitors over the period January 2016 to September 2022. Data gaps were addressed, and the data was 'cleaned' to remove readings that could be attributed to faults or periods where equipment was inoperable and ensure it was in an appropriate format for modelling.

A preliminary correlation analysis considered the influence of key variables where turbidity events or drainage failures have and haven't occurred. The correlation analysis included the below variables:

- Mined versus undisturbed sub-catchments.
- Sub-catchment characteristics present during events, including area cleared and slope.
- Maturity levels of rehabilitation, including Leaf Area Index (LAI).

Statistical modelling determined which variables had significant impact on turbidity events and if significant difference between the likelihood of drainage failures between mined areas, rehabilitation areas or undisturbed areas existed. This assessment aimed to develop a statistical data-based understanding on high turbidity event correlations with sub-catchment clearing area and terrain slope gradient to determine what mitigation, in addition to existing controls, may be required.

Key conclusions are:

- Catchment slope has a significant, positive effect on both the occurrence and number of high turbidity events, with more events occurring in catchments with higher mean slope. However, there is no statistical indication of an appropriate maximum slope threshold.
- Rainfall has a significant, positive effect on both the occurrence and number of high turbidity events and their number using any model, with more events in wetter months.
- When only total percentage cleared area (including subsequently rehabilitated areas) is considered, it has no effect on the chance of high turbidity events occurring or on the number of high turbidity events if they occur.
- When the percentage area cleared but not rehabilitated is considered, it is found to have a significant positive effect on the occurrence of events but not on their number.

- When both clearing and rehabilitation are considered, percentage area rehabilitated has a significant negative effect on the chance of high turbidity events occurring.

Considering these results together, it is determined that the total percentage cleared area has no significant effect (negative or positive) on high turbidity events. However, the two components contribute in the following manner:

- Percentage cleared but not rehabilitated has a positive effect.
- Percentage cleared and rehabilitated has a negative effect.

The best-fitting model can be used to predict the expected number of events in different scenarios and can consider changes in a single factor, keeping all else constant. This shows that:

- Risk of high turbidity events increases with increasing areas of clearing in the absence of rehabilitation.
- Risk of high turbidity events decreases with increasing levels of rehabilitation.
- Risk of high turbidity events increases with increasing catchment mean slope.
- High turbidity events can be expected within uncleared catchments.

It is acknowledged that mining within an area increases the likelihood of high turbidity events, however rehabilitation decreases the risk. This statistical based assessment of catchment turbidity with sub-catchment and mining characteristics, together with other recent catchment turbidity related assessments by Alcoa (including Silberstein 2022; Appendix 11), presents a substantial body of knowledge. Alcoa supports, and intends to undertake, further collaborative catchment turbidity research based on this established knowledge base, in consultation with the Independent Technical Advisory Group.

7.2.2.2 Groundwater Induced Streamflow and Stream Zone Turbidity

Alcoa recognised the potential risk that catchment turbidity and sedimentation can be derived directly from mining activity and indirectly from clearing induced increased stream flow effect on bank erosion relative to natural condition. Alcoa partnered with *Hydrological and Environmental Scientific Solutions* (Silberstein 2022; Appendix 11) to conduct a catchment research literature review focusing on studies concerning land use change effects on stream zone erosion and turbidity. Near stream erosion and resultant turbidity are potentially impacted through the following mechanisms:

- Groundwater rise may discharge directly to streams or may result in greater runoff generation on wetted areas, particularly in lower slope positions.
- These wetted areas are likely to generate more sediment mobilisation by modification to the structure and stability of the near stream material.
- Studies have noted that peak discharges often increase much more, and for longer periods after rehabilitation, than mean discharges and it is the high flow events most likely to cause bank erosion and sediment delivery to streams.

- The increased moisture content in stream bank soils, accompanying raised groundwater, can result in a reduction in bank stability such that bank erosion may increase, even without an increase in the size of flow events over historical levels.

The preliminary conclusions of the literature review outline there is limited availability of data from the south-west of Western Australia on sediment mobilisation and turbidity in streams resulting from land use changes. The recommendations in the literature review report seeks to identify targeted collaborative research for stream zone generated turbidity cause and effect, and specific technical controls for consideration within Alcoa's Drainage Design Manual.

7.2.3 Increased sediment from erosion of post-mining landforms

Mine development involves stripping and stockpiling the superficial soils, blasting or ripping the caprock layer then removing the bauxite caprock and friable fragmental layers. Following the completion of mining, rehabilitation is undertaken including pre-ripping of compacted floors to at least 1.2 m, landscaping batters, spreading overburden and topsoil (typically 300 mm combined depth), then contour ripping to create a furrowed surface.

The net effect of bauxite mining of Jarrah Forest soils is the removal of an approximately 4-6 m thick layer of caprock and friable fragmental material, and replacement of the seed rich topsoil and overburden over a ripped, friable substrate of sandy loams and clays. The total depth of friable material created is about 1.5 m, including topsoil, overburden and ripped substrate.

The establishment of a 1.5 m thick friable layer of topsoil, overburden and ripped substrate provides a comparable, though generally thicker, stratum than the topsoil and overburden present above the caprock prior to mining. The friable layer enables development of a dense root structure of Jarrah Forest vegetation as occurs in the topsoil and overburden present prior to mining. There is expected to be a partial loss of soil water capacity due to the removal of the bauxite friable fragmental layer, which comprised about 2 m of loamy soils that previously were accessed by deep and medium rooted vegetation. Loss of this layer represents approximately 10% of the regolith thickness, however the loamy layer may have had a higher plant available water than that of the underlying mottled and pallid clays. Loss of the bauxite caprock layer is not expected to substantially reduce the soil water capacity, as the layer was primarily cemented material that provided discrete pathways for water and roots to enter the underlying un-cemented layers.

Loss of the bauxite friable fragmental layer has not been observed to result in impaired growth or health of rehabilitation (Browers et al 2012). Monitoring of rehabilitation has demonstrated the successful establishment and persistence of an LAI of 2-2.5, comparable to that of un-mined Jarrah Forest. Monitoring has also indicated a floristic diversity of about 80% to 100% of un-mined forest, declining weed cover and sustained understorey coverage. The results of monitoring collectively demonstrate that Alcoa's rehabilitation establishes and persists, including during drought and heatwave events, indicating that the 1.5 m thick friable substrate over regolith containing ancient root channels is an effective growth medium. Alcoa research has indicated that mine rehabilitation vegetation is expected to be sustained over the long term with resilience to climate change comparable to that of the un-mined Jarrah Forest. Mine rehabilitation is therefore expected to provide long-term protection of soils from erosion and associated sediment discharge to streams and reservoirs.

Mengler et al (2006) surveyed topsoil and overburden samples in rehabilitated mine pits at the Huntly Mine. The survey indicated predominantly sandy gravel texture, comprising an average of 60% gravel (>2 mm diameter, range 38%-78%), 38% sand (2-0.02 mm diameter, range 24%-65%) and 3% silt and clay (<0.02mm diameters, range 0%-6%) for the mine. Due to the predominant sandy gravel texture, the soils had calculated low erodibility coefficients (RUSLE equation K factors) averaging 0.009 (range 0.000-0.019).

The skeletal topsoil and overburden materials are distinct to most agricultural soils and mining waste due to the low combined clay and silt contents and very high gravel contents, which develop with time a protective surface layer of gravel covering 70 - 80% of the land surface. The high porosity and coarse texture also enable rapid infiltration of rainfall within the topsoil, overburden and ripped regolith material. However, thinly applied topsoil and overburden can be mixed with finer grained pit floor materials during contour ripping, which can introduce more erodible (and potential dispersive) clayey material into the shallow subsurface surface. The regolith beneath the ripped zone generally comprises lower permeability sandy loams and clays, therefore rainfall infiltration is limited to the water storage in the overburden and ripped zoned, accordingly surface runoff occurs following extended rainfall periods that fill up the permeable materials.

Gullies form in the rehabilitated landform through an erosion sequence (Mengler et al 2006). The fine-grained content is displaced from the coarser topsoil/overburden, depositing within the furrows and filling their volume such that surface water overflows and erodes through the fine-grained materials in downslope furrows. The gully that is initially created in the fine-grained materials concentrates flow and creates knickpoints that enable erosion of the coarser topsoil/overburden and underlying ripped regolith materials.

Analysis of gully erosion at the Huntly, Willowdale, and Boddington bauxite mines suggested a minimum catchment of 0.3 ha for gully development, with gully volumes typically remaining small (20-100 m^3) but potentially increasing for higher slopes (> 10°) and shallower topsoil/overburden placement (< 200 mm). Erosion was highest in the first two to three years following rehabilitation completion until rehabilitation establishes, though there was a lack of long-term data with which to compare the erodibility of rehabilitation to that of un-mined Jarrah Forest (Mengler et al 2006). For the period at higher risk of erosion, the major triggers for gully erosion were identified as:

- Directing excessive off-site runoff into the rehabilitation.
- Poor surface completion (e.g., ripping that does not adhere to contours) that concentrates flow or impairs infiltration.
- Insufficient depth of returned topsoil and overburden (< 200 mm combined).

7.2.4 Increases in stream salinity due to mining-induced saline groundwater discharge

Salinity has been identified as a water quality risk as saline water is not potable, and small increases in salinity can affect the aesthetic of the source water. Salinity can have a wider ecosystem impact due to its effect on plant growth/health.

Rainfall varies across ML1SA, being highest to the west near the Darling Scarp and declining to the east. Mean annual evaporation exhibits an approximate inverse trend, increasing to the east, which results in the accumulation of salts in deep soils and increasing groundwater salinity (Schofield et al 1989). By comparison, groundwaters are fresh in the high rainfall zone near the Darling Scarp. The intermediate rainfall zone (IRZ), which has a long-term average of 900–1100 mm/year, has recorded groundwater that is sufficiently shallow such that clearing of native vegetation has the potential to result in the rise of saline groundwater and its discharge into streams (Dixon et al 2019).

The potential for bauxite mining to result in stream salinity was recognized in the 1970s and led to the development of the Joint Intermediate Rainfall Zone Research Program (JIRZRP)[94]. Several experiments were conducted under the JIRZRP, including the Trial Mining Project (TMP). The TMP involved the study of the effects of mining and rehabilitation during 2003-2011 in the upper catchments of the Serpentine and Dandalup rivers. The TMP findings indicated an almost complete absence of response to mining in either streamflow or stream salinity (Croton et al 2011). It was concluded that the lack of response was due to the decline in groundwater levels in the regolith and that the groundwater rise from mining was insufficient to cause saline groundwater discharge into streams (Croton et al 2011). Similar findings were reported for other catchments in the IRZ that were subject to forest thinning experiments over a comparable period (Kinal and Stoneman 2011).

Dixon et al (2019) investigated the effects of mining and rehabilitation in the Serpentine Dam catchment using the LUCICAT catchment hydrology model. Dixon et al (2019) modelled a 'no-mining' scenario and two scenarios of mining at nine and 12% of the catchment, under two climate scenarios of average rainfall (914 mm/year) and low rainfall (841 mm/year). The modelled results indicate that streamflow salinity is expected to decrease during mining then increase during rehabilitation. The modelling predicted an inverse trend in streamflow yield, an increase in streamflow during mining, and a decrease during rehabilitation (Dixon et al 2019). Dixon et al (2019) predicted that mining may increase reservoir salinity by up to 3% compared to the no-mining case, which is within acceptable limits.

Streamzone monitoring of mined and un-mined catchments has been undertaken as part of the TMP, with surveys conducted by WRM in 2005, 2007, 2009, 2011, 2014 and 2019 (WRM 2020). Streamzone monitoring involved sampling and comparative analysis of macroinvertebrates, as indicators of potential impacts to aquatic biodiversity. Analyses included univariate and multivariate analysis of species-level metrics including total taxa richness, EPT[95] richness, functional feeding groups and Bray-Curtis similarity (WRM 2020).

WRM (2020) concluded that the analyses did not indicate significant differences between the macroinvertebrate communities of sites in mined and un-mined catchments. There was a greater

[94] https://www.water.wa.gov.au/water-topics/water-quality/managing-water-quality/effects-of-mining-bauxite-hydrology
[95] EPT Richness estimates water quality by the relative abundance of three major orders of stream insects that have low tolerance to water pollution: *Ephemeroptera* (mayflies), *Plecoptera* (stoneflies), and *Trichoptera* (caddisflies).

variation in total species richness and EPT taxa richness within the groups of sites in mined and un-mined catchments rather than between the groups, indicating that the fauna is more dependent on natural habitat characteristics and localised anthropogenic disturbance at each site.

7.2.5 Changes to hydrological regimes

Groundwater rise associated with clearing and mine pit development is expected. The increase in groundwater level is attributed to removal of native vegetation. Current monitoring data indicates:

- Conceptually, natural groundwater surface geometry mimics terrain surface geometry noting water levels are 15-25 m bgl in higher elevation terrain and relatively lower in stream zones. The water level gradient flattens beneath higher elevation terrain.
- Seasonal fluctuation of 1-5 m is expected, with winter measured water levels assumed to substantively represent the seasonal high.

Research (Grigg, 2017) on the impact of bauxite mining on catchment hydrology, using historical Alcoa mining data, considered three catchments:

- Mined (5-year period of mining and rehab).
- Intense thinning of tree cover by timber harvesting.
- Control catchment, not subject to either mining or recent forestry disturbance

The three catchments were monitored for rainfall, streamflow, groundwater and Leaf Area Index (LAI) over a 36-year period. The nature of responses to mining appears to have been:

- Overall catchment LAI declined between about 1997 and 2005, with the peak change of about 60% reduction occurring in around 1999, and gradual recovery thereafter until around 2005 - 2006 when pre-mining LAI levels were reported.
- LAI changes in the mined parts of the catchment were more significant, with LAI reducing effectively by 100% for a 2 to 3 year period, before recovering over a further 1 to 4 years to or above pre-mining levels.
- Groundwater level rises were noted in response to clearing, with the rises in upper catchment mid-slope locations peaking at 2.5 - 5 m between 1999 and 2003; slightly higher peaks of 2.5 - 5.5 m in lower slope and valley edge locations, peaking around 2003; lowest response was observed in streamzone locations near catchment outlet, in range 0.5 - 1.5 m.
- After peaking, groundwater levels gradually declined to, or slightly below, the pre-mined levels by 2008.
- Thus, the peak groundwater levels were reported between 2 and 6 years after commencement of clearing, and full recovery to pre-mined levels after 11 years.
- Mining caused a peak response in catchment streamflow of 225 mm or 18% of rainfall before returning to pre-mine levels 11 years after mining commenced. Changes in streamflow were

closely associated with an expansion and subsequent contraction of the groundwater discharge area in the valley floor, which in turn was primarily driven by changes in LAI and rainfall.

The study completed by Nixon et al (2019) investigated the potential effects of Alcoa's mining on stream flows and salinity into the Serpentine Reservoir. A conceptual catchment hydrology model was used to consider long-term mine plans and accounted for a changing climate over a 40-year planning horizon.

Two scenarios were considered – clearing (inclusive of mining and rehabilitation) nine and 12 percent of the entire Serpentine catchment. Model results showed that, regardless of the mining case or future climate, the projected change in inflows due to mining was no greater than approximately 2 GL/year in any one year, or 5% of flow on an annual average basis. Both increases and decreases in flow were observed over the time series relative to the unmined alternative.

Similar groundwater and stream zone changes are expected as a result of the mine plan. The scale of impacts is not expected to be significantly different to those occurring historically.

7.2.6 Contamination for spills and/or leaks from storage and handling of hazardous materials and waste

Herbicides and fertilisers are utilised by Alcoa in rehabilitation and weed control. Hydrocarbons and other chemicals are used within equipment and maintenance areas. All substances could interact with the environment from storage, use and spills.

The mines are diesel-only fuel sites, with no storage or handling of unleaded petrol. Diesel is predominantly used for haul trucks, excavators and other large earthmoving equipment, and, to a lesser extent, for light vehicles. The storage and handling of diesel creates a potential hazard for spillage of diesel that may enter reservoirs.

A large volume diesel spill may result in water quality impacts in the stream zone downstream of the spill as well as the upper reservoir prior to substantial mixing and attenuation. Localised impacts within the stream zone may impact aquatic fauna that occur seasonally during stream flow, as well as the condition of riparian vegetation. Impacts within the upper reservoir may affect aquatic fauna that reside in the perennial waterbody, including native fish, freshwater crayfish and, potentially, populations of Carter's Freshwater Mussel.

7.2.6.1 Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) – Source Elimination

Alcoa introduced C6 Aqueous Film Forming Foams (AFFF) as a fire suppressant on its heavy vehicle mining fleet in 2013-2014 (which at the time was understood to be 'PFAS free') in response to safety concerns following a fire incident on a heavy vehicle.

In 2019, Alcoa became aware that the C6 AFFF contained low concentrations of PFAS compounds and conducted a review of fluorine-free foams available in Australia through a comprehensive due diligence process, including independent laboratory testing, which identified five fluorine-free foams. These five foams were subsequently approved for use under Schedule 10 of the *Materials and Substance in Contact with Drinking Water factsheet*.

Replacement of the C6 AFFF with approved fluorine-free foam across both Huntly and Willowdale mines was completed in December 2021.

7.2.7 Contamination from pathogens

Pathogen contamination of drinking water can have significant effects on human health. Potential sources of pathogen contamination from Alcoa's operations include:

- Sewage overflow during on-site treatment.
- Washout of treated effluent from an irrigation area.
- Subsurface leaching of treated effluent.
- Direct faecal deposition in a riparian zone by a staff member with asymptomatic cryptosporidiosis.
- Use of bushland for toileting pathogens.
- Sewage treatment of workforce sewage pathogens, nutrients and suspended solids.
- Irrigation of treated effluent over bushland near construction compound and mine facilities.
- Mobile ablutions facilities.
- Pump out and transport of raw sewage for off-site disposal.
- Raw sewage leaks during tanker collisions.
- Waste Water Treatment Plant (WWTP) process upsets / failure resulting in reduced treatment efficacy / higher contaminant loading.
- Waste solid and liquid waste generation from construction and operational activities.
- Nutrients, hydrocarbons, metals, pathogens, surfactants, plastics, suspended solids.
- On-site waste disposal.

7.2.8 Big Brook Causeway

The Big Brook Causeway (previously referred to as Serpentine Dam Causeway) is an existing, critical piece of haul road infrastructure for the Huntly mine. The causeway provides access to the eastern side of the Myara region by crossing Big Brook, which feeds Serpentine Dam.

The Causeway was approved by the MMPLG and constructed over the summer of 2012/2013. It was subject to implementation of the Big Brook Causeway Construction and Operational Plan, which was informed by a risk assessment conducted by Professor Barry Hart (Water Science 2008). On the recommendation of the Water Corporation, Alcoa committed to maintain a 100 m buffer between the Big Brook Causeway and the Serpentine Dam reservoir top water level (TWL).

In August 2021, the water level came within 100m of Big Brook Crossing and the Water Corporation directed Alcoa to cease its operation. A revised risk assessment, including controls, was prepared by Alcoa and agreed with Water Corporation allowing operations to recommence in September 2021.

A conceptual area for an alternative Big Brook Crossing location was included in the 2021-2025 MMP. Alcoa has undertaken a process of options identification (FEL[96] 1) and options selection (FEL 2) to develop a comprehensive risk reduction solution to mitigate the removal of the 100 m trigger level for the Big Brook Causeway.

Alcoa engaged with Water Corporation and DWER via an MMPLG meeting in December 2022 to review and endorse engineering upgrades of the Causeway, updated Big Brook Causeway Operational Plan and updated Big Brook Causeway Risk Assessments. A consolidated package of the actions from the MMPLG meeting, including potential groundwater interaction technical memorandum, revised clearing area, referenced technical reports, and approvals process memorandum was provided to MMPLG members in March 2023.

A revised conceptual area is included in this MMP, following a detailed design process, which resulted in a decrease in the clearing area. The revised clearing area has been identified to enable the implementation of a range of additional risk mitigation controls. The actual clearing has since been significantly reduced to enable the implementation of the proposed engineering upgrades and risk mitigation controls (primarily upgrades to existing sump capacity) in accordance with the preliminary engineering design presented to the MMPLG in December 2022.

Further consultation with ITAG is expected to occur on previously submitted designs and controls. Clearing within the extended Big Brook Causeway Conceptual Clearing Area will only occur if an agreement on the additional controls is reached between Alcoa, WC and DWER through endorsement of the Big Brook Causeway Operational Plan and associated risk assessment.

7.2.9 Cumulative Impacts

7.2.9.1 Past and present activities

The NJF subregion has been subject to environmental impacts from a range of past and present activities, including (in order of area of disturbance):

- Agriculture.
- Timber harvesting.
- Prescribed burning.
- Bauxite and gold mining.
- Plantations.
- Water supply reservoirs.

Agriculture has caused widespread impacts including:

- Loss of biodiversity and habitat from permanent clearing.
- Spread of *Phytophthora* Dieback in forested areas from timber harvesting.
- Agricultural impacts to soils including erosion, salinity, compaction and acidification.

96 Front End Loading

- Secondary salinity impacts to the Murray and Avon rivers from permanent clearing.

Mining has caused impacts as follows:

- Short to medium term ecological and amenity impacts during operations and until rehabilitation establishes.
- Rehabilitation restoring varying biodiversity, ecological integrity and landscape quality.

Prescribed burning is undertaken to reduce the severity and extent of wildfires, which can have some impacts on ecology, water quality and local amenity (similar to timber harvesting).

While water supply reservoirs have lead to localised loss of incised river valley landforms and vegetation, and caused widespread disruption to the migration and dispersal of aquatic fauna, they have also created perennial waterbodies that provide refuges for aquatic wildlife.

7.2.9.2 Reasonably foreseeable future activities

Both approved and proposed mining can be reasonably anticipated within the NJF subregion in future. It is expected that Jarrah Forest cleared for mining will undergo rehabilitation, with the time from clearing to rehabilitation being variable and dependent upon if area is used for mining or long-term infrastructure.

In 2024, the WA Government ceased native forest logging, except for timber harvesting in approved mining areas or for ecological thinning purposes.

As part of the WA Government's strategy to reduce fuel loads and minimize the likelihood and severity of large-scale wildfires, prescribed burning is expected to continue within the subregion. In addition, bushfires or extreme weather events could reasonably occur and have a potential impact on water.

Other potential future activities within the subregion may include urban or rural residential development, infrastructure development, and agriculture. Any clearing associated with these activities will be subject to regulation under either Part IV or Part V of the EP Act.

7.2.9.3 Water Cumulative Impacts

Alcoa has considered the cumulative impacts to Public Drinking Water Sources Areas and indicative estimates of mining disturbance within the RPZ associated with the 24 Month Clearing Schedule (Table 7-14, Table 7-15, including all Alcoa previous and future activities such as clearing associated with Assessment 2253 and any future Part IV EP Act Referrals).

Clearing within the Huntly region is expected to impact 179 ha of area within the Serpentine RPZ. Less than 0.3% of the Top Water Line 1km Buffer of the RPZ, OCA2 Water Resource Sensitivity Zones and the OCA1 Top Water Line 200m Buffer will be impacted for infrastructure purposes. Less than 0.2% of both the North and South Dandalup RPZ are likely to be impacted with 0.04% of the south Dandalup RPZ being within the Top Water Line 1km Buffer of the RPZ. No impacts to Willowdale RPZs are expected.

Table 7-13: Indicative cumulative impacts to Public Drinking Water Catchments

Public Drinking Water Source Areas	Catchment Area (ha)	Open Area (ha)	Proportion of catchment (%)	Rehabilitation Area (ha)	Proportion of catchment (%)	FCA Endorsed Areas (ha)	Proportion of catchment (%)	24 Month Clearing Schedule (including Assessment 2253) (ha)	Proportion of catchment (%)	5 Year Clearing Schedule (including Assessment 2253 and future Part IV EP Act Referrals) (ha)	Proportion of catchment (%)	10 Year Mine Plan (including Assessment 2253 and future Part IV EP Act Referrals) (ha)	Total future mined area (ha)	Proportion of catchment total future mined (%)
Huntly Mine Region														
Conjurunup Creek Pipehead Dam Catchment Area	3,921	56	1.4%	1,606	41.0%	18	0.5%	7	0.2%	0	0.0%	0	1,687	43.0%
Dirk Brook Reserve	3,115	245	7.9%	501	16.1%	115	3.7%	83	2.7%	24	0.8%	0	968	31.1%
Gooralong Brook Water Reserve	4,120	0	0.0%	0	0.0%	0	0.0%	0	0.0%	46	1.1%	0	46	1.1%
North Dandalup Dam Catchment Area	15,150	454	3.0%	4,023	26.6%	135	0.9%	228	1.5%	130	0.9%	0	4,970	32.8%
Serpentine Dam Catchment Area	31,675	2,659	8.4%	4,169	13.2%	532	1.7%	3,243	10.2%	4,396	13.9%	215	15,214	48.0%
Serpentine Pipehead Dam Catchment Area	3,854	68	1.8%	99	2.6%	0	0.0%	0	0.0%	0	0.0%	0	167	4.3%
South Dandalup Dam Catchment Area	127,107	8	0.0%	2,175	1.7%	13	0.0%	228	0.2%	117	0.1%	0	2,541	2.0%
South Dandalup Pipehead Dam Catchment Area	1,838	41	2.2%	577	31.4%	10	0.5%	13	0.7%	0	0.0%	884	1,525	83.0%
Wungong Brook Catchment Area	7,755	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	33	33	0.4%
Outside Public Drinking Water Source Area	-	-	-	-	-	3	-	2	-	3	-	1,361	1,369	-
Grand Total	**198,535**	**3,532**	**1.8%**	**13,151**	**6.6%**	**827**	0.4%	**3,804**	**1.9%**	**4,715**	**2.4%**	**2,492**	**28,520**	**14.4%**
Willowdale Mine Region														
Bancell Brook Catchment Area	1,838	2	0.1%	108	5.9%	1	0.1%	0	0.0%	0	0.0%	51	162	8.8%
Harvey Dam Catchment Area	12,707	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	253	253	2.0%
Samson Brook Catchment Area	7,456	581	7.8%	1,418	19.0%	172	2.3%	147	2.0%	174	2.0%	1	2493	33.4%
Stirling Dam Catchment Area	25,382	633	2.5%	92	0.4%	263	1.0%	657	2.6%	446	1.8%	913	3004	11.8%
Outside Public Drinking Water Source Area	-	-	-	-	-	310	-	243	-	298	-	891	851	-
Grand Total	**47,383**	**1,216**	**2.6%**	**1,619**	**3.4%**	**747**	**1.6%**	**1,047**	**2.5%**	**918**	**2.8%**	**2,109**	**6763**	**14.3%**

Table 7-14: Indicative cumulative impacts within the RPZs – Huntly

Area	Area (ha)	Open Area (ha)	Proportion of catchment (%)	Rehabilitated Area (ha)	Rehabilitated areas Proportion of catchment (%)	FCA Endorsed Areas	Proportion of catchment (%)	24 Month Clearing Schedule Area (ha)	Proportion of catchment (%)	5 year Clearing Schedule Area (including Assessment 2253) (ha)	Proportion of catchment (%)	Total mined area (ha)	Proportion of catchment (%)
Conjurunup													
OCA1 Top Water Line 200m Buffer	51	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	154	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Reservoir Protection Zones (RPZ)	488	0	0.00%	57	11.71%	2	0.41%	0	0.00%	0	0.00%	59	12.09%
Top Water Line 1km Buffer	496	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
North Dandalup													

Area	Area (ha)	Open Area (ha)	Proportion of catchment (%)	Rehabilitated Area (ha)	Rehabilitated areas Proportion of catchment (%)	FCA Endorsed Areas	Proportion of catchment (%)	24 Month Clearing Schedule Area (ha)	Proportion of catchment (%)	5 year Clearing Schedule Area (including Assessment 2253) (ha)	Proportion of catchment (%)	Total mined area (ha)	Proportion of catchment (%)
OCA1 Top Water Line 200m Buffer	995	0	0.00%	9	0.89%	0	0.00%	0	0.00%	0	0.00%	9	0.90%
OCA2 Water Resource Sensitivity Zones	1,860	12	0.64%	160	8.59%	0	0.00%	0	0.00%	0	0.00%	172	9.25%
Reservoir Protection Zones (RPZ)	3,938	132	3.34%	652	16.57%	19	0.48%	0	0.00%	6	0.15%	809	20.54%
Top Water Line 1km Buffer	2,669	43	1.61%	306	11.45%	2	0.07%	0	0.00%	0	0.00%	351	13.15%
Serpentine													
OCA1 Top Water Line 200m Buffer	2,393	6	0.24%	0	0.00%	2	0.08%	6	0.25%	0	0.00%	14	0.59%
OCA2 Water Resource Sensitivity Zones	4,958	116	2.35%	74	1.49%	10	0.20%	17	0.34%	0	0.00%	217	4.38%
Reservoir Protection Zones (RPZ)	11,298	1419	12.56%	583	5.16%	210	1.86%	179	1.59%	20	0.02%	2411	21.34%
Top Water Line 1km Buffer	6,879	502	7.30%	309	4.49%	22	0.32%	18	0.26%	0	0.00%	851	12.37%
Serpentine Pipehead													
OCA1 Top Water Line 200m Buffer	296	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	928	0	0.00%	0	0.04%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Reservoir Protection Zones (RPZ)	2,161	7	0.34%	76	3.52%	1	0.05%	0	0.00%	0	0.00%	84	3.89%
Top Water Line 1km Buffer	1,498	0	0.00%	5	0.32%	0	0.00%	0	0.00%	0	0.00%	5	0.33%
South Dandalup													
OCA1 Top Water Line 200m Buffer	3,459	0	0.00%	55	1.59%	0	0.00%	0	0.00%	0	0.00%	55	1.59%
OCA2 Water Resource Sensitivity Zones	6,363	0	0.00%	473	7.43%	3	0.05%	0	0.00%	0	0.00%	476	7.48%
Reservoir Protection Zones (RPZ)	11,341	8	0.07%	1,269	11.19%	9	0.08%	13	0.11%	0	0.00%	1,299	11.45%
Top Water Line 1km Buffer	8,534	7	0.08%	861	10.09%	4	0.05%	3	0.04%	0	0.00%	875	10.25%

Table 7-15 Indicative cumulative impacts within the RPZs - Willowdale

Area	Area (ha)	Open Area (ha)	Open areas proportion of catchment (%)	Rehabilitated Area (ha)	Rehabilitated areas Proportion of catchment (%)	FCA Endorsed Areas	Proportion of catchment (%)	24 Month Clearing Schedule Area (ha)	Proportion of catchment (%)	5 year Clearing Schedule Area and future Part IV EP Act Referrals (ha)	Proportion of catchment (%)	Total mined area (ha)	Proportion of area total mined (%)
Samson Brook													
OCA1 Top Water Line 200m Buffer	314	8	2.55%	1	0.32%	3	0.96%	0	0.00%	0	0.00%	12	3.82%
OCA2 Water Resource Sensitivity Zones	1512	52	3.44%	228	15.08%	17	1.12%	0	0.00%	0	0.00%	297	19.64%
Top Water Line 1km Buffer	756	40	5.29%	93	12.29%	6	0.79%	0	0.00%	0	0.00%	139	18.38%
OCA1 Top Water Line 200m Buffer	1,960	97	4.95%	421	21.49%	27	1.38%	0	0.00%	0	0.00%	545	27.81%
Samson Brook Pipehead													
OCA1 Top Water Line 200m Buffer	36	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
OCA2 Water Resource Sensitivity Zones	145	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Reservoir Protection Zones (RPZ)	438	1	0.23%	70	15.98%	1	0.23%	0	0.00%	0	0.00%	73	16.67%
Top Water Line 1km Buffer	195	2	1.03%	36	18.46%	0	0.00%	0	0.00%	0	0.00%	38	19.49%

7.3 Mitigation

Alcoa's environmental management approach incorporates the mitigation hierarchy, consistent with industry guidance (in order of priority):

- Impact avoidance
- Impact minimisation
- Rehabilitation.

A risk-based approach has been undertaken to align with Alcoa's environmental management system and management plans incorporating mitigation actions as a risk register (Table 7-16) and risk assessment methodology (Appendix 2).

The key mitigations include:

- Limiting actual clearing to 800 ha of native vegetation per calendar year[97] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[98].
- Not undertaking clearing or mining[99] within:
  - 1 km of the top water level of any water reservoir.
  - Serpentine Pipehead Dam Catchment
  - Areas with an average pit slope greater than 16% within any RPZ
- Revising and implementing of the Water Resources Management Plan (WRMP)[100] (Appendix 12), to the extent practicable, as provided to JTSI and publicly available on Alcoa's website
- Avoiding or minimising discharge of environmentally hazardous material outside of containment infrastructure[101]
- Undertaking compliance monitoring associated with 2023-2027 MMP Ministerial Approval Conditions[102] and associated incident reporting[103]
- Developing and implementing of Drainage Control Management Plans (DCMPs) for pits or haul roads within public drinking water catchments[104].
- Providing drainage control as-builts[105]

[97] 2023-2027 MMP Ministerial Approval Condition 9.
[98] 2023-2027 MMP Ministerial Approval Condition 10.
[99] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.
[100] 2023-2027 MMP Ministerial Approval Condition 13, 14 and 17.
[101] 2023-2027 MMP Ministerial Approval Condition 4.
[102] 2023-2027 MMP Ministerial Approval Condition 27 – 28, 31 - 37 and s6 exemption.
[103] 2023-2027 MMP Ministerial Approval Condition 29 and s6 exemption.
[104] 2023-2027 MMP Ministerial Approval Condition 11 and 16.
[105] 2023-2027 MMP Ministerial Approval Condition 12 and 16.

- Prioritising rehabilitation within public drinking water catchments and increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[106]

Alcoa is committed to protecting public drinking water resources and will consult with relevant technical experts to ensure adequate protective mechanisms are implemented. The revised WRMP details the key mitigations and is included in Appendix 12 with the key objectives being:

- To maintain and protect the quality and hydrological regimes of Inland Waters by implementing measures to prevent and minimise contamination risks, control erosion and turbidity, and prevent salinity increases.
- Ensure the quality and supply of water resources is maintained, avoiding adverse changes that compromise water values or uses. Water quality parameters shall not exceed the thresholds specified in the criteria or other relevant standards.

The objectives are supported by the following outcomes which include associated monitoring:

- Ensure that turbidity levels in surface water bodies do not exceed 1 NTU over a rolling one-hour average during flowing conditions at designated receptor locations.
- Ensure that TDS levels in surface water bodies do not exceed 1200 mg/L over a 24-hour average at designated in stream monitoring locations.
- No reduction in the quality of groundwater or surface water as a result of mining activities.
- No contamination of groundwater attributable to hydrocarbon storage areas.
- No contamination of surface water because of discharge from wastewater treatment facilities.
- No adverse impacts from bacterial contamination shall occur in surface water within PDWSA.
- Minimise changes to streamflow of McKnoes Brook from discharge of treated water to McKnoes Brook

Alcoa considers the reconstitution of the ITAG to be a key component to ensure relevant and representative scientific studies and research to improve water related knowledge are undertaken. A water management framework has been developed (Figure 7-12) to detail interactions between studies, the mine planning process and documentation. Key activities in the water management framework include:

- Consultation with ITAG on Drainage Design Manual[107]. The Drainage Design Manual is the basis of design to ensure the design and construction of mining pits, haul roads and associated infrastructure does not impact on the surrounding environment and PDWSAs. Alcoa will use the Drainage Design Manual and field data in the development of DCMPs. DCMPs will be provided for FCA submissions for pits or haul roads within the public drinking water catchment areas[108].

[106] 2023-2027 MMP Ministerial Approval Condition 15
[107] 2023-2027 MMP Ministerial Approval Condition 26.
[108] 2023-2027 MMP Ministerial Approval Condition 11 and 16.

- Consultation with ITAG on Rehabilitation Design Manual[107]. The Rehabilitation Design Manual details the rehabilitation design inputs and processes from rehabilitation planning to rehabilitation execution to meet the rehabilitation objective and associated completion criteria. It provides connection between decades long adaptive management science and rehabilitation execution and a consolidated reference for rehabilitation practitioners in order to maintain consistent rehabilitation outcomes over time.
- Undertaking a catchment scale, risk-based approach through the development and implementation of a Catchment Risk Assessment Tool, as part of the development of a cumulative catchment scale risk assessment[109]. The output of this tool is a spatial risk assessment that will identify high risk areas of potential impacts to drinking water and can be utilised to plan and review mitigation measures.
- Revision and implementation of the Water Resources Management Plan (WRMP)[110] (Appendix 12). The WRMP details management objectives and targets, with associated management measures. The WRMP includes a monitoring framework to identify potential impacts to key water values, which will be refined.
- Undertaking further hydrogeological and hydrological studies of the long-term impacts of mining and rehabilitation.

[109] 2023-2027 MMP Ministerial Approval Condition 25.
[110] 2023-2027 MMP Ministerial Approval Condition 13, 14 and 17.

Document Map

Alcoa

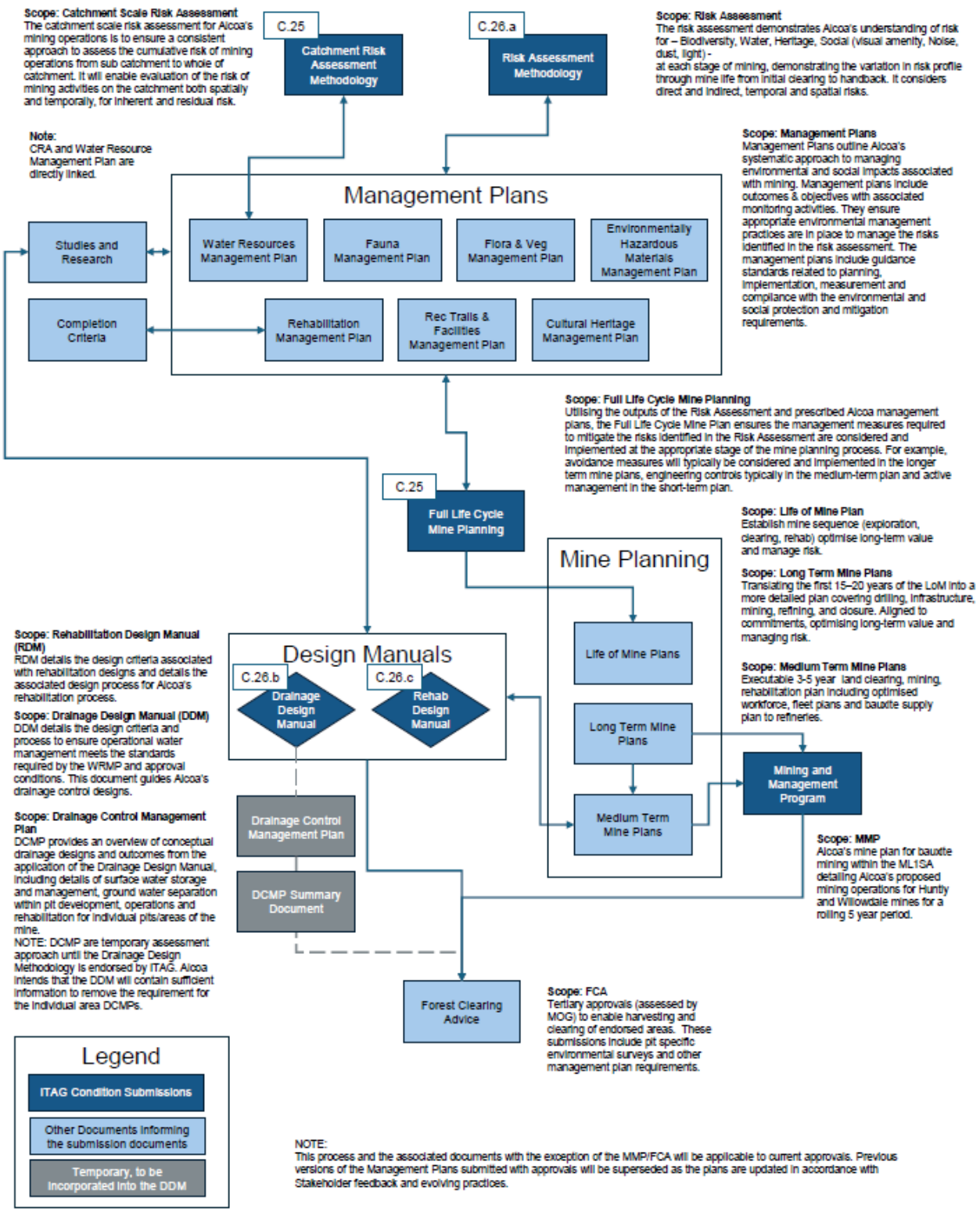


Figure 7-10: Water Management Framework

Table 7-16: Avoidance and minimisation of potential impacts to inland waters

Risk	Description of Impact	Risk Controls	Residual Risk Rating

Clearing vegetation resulting in change to the hydrological system (e.g., may result in groundwater rise).	Death to vegetation, change in local vegetation communities.
	
	Groundwater rise results in expression of groundwater containing high salinity causing increase in salinity of downstream receptors i.e., groundwater/surface water PDWSA.
	
	Increased in turbid water discharge (e.g., groundwater expression to surface, groundwater connection to sumps reducing storage capacity).
		Avoid
		• No clearing or mining[111] within:
		  ○ 1 km of the top water level of any water reservoir.
		  ○ Serpentine Pipehead Dam Catchment.
		  ○ Areas with an average pit slope greater than 16% within any RPZ.
		• No mining within 100 m of stream vegetation.
		Minimise
		• Implementation of Drainage Design Manual and Rehabilitation Design Manual.
		• Revision and implementation of the WRMP[112] (Appendix 12), to the extent practicable.
		• Groundwater monitoring program - water level and chemistry and estimated maximum groundwater level minimises groundwater interactions.
		• Mine surface water control designs (detailed in Drainage Design Manual) informed by hydrological studies (flow, infiltration diversion for mine planning storage purposes):
		  ○ Drainage Protection Slots (DPSs)s, comprise shallow (~1.8 m) blasted or ripped ground, if required by risk rating. DPSs capture and infiltrate surface runoff within the blasted voids.
		  ○ In-pit sumps, pit faces and trenches (as per Drainage Design Manual).
		• Development and implementation of DCMPs for pits or haul roads within public drinking water catchments[113], which include:
		  ○ Risk assessment for clearing and pit controls.
		  ○ Clearing and pit catchment and control conceptual designs.
		  ○ Assessment against the Groundwater Risk Assessment Framework (GWRAF).
		  ○ Groundwater investigations.
		• Detailed design process for clearing and pits.
		• Provision of surface water drainage control as-builts[114].
		• Regular pit and clearing inspections and associated adaptive management.
		• Red alert procedure, is a system which is designed as an early warning of forecast for intense rainfall events, allowing mine personnel time to review the mine's drainage controls, winterisation, and state of readiness to cope with the heavy rainfall event.
		• Active water management to prevent loss of containment.
		Rehabilitate
		• Prioritise rehabilitation within public drinking water catchments and increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[115].
			Medium

Risk of bacterial contamination of groundwater and/or surface water as a result of human pathogens.	Localised contamination of surface water and/or groundwater.
	
	Localised contamination in proximity to drinking water off-take resulting in impact to public drinking water source quality with
		Avoid
		• No clearing or mining[111] within:
		  ○ 1 km of the top water level of any water reservoir.
		  ○ Serpentine Pipehead Dam Catchment.
		  ○ Areas with an average pit slope greater than 16% within any RPZ.
		• No mining within 100 m of stream vegetation.
			Medium

[111] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.
[112] 2023-2027 MMP Ministerial Approval Condition 13, 14 and 17.
[113] 2023-2027 MMP Ministerial Approval Condition 11 and 16.
[114] 2023-2027 MMP Ministerial Approval Condition 12 and 16.
[115] 2023-2027 MMP Ministerial Approval Condition 15

Risk	Description of Impact	Risk Controls	Residual Risk Rating
	potential disruption to drinking water supply and/or human health impacts.	Minimise • Where practicable, personnel should use designated ablution block facilities, if this is not possible then biological waste must be bagged and disposed of at a designated disposal location outside of the RPZ. • Reservoir Protection Zone Management Plan (AUACDS-2053-5554). • A Permit to Work in Close Proximity to Water Catchment Areas will be sought where work activities are carried out near a reservoir. • Fit for work policy includes restriction to RPZ for personnel with gastrointestinal symptoms. • Minimise worker access in stream zones. • Worker training and awareness around hygiene practises within the RPZ.	
Loss of containment (hydrocarbons, oils and lubricants, hydraulic fluids) from heavy machinery	Cumulative contamination of surface water and/or groundwater resulting in Impact to public drinking water source quality resulting in potential disruption to drinking water supply and/or human health impacts. Localised contamination of surface water and/or groundwater. Localised contamination of PDWSA in proximity to drinking water off-take resulting in Impact to public drinking water source quality resulting in potential disruption to drinking water supply and/or human health impacts.	Avoid ○ No clearing or mining[116] within: ○ 1 km of the top water level of any water reservoir. ○ Serpentine Pipehead Dam Catchment. ○ Areas with an average pit slope greater than 16% within any RPZ. ○ No mining within 100 m of stream vegetation. Minimise ○ Vehicle access to RPZ requires an authorised permit. ○ Maintenance programs & pre-start checks. ○ Pre-mobilisation inspections. ○ Re-fuelling procedure. ○ Speed restrictions apply (Dangerous Goods & Hazardous Materials MP AUACDS-2053-5535). ○ Volume restrictions for hydrocarbon volumes (Dangerous Goods & Hazardous Materials MP AUACDS-2053-5535). ○ Active water management of sumps with associated sump cleanout program. ○ Personnel inductions / training – Loss of containment and spill response. ○ Chemical approval process. ○ Engineering and design controls. Rehabilitate ○ Spill kits and spill remediation equipment kept available. ○ Emergency response team and procedure. ○ Remediation Validation Procedure.	Medium
Loss of containment (hydrocarbons, oils and lubricants, hydraulic fluids) from banks, bunds, pipes or other potential discharge sources. Discharges during delivery or offtake.	Localised contamination of surface water and/or groundwater.	Avoid • Workshops, fuel bays, ablution facilities etc. designed to be located outside of RPZ. • AFFF containing PFAS prohibited from coming to site. Minimise • Separate stormwater and wastewater networks. • Concrete sump network associated with washdown facilities. • Personnel inductions / training - LOC and spill response. • Chemical approval process.	Medium

[116] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Red alert procedure, is a system which is designed as an early warning of forecast for intense rainfall events, allowing mine personnel time to review the mine's drainage controls, winterisation, and state of readiness to cope with the heavy rainfall event. • Roofed bunded areas (outdoor storage areas have roofing to prevent water egress). • 3rd party annual Dangerous Goods Depot inspections. • Maintenance programs & pre-start checks. • Engineering and design control including bunding and workshop floors designed to be impermeable. • Regular audits & inspections of waste and dangerous goods transport providers. Rehabilitate • Spill kits and spill remediation equipment kept accessible. • Emergency response team and procedure. • Remediation Validation Procedure.	

Removal of vegetation increasing the risk of erosion and turbid water discharge prior to the implementation of long term mitigative controls (e.g., water shots and water storage sumps).	Localised erosion and increase in turbidity of surface water.
	
	Cumulative erosion and increase in turbidity of surface water.
		Avoid
		• No clearing or mining[117] within:
		  ○ 1 km of the top water level of any water reservoir.
		  ○ Serpentine Pipehead Dam Catchment.
		  ○ Areas with an average pit slope greater than 16% within any RPZ.
		• No mining within 100 m of stream vegetation.
		Minimise
		• Staged clearing and development minimises open areas.
		• Implementation of Drainage Design Manual and Rehabilitation Design Manual.
		• Revision and implementation of the WRMP[118] (Appendix 12), to the extent practicable.
		• Groundwater monitoring program - water level and chemistry and estimated maximum groundwater level minimises groundwater interactions.
		• Mine surface water control designs (detailed in Drainage Design Manual) informed by hydrological studies (flow, infiltration diversion for mine planning storage purposes):
		  ○ Drainage Protection Slots (DPSs)s, comprise shallow (~1.8 m) blasted or ripped ground, if required by risk rating. DPSs capture and infiltrate surface runoff within the blasted voids.
		  ○ In-pit sumps, pit faces and trenches (as per Drainage Design Manual).
		• Development and implementation of DCMPs for pits or haul roads within public drinking water catchments[119], which include:
		  ○ Risk assessment for clearing and pit controls.
		  ○ Clearing and pit catchment and control conceptual designs.
		  ○ Assessment against the Groundwater Risk Assessment Framework (GWRAF).
		  ○ Groundwater investigations.
		• Detailed design process for clearing and pits.
		• Provision of surface water drainage control as-builts[120].
		• Regular pit and clearing inspections and associated adaptive management.
		• Red alert procedure, is a system which is designed as an early warning of forecast for intense rainfall events, allowing mine personnel time to review the mine's drainage controls, winterisation, and state of readiness to cope with the heavy rainfall event.
			Medium

[117] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.
[118] 2023-2027 MMP Ministerial Approval Condition 13, 14 and 17.
[119] 2023-2027 MMP Ministerial Approval Condition 11 and 16.
[120] 2023-2027 MMP Ministerial Approval Condition 12 and 16.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Active water management to prevent loss of containment. • Clearing to preferentially occur outside of winter months. • Minimise stream crossings, where possible. • Permit system is in placed to minimise risk associated with installation of stream crossings. • Clearing or construction activities within stream zones will occur during summer or autumn months, as far as practicable. • Stream crossing appropriately designed to minimise impacts and potential for erosion with appropriate surface water controls. Rehabilitate • Prioritise rehabilitation within public drinking water catchments and increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[121].	

Drainage failure, discharge from containment sumps, diffuse discharge from operational areas resulting in discharge of water containing high turbidity, hydrocarbons, PFAS.	Cumulative contamination of surface water and/or groundwater resulting in Impact to public drinking water source quality resulting in potential disruption to drinking water supply and/or human health impacts.	Avoid
		• No clearing or mining[122] within:
		  ○ 1 km of the top water level of any water reservoir.
		  ○ Serpentine Pipehead Dam Catchment.
		  ○ Areas with an average pit slope greater than 16% within any RPZ.
		• No mining within 100 m of stream vegetation.
		Minimise
		• Staged clearing and development minimises open areas.
		• Implementation of Drainage Design Manual and Rehabilitation Design Manual.
		• Revision and implementation of the WRMP[123] (Appendix 12), to the extent practicable.
		• Groundwater monitoring program - water level and chemistry and estimated maximum groundwater level minimises groundwater interactions.
		• Mine surface water control designs (detailed in Drainage Design Manual) informed by hydrological studies (flow, infiltration diversion for mine planning storage purposes):
		  ○ Drainage Protection Slots (DPSs)s, comprise shallow (~1.8 m) blasted or ripped ground, if required by risk rating. DPSs capture and infiltrate surface runoff within the blasted voids.
		  ○ In-pit sumps, pit faces and trenches (as per Drainage Design Manual).
		• Development and implementation of DCMPs for pits or haul roads within public drinking water catchments[124], which include:
		  ○ Risk assessment for clearing and pit controls.
		  ○ Clearing and pit catchment and control conceptual designs.
		  ○ Assessment against the Groundwater Risk Assessment Framework (GWRAF).
		  ○ Groundwater investigations.
		• Detailed design process for clearing and pits.
		• Provision of surface water drainage control as-builts[125].
		• Regular pit and clearing inspections and associated adaptive management.
		• Red alert procedure, is a system which is designed as an early warning of forecast for intense rainfall events, allowing mine personnel time to review the mine's drainage controls, winterisation, and state of readiness to cope with the heavy rainfall event.
		• Active water management to prevent loss of containment.
			Medium

[121] 2023-2027 MMP Ministerial Approval Condition 15
[122] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.
[123] 2023-2027 MMP Ministerial Approval Condition 13, 14 and 17.
[124] 2023-2027 MMP Ministerial Approval Condition 11 and 16.
[125] 2023-2027 MMP Ministerial Approval Condition 12 and 16.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Clearing to preferentially occur outside of winter months. • Minimise stream crossings, where possible. • Permit system is in placed to minimise risk associated with installation of stream crossings. • Clearing or construction activities within stream zones will occur during summer or autumn months, as far as practicable. • Stream crossing appropriately designed to minimise impacts and potential for erosion with appropriate surface water controls. Rehabilitate • Prioritise rehabilitation within public drinking water catchments and increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[126].	

Change to stormwater / surface water flow outside of the approved clearing boundary, resulting in impacts to streamzone vegetation and/or catchment inflow	A death or change in vegetation communities resulting from either increased or decreased stream flow.
	
	Increased stream flow resulting in stream erosion and increased turbidity.
		Avoid
		• No clearing or mining[127] within:
		  ○ 1 km of the top water level of any water reservoir.
		  ○ Serpentine Pipehead Dam Catchment.
		  ○ Areas with an average pit slope greater than 16% within any RPZ.
		• No mining within 100 m of stream vegetation.
		Minimise
		• Staged clearing and development minimises open areas.
		• Implementation of Drainage Design Manual and Rehabilitation Design Manual.
		• Revision and implementation of the WRMP[128] (Appendix 12), to the extent practicable.
		• Groundwater monitoring program - water level and chemistry and estimated maximum groundwater level minimises groundwater interactions.
		• Mine surface water control designs (detailed in Drainage Design Manual) informed by hydrological studies (flow, infiltration diversion for mine planning storage purposes):
		  ○ Drainage Protection Slots (DPSs)s, comprise shallow (~1.8 m) blasted or ripped ground, if required by risk rating. DPSs capture and infiltrate surface runoff within the blasted voids.
		  ○ In-pit sumps, pit faces and trenches (as per Drainage Design Manual).
		• Development and implementation of DCMPs for pits or haul roads within public drinking water catchments[129], which include:
		  ○ Risk assessment for clearing and pit controls.
		  ○ Clearing and pit catchment and control conceptual designs.
		  ○ Assessment against the Groundwater Risk Assessment Framework (GWRAF).
		  ○ Groundwater investigations.
		• Detailed design process for clearing and pits.
		• Provision of surface water drainage control as-builts[130].
		• Regular pit and clearing inspections and associated adaptive management
		• Red alert procedure, is a system which is designed as an early warning of forecast for intense rainfall events, allowing mine personnel time to review the mine's drainage controls, winterisation, and state of readiness to cope with the heavy rainfall event.
		• Active water management to prevent loss of containment.
		• Clearing to preferentially occur outside of winter months.
			Medium

[126] 2023-2027 MMP Ministerial Approval Condition 15
[127] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.
[128] 2023-2027 MMP Ministerial Approval Condition 13, 14 and 17.
[129] 2023-2027 MMP Ministerial Approval Condition 11 and 16.
[130] 2023-2027 MMP Ministerial Approval Condition 12 and 16.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Minimise stream crossings, where possible. • Permit system is in placed to minimise risk associated with installation of stream crossings. • Clearing or construction activities within stream zones will occur during summer or autumn months, as far as practicable. • Stream crossing appropriately designed to minimise impacts and potential for erosion with appropriate surface water controls. Rehabilitate • Prioritise rehabilitation within public drinking water catchments and increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[131].	

Discharge of water containing contaminants of concern e.g. PFAS, hydrocarbons, ANFO, nutrients/fertilisers	Cumulative impact to surface and/or groundwater resulting in changes to ecological communities and/or eutrophication of downstream surface or groundwater.
	Localised impact to surface and/or groundwater resulting in changes to ecological communities and/or eutrophication of downstream surface or groundwater.
		Avoid
		• No clearing or mining[132] within:
		  ○ 1 km of the top water level of any water reservoir.
		  ○ Serpentine Pipehead Dam Catchment.
		  ○ Areas with an average pit slope greater than 16% within any RPZ.
		• No mining within 100 m of stream vegetation.
		• Workshops, fuel bays, ablution facilities etc. located outside of RPZ.
		• No mine facilities, wastewater and sewage treatment plants inside the RPZ.
		Minimise
		• DWER licence conditions - sample requirements, discharge requirements (specified discharge points).
		• Inspections and maintenance - Water Crew and Environmental Dept. regular inspections.
		• Treatment plant and associated sump networks constructed and engineered with applicable design standards.
		• Maintain freeboard in treated water sumps.
		• Active water management.
		• Prohibition on use of PFAS containing AFFF- removes further introduction of PFAS into wastewater/ stormwater system from AFFF use.
		• Water meter calibrations (annual)- accurate metering of discharge volumes.
		• Annual liner inspections of lined sumps associated with licenced wastewater treatment facility.
		• Sumps designed and constructed as per the Drainage Design Manual.
		• Regular sump inspections.
		• Red alert procedure, is a system which is designed as an early warning of forecast for intense rainfall events, allowing mine personnel time to review the mine's drainage controls, winterisation, and state of readiness to cope with the heavy rainfall event.
		• Active management of water to prevent overflow (pumping etc.).
		• Fertiliser program (measured fertiliser application, concentration and mix approved by DBCA).
		• Fertiliser program execution on non-rain days/dry part of year- during optimal time of year for uptake of nutrients by plants (Spring).
		• Fertiliser maps produced for the contractor - Overview Map, Individual Helipad Maps - showing all pits to be fertilised from the one helipad location, and Individual map - where greater detail for specific pits is required.
			Medium

Loss of containment and/or discharge of effluent exceeding quality criteria	Localised contamination of surface water and/or groundwater.	Avoid • No clearing or mining[133] within: ○ 1 km of the top water level of any water reservoir.	Low

[131] 2023-2027 MMP Ministerial Approval Condition 15

[132] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

[133] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		○ Serpentine Pipehead Dam Catchment. ○ Areas with an average pit slope greater than 16% within any RPZ. • No mining within 100 m of stream vegetation. • No sewage treatment plants inside the RPZ or within stream zones. ○ No swimming or un-authorised immersion in drinking water reservoirs. Minimise • Sewage Treatment Plants: ○ Ongoing maintenance and monitoring of Sewage Treatment Plants. ○ DoH or Local Government Authority approvals for sewage treatment plants stipulates design and operational controls. ○ Buffer zone of >50m around land irrigation area. ○ Surface irrigation only, no sub-surface discharge. ○ Drip irrigation used. ○ Secondary treatment including chlorination and UV disinfection. • Sewage infrastructure is not located in steep slopes or within proximity to stream zones.	
Non-compliance with water abstraction licence conditions	Impacts to downstream vegetation. Impact to surface water resource.	Avoid • No clearing or mining[133] within: ○ 1 km of the top water level of any water reservoir. ○ Serpentine Pipehead Dam Catchment. ○ Areas with an average pit slope greater than 16% within any RPZ. • No mining within 100 m of stream vegetation. Minimise • Annual downstream vegetation monitoring (photograph points) (Huntly only). • Water Abstraction Licences (RIWI Act). • Water Operating Strategy. • Water meter calibrations (annual). • Regular inspections of water abstraction points. • Regular recording of abstraction volumes. • Maintenance of water abstraction infrastructure e.g. pumps.	

7.3.1 Turbidity

7.3.1.1 Risk-based management approach

Approximately 69% percent of the Huntly and Willowdale mine areas are located within PDWSAs. A critical enabler of Alcoa's ongoing operations is its management of mining activities to prevent impact on these PDWSAs.

Due to changes to the IWSS and acknowledging the increasing risk factors in some mining areas (such as increased slope), Alcoa is working closely with the WC and DWER to identify and manage emerging risks over and above the Water Working Arrangements (Version 5, 2019) requirements. In 2020, feedback from the DWER and WC identified general concern and increased risk to the PDWSA catchment due to the portion of high-slope mining and level of sub-catchment clearing nominated within the initial Five Year Mine Plan.

Parts of the current 24 Month Clearing Schedule are located within areas considered by the DWER and the WC to present an increased risk to the catchment area within the Huntly mine region as they contain:

- Areas with slope greater than 16%; or
- Sub catchments in which mining disturbance is greater than 30% of the total sub catchment area.

Alcoa considers that with the risk-based approach and enhanced management controls outlined in this MMP, these areas can be safely mined and rehabilitated to minimise risk to PDWSAs to as low as reasonably practicable. Further detail on the risk-based approach and enhanced drainage design controls are described in detail in this MMP.

To address concerns associated with mining in these areas, Alcoa proposes a risk-based management approach (Figure 7-11) as part of the ongoing MMP approval and FCA endorsement process. Alcoa's risk-based approach involves doing all things reasonably practicable to ensure that leading environmental practices are adopted as part of its operations.

This risk-based approach is supported by the development of technical workstreams to address knowledge gaps and uncertainties. The workstreams have guided, and will continue to guide, the development of knowledge, technical solutions and improvement projects that are targeted to manage catchment protection risks associated with slope, catchment clearing and groundwater management.

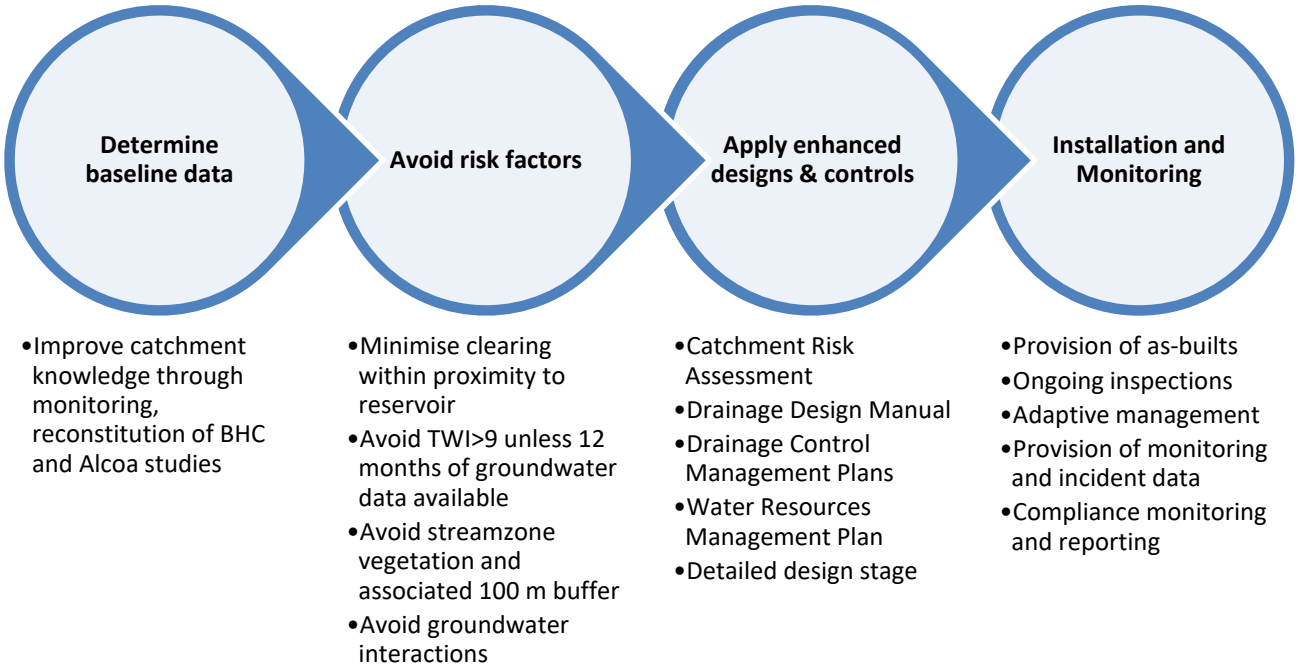


Figure 7-11: Risk based management approach key steps

7.3.1.2 Baseline data requirements

Alcoa has undertaken significant studies and research into the receiving environment (Sections 7.1 and 7.2), that provide a sound basis for the assessment and risk controls provided in this MMP. Alcoa remains focused on opportunities to continue to improve understanding of catchment dynamics and impacts and obtaining further data in that regard. Consultation will occur with the ITAG to develop the full mining cycle planning approach, cumulative catchment scale risk assessment methodology, Drainage Design Manual, Rehabilitation Design Manual and other relevant technical studies or documents[134]. Alcoa will undertake further studies to confirm and refine drainage control effectiveness and improve groundwater knowledge (Section 7.3.1.4.5).

Development of baseline data, focusing on site specific information, to ensure adequate engineered controls and a catchment and sub-catchment activities, will help further minimise impacts.

The following data will be obtained to inform specific designs and incorporated into mine and haul road designs:

- Site specific infiltration rates.
- Baseline surface water data.
- Known information on groundwater levels in the area.
- Information from drilling programs relating to regolith depth.

[134] 2023-2027 MMP Ministerial Approval Condition 25 and 26.

7.3.1.3 Avoidance of risk factors

The Water Working Arrangements agreement between Alcoa, DWER and WC (Version 5, 2019) is the framework under which Alcoa manages its mining operations within the PDWSAs including management of mining adjacent to reservoirs, as defined below:

- **Operational Control Area 1 (OCA1):** A 200 m buffer that extends perpendicular from the reservoir TWL. Access to OCA1 is generally prohibited except for the purposes of constructing, maintaining or travelling along roads or infrastructure, which are approved within the MMP, Five Year Mine Plan or FCAs – or for the purpose of safety inspections prior to blasting activities.
- **Operational Control Area 2 (OCA2):** A 300 m extension perpendicular from OCA1 (total of 500 m from the TWL). OCA2 extends a further 500 m upstream along reservoir tributaries (to an extent of 1,000 m) from the reservoir.

Alcoa has historically applied variable width buffers to stream zone vegetation, based on the order of the watercourse and proximity to reservoirs as outlined above. The mine plan does not include any mining in the stream zone buffers, but does provide allowance for infrastructure corridors i.e., haul roads, of which disturbance to stream zones is minimised. Alcoa will implement a 100 m buffer around streamzone vegetation to minimise impacts to surface water.

As part of the mine plan, Alcoa will consider other key risk factors, and minimise impacts where possible, including:

- Topographical Wetness Factor greater than 9, which are typically found in association with stream zones, unless 12 months of groundwater data is available[135] (at least one record within post-winter to indicate highest groundwater level).
- High potential for groundwater interaction through the implementation of a groundwater separation distance from the base of the pit.
- Streamzone vegetation and an associated 100 m buffer.
- Clearing or mining[136] within:
  - 1 km of the top water level of any water reservoir.
  - Serpentine Pipehead Dam Catchment.
  - Areas with an average pit slope greater than 16% within any RPZ.

As rehabilitation has been shown to decrease high turbidity event risk (DAA 2023), Alcoa will endeavour to minimise open areas within the public drinking water source area, with a priority placed

[135] 2023-2027 MMP Ministerial Approval Condition 6.

[136] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.

on proximity to the reservoir, through rapid rehabilitation. An increase in rehabilitation area will be completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[137] and rehabilitation targets detailed in Table 3-12.

To provide better protection of the drinking water supply to Perth's IWSS, Alcoa has ceased exploration activities and will not progress additional mine development approval applications within the Serpentine Pipehead Dam catchment.

7.3.1.4 Control Design

7.3.1.4.1 Catchment Risk Assessment

Alcoa is developing a catchment risk assessment tool in consultation with ITAG[138], which will consider potential hazards to PDWSAs and other factors to evaluate mining related catchment risk. This is an iterative process that will allow refining of the model to ensure it is more accurate on the completion of each subsequent iteration.

The risk assessment tool will further improve the understanding of inherent and residual risks within Alcoa's operations and ensure that the appropriate level of mitigations are applied. This will support the mine planning process and ongoing management of operational risks.

Iteration 1 of the model has been completed and developed a framework to provide an initial 'proof of concept' for review and feedback by ITAG. Iteration 1 focuses on assessment of relevant water quality contaminants, sources, pathways which could combine to present a risk to the PDWSA reservoirs. Contaminants of concern include:

- Turbidity.
- *E. Coli* and pathogens.
- Hydrocarbons.
- Fire ash.
- PFAS.
- Salinity.

The basic steps undertaken for the assessment are:

- Step 1 – Delineate the stream network, catchment and sub-catchment boundaries.
- Step 2 – Upload the current and future mine plan.
- Step 3 – Undertake an assessment utilising a range of spatial inputs to identify inherent risks (i.e. risk assessment without mitigative controls applied).
- Step 4 - Undertake a risk assessment with controls applied to understand the residual risk.

The output of the process is a spatial risk assessment with outputs available in GIS format and results summarised in a source-pathway-receptor table.

[137] 2023-2027 MMP Ministerial Approval Condition 15
[138] 2023-2027 MMP Ministerial Approval Condition 25

The process allows assessment of each individual sub-catchment and allows aggregation of sub-catchments to determine an overall assessment of the cumulative effects of mining along each stream network.

Future iterations of the project will refine the tool to improve functionality and accuracy.

7.3.1.4.2 Drainage Design Manual

The WA Mining and Haul Road Drainage Design Manual (Appendix 13) guides the design of drainage facilities to serve the mine and haul roads. Darling Range hydrology, with and without bauxite mining, is well documented, including several decades long research catchment studies in relation to key hydrological processes at local and regional scale[139]. Processes include infiltration, surface runoff and groundwater. The Manual outlines Alcoa's approach to drainage management in relation to these processes with feedback and action (Appendix 13).

The purpose of the Manual is to outline the design process for pit and haul road drainage control to manage catchment surface water runoff quality within the agreed water quality trigger. The Manual is derived from risk-based or failure mode-based assessment relative to key factors of concern, and considers the extensive research catchment studies, to manage catchment turbidity.

It contains the Basis of Design information, design criteria and detailed design methodologies required to provide the designs. The Drainage Design Manual is currently under revision, as per 2023-2027 MMP Ministerial Approval Condition 26.

7.3.1.4.3 DCMPs

DCMPs provide an overview of conceptual drainage designs and outcomes from the application of the Drainage Design Manual, including details of surface water storage and management, groundwater separation within pit development, operations and rehabilitation. The intent of the DCMP is to provide details of drainage control design, effectiveness, implementation and maintenance to minimise drainage events. Alcoa has refined DCMP content during 2024 to ensure alignment with regulators and an independent engineering endorsement process.

A DCMP Summary document provides an over-arching reference document to the individual pit and haul road DCMPs. The DCMP Summary Document outlines more specific details on operational practices as they relate to engineered drainage control design, implementation and effectiveness. It

[139] Borg et al 1987a. Stream and ground water response to logging and subsequent regeneration in the southern forest of Western Australia: interim results from paired catchment studies.
Borg et al 1987b. Stream and ground water response to logging and subsequent regeneration in the southern forest of Western Australia: Results from four catchments.
Ruprecht 1991. Soil water investigations within the native Jarrah Forest and rehabilitated bauxite minepits in south-west Australia.
Bari and Croton 1997. The effect of bauxite mining on the infiltration characteristics of darling range soils
Mengler et al 2006. Erosion resistant landform design for steep slopes in rehabilitated bauxite mines
Croton and Reed 2007. Hydrology and Bauxite Mining on the Darling Plateau
Kinal and Stoneman 2012. Disconnection of groundwater from surface water causes a fundamental change in hydrology in a forested catchment in south-western Australia.
Grigg 2017. Hydrological response to bauxite mining and rehabilitation in the Jarrah Forest in south west Australia.
Kinal and Grigg 2020. On the contribution of groundwater to streamflow in laterite catchments of the Darling Range, south-western Australia
[unpublished; Alcoa consultancy engagement with Ruprecht and Dundon independent review] Silberstein 2022. The impact of land use change on sediment mobilisation and stream turbidity: a review

provides further information on drainage control design process and criteria, operational controls, detailed design stage, as-built reviews and inspections and groundwater investigations.

7.3.1.4.4 Detailed Design

Further detailed design occurs at each stage of the process – prior to harvesting, clearing, development, mining and rehabilitation for each individual area:

1. GDP granted prior to harvesting an area.
2. Development Plan developed prior to woody windrow and DPS installation within an area.
3. Soil Movement Plan developed prior to stripping an area.
4. Drill and Blast Plan developed prior to drilling an area.
5. Extraction Plans developed prior to mining an area.
6. Rehabilitation Plans developed prior to rehabilitating an area.

7.3.1.4.5 Studies

Alcoa is committed to further adaptive management and studies. Alcoa supports the reconstitution of ITAG[140] and will consult with ITAG on[141]:

- Cumulative catchment scale risk assessment.
- Full mining cycle planning approach.
- Risk assessment methodology.
- Drainage Design Manual.
- Rehabilitation Design Manual.

Further to ITAG consultation, Alcoa will undertake further studies to confirm and refine drainage control effectiveness and improve groundwater knowledge, including:

- A field study into DPS effectiveness focusing on upslope and downslope surface water characteristics under a range of actual rainfall conditions. This study is expected to provide further evidence of DPS impacts on surface water quality and capacity.
- Erosion modelling and implications of DPS and pit controls, particularly on slopes greater than 16% and effectiveness of the 100 m streamzone vegetation buffer, with the report provided by 21 May 2025. This study is expected to develop a model to predict erosion from cleared and developed areas and impacts of controls and contingency actions (100 m buffer distance from stream vegetation) on turbidity levels. Validation of the quantitative model will be undertaken through further field studies and testing.

[140] 2023-2027 MMP Ministerial Approval Condition 24.
[141] 2023-2027 MMP Ministerial Approval Condition 25 and 26.

- Further infiltration test work on haul road and pit areas under a range of actual rainfall conditions, with the report provided by 21 May 2025. This study is expected to provide evidence of the DPS porosity and infiltration rates utilised.
- Orebody Knowledge Geophysics - A landscape scale airborne geophysical survey for regolith depth, bedrock and clay layer definition is undergoing finalsation. The expected outcome includes an improved hydrogeological and groundwater interpretation to inform mine planning. In addition, a local ground scale geophysical survey is proposed for targeted interpretation. The outcomes from the proposed geophysics programme will inform the regolith depth following bauxite removal and a local scale hydrogeological model. In addition, it is expected to further improve Alcoa's understanding of mine pit and groundwater interaction risk.
- Groundwater Predictive Tool - Groundwater risk is currently assessed using the vertical distance between depth of mining and estimated maximum groundwater levels as a primary criterion. It has been identified that mine water management would benefit from an alternate, easy to use groundwater level predictive tool tailored to the hillslope based upon, but not limited to, rainfall, LAI, clearing extent and duration, terrain slope.

  The Groundwater Predictive (likely Excel-based) tool aims to be simple, transparent and uncertainty-based targeting hillslope pit scale extents. The critical component to this study is to define simplified relationships between the governing hydrogeological, geomorphological and possibly vegetation mapping-based parameters. It will make use of readily available data and other more sophisticated tools existing for the site to capture these simplified relationships within Excel. This tool has been developed to predict clearing induced groundwater rise and rehabilitation recovery to natural trend and is expected to be refined through consultation with ITAG.

7.3.1.5 Installation and Monitoring

Installation of drainage control structures will occur through the mine development process. Three key reviews are undertaken as pits and haul roads are developed:

1. Ongoing active pit reviews.
1. Active pit as-built reviews on a quarterly basis.
2. DPS as-built reviews.
3. Haul roads as-builts upon completion.

Inspections occur as required, to identify any maintenance or improvement requirements. As-built reviews occur as required, to confirm that control installation has been to the prescribed design. If insufficient control capacity is identified, capacity is increased accordingly or adaptive maintenance and improvement is undertaken.

Compliance monitoring associated with 2023-2027 MMP Ministerial Approval Conditions[142] and associated incident reporting[143] will occur. Alcoa has a robust incident reporting and investigation process which includes determination and implementation of corrective and preventative actions as required, and recording of actions in the tracking register.

7.3.2 Catchment Protection

7.3.2.1 Samson Dam Causeway

Haul road and conveyor access to the Orion crusher, from the Willowdale Mine entrance and main workshop, is via a causeway across Samson Dam. The Samson causeway infrastructure assists in managing surface water storage for the Willowdale Mine and is managed in accordance with the approved operating strategy 'Willowdale Mine Operational Strategy, Surface Water Licence 0061024, June 2022'.

A spill recovery shed is located at the Samson Dam causeway to facilitate prompt response to spills. The shed contains spill recovery equipment, instructions, and contact information to use in the event of a spill. An emergency drill is run annually to assess the procedure for responding to a spill on the causeway.

7.3.2.2 Sewage Treatment and Hydrocarbon Storage

Sewage water is treated using biological aeration treatment units that incorporate disinfection. A monitoring program and maintenance contract is in place to ensure treated water meets the requirements for its intended re-use or release to the environment. The released and treated water is reticulated over areas of the forest to encourage infiltration.

Hydrocarbons are stored in above-ground tanks in accordance with the *Dangerous Goods Safety Act 2004.* Oily wastewater from the workshops, fuel bays and vehicle wash-down facilities are collected and treated to remove hydrocarbons and detergents.

At Huntly and Willowdale mining operations, the treated water combines with stormwater collected from light vehicle roads and parking areas, roof water and general surface runoff. All water is collected before being re-used for haul road watering, vehicle wash down and workshop hose down.

An Emergency Response Plan is in place to ensure a rapid response to a pollution emergency. Hydrocarbon Management and Spill Response Training is mandatory for all production and maintenance personnel. Areas impacted by chemical and hydrocarbon spills resulting from mining and associated activities are remediated and recorded in the environmental incident reporting system.

Alcoa has implemented a spill reduction initiative to minimise spill incidents. Details of these are provided in the AER.

[142] 2023-2027 MMP Ministerial Approval Condition 27 – 28, 31 - 37 and s6 exemption.
[143] 2023-2027 MMP Ministerial Approval Condition 29 and s6 exemption.

7.3.2.3 Contaminated Sites Assessment

In January 2021, Alcoa's Huntly Bauxite Mine, McCoy, Myara, Willowdale Bauxite Mine, Arundel and Orion workshop areas, and their immediate surrounds, were classified by DWER as 'Possibly Contaminated – Investigation Required' under the *Contaminated Sites Act 2003.*

A contaminated sites assessment of both Huntly and Willowdale mine sites began in Q4 2020. A detailed site investigation has commenced and remains ongoing.

7.3.2.4 Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) – Water Treatment and Re-use

Alcoa has developed and implemented Interim PFAS Water Management Strategies for WA mining operations at Huntly and Willowdale. The key objective is to manage PFAS-affected water and to minimise impact to the drinking water catchment and the environment.

The permanent PFAS management strategy has been implemented at Willowdale. DWER issued an amended licence to operate (L6465/1989/10) on 20 February 2024, enabling construction and operation of a PFAS water treatment unit, two pre-treatment dams (50ML and 60ML) and three treated water batching ponds (4.5ML each). The prescribed treated water quality limits for the 21 PFAS analytes defined in the licence have been set at the limit of reporting for ultra-trace analysis. Once confirmed, treated water is authorised to be discharged to McKnoes Brook.

Huntly's interim management strategy focuses on the treatment of PFAS-affected water to non-detect levels for re-use on-site via a temporary water treatment plant which was constructed in November 2020. Validation sampling occurs at the PFAS water treatment plant via an autosampler for every 0.5 ML of throughput. This forms a composite sample for approximately 5 ML of water that is discharged to the clean water batching dams. All treated water is batched and confirmed to non-detect levels for all 28 ultra-trace PFAS suite species, as specified in PFAS National Environmental Management Plan 2.0 (PFAS NEMP V2.0), prior to re-use for operational purposes.

Huntly's permanent solution has commenced under a capital project. Stage one will entail the construction of a PFAS water treatment plant at McCoy and associated containment infrastructure. A works approval application under Part V of *the Environmental Protection Act 1986* will be submitted to DWER. The PFAS treatment unit will utilise the same physico-chemical treatment process and achieve compliance with the same water quality limits for PFAS analytes as detailed within the Willowdale mine site licence to operate. Treated water will be reused for operational purposes throughout existing and future mine areas within ML1SA to supplement the site's existing surface and groundwater sources.

Stage two of the Huntly permanent solution will involve the upgrade or replacement of the existing temporary PFAS treatment unit at Myara and the construction of ancillary containment infrastructure. Submission of a works approval application for Stage 2 is currently in preparation.

7.3.3 Monitoring

7.3.3.1 Catchment surface and groundwater monitoring

Alcoa have initiated early project engineering to develop and implement a systematised and continuous water monitoring program for trigger action response. This will consider the existing catchment monitoring network and improvements to other areas of monitoring. This includes the

intent to implement or upgrade network of sensors for mine drainage controls (e.g. haul road storage, mine pit storage and rehabilitation), stream zones and groundwater bores with data gathered to trigger automated alerts to enact the required response, as defined in trigger action response plan (TARP). Alcoa propose to embed a risk-based ranking for water monitoring so that future operations are equipped with the right sensors at the right time and are included in the capital budget (for mine infrastructure) and operational budget (for mine development).

Monitoring locations for turbidity and groundwater bores are determined through a systematic approach process to ensure accuracy, reliability and accessibility. Locations are selected based on:

- Proximity to mine pits and non-mining contributions - to capture potential sources of turbidity and other water quality impacts effectively.
- Accessibility - ensuring that sites are easy to maintain and monitor.
- Optimisation of the functionality of monitoring equipment - ensuring sufficient sunlight for solar powered turbidity monitors and reliable radio communication for data transmission.
- Minimisation of public visibility - to enhance security and prevent potential interference.

All proposed monitoring sites undergo a rigorous approval process, which includes location truthing for heritage status and compliance with regulatory requirements. Sites within Conservation and Land Management Act 1984 (CALM Act) reserves require additional approvals under Regulation 4 or the Disturbance Approval System (DAS) from the DBCA. Once a GDP is completed and approved, notifications are sent to the DBCA and Water Corporation to ensure alignment with broader regulatory frameworks.

Alcoa employs clearly defined thresholds for turbidity and groundwater quality (as detailed in the WRMP – Appendix 12), which are aligned with relevant environmental and regulatory standards. These thresholds serve as triggers for immediate investigation and corrective action when exceeded, ensuring that potential impacts are addressed promptly and effectively. The current monitoring schedule for surface and groundwater involves regular sampling based on site specific conditions and regulatory requirements. This schedule ensures continuous data collection and evaluation, supporting Alcoa's commitment to robust environmental management.

7.3.3.2 Turbidity Monitoring

Alcoa has a turbidity monitoring program (Table 7-17) to assess the performance of mine stormwater management and to better understand catchment performance.

Table 7-17: Turbidity Monitoring Program

Aspect	Details
Compliance monitors	Located immediately upstream of neighbours or public water supply storage reservoirs in accordance with the operational requirements agreed in the Water Working Arrangements. Where telemetry is available, live data is transmitted to site to allow for a quick response to investigate elevated readings. Where transmission via telemetry is restricted, data is downloaded monthly or after every 20 mm or greater rain event. Agreed reporting limits are set by the DWER and WC, and all monitored turbidity events greater than 25 nephelometric turbidity unit (NTU) for an hour or more are reported.

Aspect	Details
Local monitors	Positioned upstream from the compliance monitoring points. Local monitors provide information on the performance of the drainage infrastructure of the mine. They are generally located in streams below haul road crossings or in a series of large mine pits.
Visual checks	Visual Checks of the turbidity control structures are completed when significant rain is predicted and daily during rainfall periods to ensure runoff and turbidity are controlled.
Turbidity Events	All turbidity events above the agreed reporting limits are investigated to determine the root cause and associated corrective actions, where possible. Events with confirmed mining contributions are reported to DWER and the WC within 24 hours of identification. All identified events are reported to DWER and WC in the monthly report as required by the Water Working Arrangements and are incorporated into the Environmental Review submitted to JTSI each year.

Alcoa undertakes a detailed, annual review of the turbidity monitoring network to ensure implementation of turbidity monitors on all streams flowing from the mine site into the drinking water supply reservoir. The location of the existing monitors is provided in Figure 7-12 and Figure 7-13.

Towns
Gooralong Brook Water Reserve
Wungong Brook Catchment Area
Monadnocks East
Myara North
Canning River Catchment Area
Serpentine Pipehead Dam Catchment Area
Karnup-Dandalup Underground Water Pollution Control Area
Monadnocks
Dirk Brook Water Reserve
Myara
Karnup-Dandalup Water Reserve
Yamba
Darling Scarp
Serpentine Dam Catchment Area
North Dandalup Pipehead Dam Catchment Area
O'Neil
Willard
McCoy
Conjurunup Creek Pipehead Dam Catchment Area
White
Duncan
South Dandalup Pipehead Dam Catchment Area
Huntly
Del Park
South Dandalup Dam Catchment Area
Holyoake
Teesdale
Dwellingerup Catchment Area

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- Turbidity Monitors - Installed
- Turbidity Monitors - Proposed
- Catchments
- Reservoir Protection Zone (RPZ)
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservior Top of Water Line (TWL)
- Streams
- National Parks

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-12: Surfacewater monitoring network – Huntly

Scale: 1:115,000

Date Printed: 4/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Samson Brook Catchment Area
Samson Brook Catchment Area
Arundel
Bancell Brook Catchment Area
Samson Brook Catchment Area
Laregó
Stirling Dam Catchment Area
Cornwall

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- Catchments
- Turbidity Monitors - Installed
- Reservoir Protection Zone (RPZ)
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservior Top of Water Line (TWL)
- Streams

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-13: Surfacewater monitoring network – Willowdale

Scale: 1:75,000

Date Printed: 4/03/2025

7.3.3.3 Groundwater Monitoring

Alcoa has installed groundwater monitoring bores to facilitate groundwater investigation, typically for groundwater level monitoring but also for water quality assessment, with the aim of working towards providing at least two years of data ahead of mining in high GWRAF rated areas. Where two years of data is not available, at least one groundwater level is used to develop an estimated maximum groundwater level to inform pit designs.

Bores are constructed in accordance with Minimum Construction Guidelines for Water Bores in Australia (National Uniform Drillers Licencing Committee, 2020). Typically, bores are constructed downslope of proposed clearing areas to facilitate development of a groundwater transect. Mid-slope and up-slope bores may be installed if shallow groundwater is expected.

Bores are installed using appropriate drilling methodologies (e.g., air core, sonic, or similar suitable method for the geology and installation requirements). Any waste generated during bore installation is removed from site. Bore installation is managed as per the exploration drilling low disturbance requirements, and in accordance with Alcoa/DEC Working Arrangements (DEC now DBCA) 2015, and associated limitations on vegetation disturbance (i.e., tree diameter), soil disturbance and dieback management procedures.

Ongoing monitoring of bores (depth to groundwater and water quality) will provide a good understanding of fluctuations in groundwater due to seasonal variation and influence from mining activities. Groundwater bore locations are shown in Figure 7-14 and Figure 7-15. Proposed bore locations should be considered indicative and may change depending on regulatory feedback and appropriate approvals. The drilling program will be undertaken as an Exploration activity, as detailed in Section 2. If clearing outside of the EDF is required, a Native Vegetation Clearing Permit may be required.

Towns
Gooralong Brook Water Reserve
Wungong Brook Catchment Area
Monadnocks East
Myara North
Canning River Catchment Area
Serpentine Pipehead Dam Catchment Area
Karnup-Dandalup Underground Water Pollution Control Area
Monadnocks
Dirk Brook Water Reserve
Myara
Karnup-Dandalup Water Reserve
Yamba
Darling Scarp
Serpentine Dam Catchment Area
O'Neil
North Dandalup Pipehead Dam Catchment Area
Willard
McCoy
Conjurunup Creek Pipehead Dam Catchment Area
White
Duncan
South Dandalup Pipehead Dam Catchment Area
Huntly
South Dandalup Dam Catchment Area
Del Park
Holyoake
South Dandalup Dam Catchment Area
Teesdale
Dwellingerup Catchment Area

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- Groundwater Monitoring Bores
- Catchments
- Reservoir Protection Zone (RPZ)
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservior Top of Water Line (TWL)
- Streams
- National Parks

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-14: Groundwater monitoring bore network – Huntly

Scale: 1:115,000

Date Printed: 4/03/2025

Teesdale
Holyoake
Amphion
Darling Scarp
Orion
East Murray
Samson Brook Catchment Area
Samson Brook Catchment Area
Arundel
Bancell Brook Catchment Area
Samson Brook Catchment Area
Laregoo
Stirling Dam Catchment Area
Cornwall

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Rehabilitation
- Cleared Areas
- Groundwater Monitoring Bores
- Catchments
- Reservoir Protection Zone (RPZ)
- OCA1
- OCA2
- 1km Radius from Reservior TWL
- Reservior Top of Water Line (TWL)
- Streams

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 7-15: Groundwater monitoring bore network – Willowdale

Scale: 1:75,000

Date Printed: 4/03/2025

7.4 Assessment of impacts

Alcoa has undertaken a risk-based approach to assess impacts. The risk assessment methodology tables can be found in Appendix 2.

The direct impacts to PDWSA catchments from 24 Month Clearing Schedule are medium, with the 24 Month Clearing Schedule being less than 3% of each catchment, besides the Serpentine Dam Catchment Area which is expected to result in up to 8% potential impacts to the catchment area.

Alcoa have committed to not mine in the Serpentine Pipehead Dam PDWSA, which has the highest risk associated with direct faecal deposition and turbidity. It is also proposed to:

- Limit actual clearing to 800 ha of native vegetation per calendar year[144] with unused capacity for any year able to be rolled over into the following year with approval from the Minister for State Development[145].
- Not undertaken any clearing or mining[146] within:
  - 1 km of the top water level of any water reservoir.
  - Serpentine Pipehead Dam Catchment
  - Areas with an average pit slope greater than 16% within any RPZ
- Prioritise rehabilitation within the Serpentine Dam RPZ.
- Minimise clearing inside of the RPZ through move to O'Neil mine region
- Prioritise rehabilitation within public drinking water catchments and increase rehabilitation area completed each consecutive year, to achieve a minimum of 3,159 ha between 2024 to 2027[147]

A risk-based approach is undertaken within constrained areas, with additional details provided within FCAs. The Drainage Design Manual and conceptual DCMPs will be utilised to ensure drainage controls minimise drainage events. Multiple barriers are implemented to prevent impacts to downstream drinking water reservoirs. The resulting risk will be medium.

The potential impacts from turbidity in rehabilitated areas will be lower than active mine areas. Rehabilitation vegetation establishment is expected to provide long-term soil protection from erosion and rehabilitation design will maximise water infiltration and retention.

The impacts of expected minor increases to stream salinity are considered low. Research indicates that streamflow salinity is expected to decrease during mining then increase during rehabilitation. However, an inverse trend in streamflow yield is expected with an increase in streamflow during

[144] 2023-2027 MMP Ministerial Approval Condition 9.
[145] 2023-2027 MMP Ministerial Approval Condition 10.
[146] 2023-2027 MMP Ministerial Approval Condition 5 and s6 exemption. Infrastructure, monitoring and rehabilitation activities may still occur within these areas (2023-2027 MMP Ministerial Approval Condition 6 and s6 exemption). In addition, the areas will have drainage controls, stabilised or rehabilitated as per 2023-2027 MMP Ministerial Approval Condition 7 and s6 exemption.
[147] 2023-2027 MMP Ministerial Approval Condition 15

mining, and a decrease during rehabilitation. The predicted increase in reservoir salinity, of up to 3% compared to the no-mining case, is within acceptable limits.

The potential impacts from contamination from hazardous materials and pathogens is considered medium.

8 Air Quality

8.1 Receiving environment

8.1.1 Baseline monitoring

The Huntly monitoring station (Yamba) is located within the Myara mine region and consists of a High Volume Air Sampler (HVAS) and Beta Attenuation Monitor (BAM). Total Suspended Particles (TSP), particulate matter less than 10µm in aerodynamic equivalent diameter (PM10) and particulate matter less than 2.5µm in aerodynamic equivalent diameter (PM2.5) is monitored at these locations. Willowdale mine does not currently have any monitoring stations.

A weather station for the Huntly mine is located approximately 9km WNW of the Myara crusher. The Willowdale weather station is located at Nanga Dell, approximately 6 km north of the Orion crusher. Specialised weather forecasts for mining operations are received, which include rain and wind forecasts.

8.1.2 Existing air quality

Air quality within the region is typical of a rural area. The dominant dust sources influencing air quality in the local area include:

- Mine operations – including dust from stockpiles, blasting, bauxite handling and haulage, truck and equipment movements, crushing and conveying and any burning activities.
- Agriculture activities – including wind eroded dust from cleared areas.
- Motor vehicle emissions – from combustion of fuel in mining and non-mining vehicles and equipment.
- Domestic fuel burning - gas, liquid, solid.
- Regional events - such as dust storms, dust events during harvest, prescribed burning and wildfires.

Ambient Total Suspended Particulates (TSP), PM_{10} and $PM_{2.5}$ data was sourced from the Alcoa Yamba Drive dust monitoring station installed and operated by Ecotech Pty Ltd and managed by Alcoa. Concentrations recorded over the period March 2018 to February 2019 are summarised in Table 8-1.

Table 8-1: Yamba Drive Ambient air quality concentrations, March 2018 to February 2019

Pollutant	Averaging period	Measured concentration (µg/m^3) with extreme dust events removed
TSP	24 hour maximum	69.0
	Annual average	20.2
PM_{10}	24 hour maximum	47.3
	Annual average	15.0
PM_2.5	24 hour maximum	20.3

Pollutant	Averaging period	Measured concentration (µg/m^3) with extreme dust events removed
	Annual average	4.5

8.1.3 Sensitive receptors

Consistent with the NSW EPA (2016 and 2022) Approved Methods, sensitive receptors were defined as a location where people are likely to work or reside and may include a dwelling, school, hospital, office or public recreation areas. A review of aerial photography identified nearby sensitive receptors, with consideration given to Jarrahdale and Dwellingup townsites, rural properties, overnight campsites (e.g. along the Bibbulmun Track) and other dust sensitive receptors.

A total of five sensitive receptors were identified for the Huntly mine and eight for the Willowdale mine within 2 km of the 24 Month Clearing Schedule's mining and haul road activities (Figure 8-1 and Figure 8-2):

- Serpentine Dam lookout, café, playground and picnic area.
- Mount Solus.
- Six private properties surrounding Larego.
- Mt William recreation facility.
- Hoffman Mill recreation facility.

Three Alcoa owned properties were excluded from this assessment.

Towns
Kitty's Gorge
Serpentine Falls
Serpentine National Park
Balmoral
Munda Biddi
Balmoral extension
Myara North
Sullivan Rock trail
Monadnocks East
Bibbulmun Track
Monadnocks
Myara
Darling Scarp
Willard
McCoy
O'Neil
White
Huntly
Duncan
Munda Biddi
Del Park
Holyoake
Whitstein
Blaze
Marrinup
Solitaire
BFG
Emu Run
The Mack
Bibbulmun Track
Les Couzens
Murray Valley Circuit
Teesdale

Legend

Mining Regions
24 Month Clearing Schedule
City/Town
Rehabilitation
Cleared Areas

Sensitive Receptors
Alcoa property
Campsite
Cemetery
City/Town
Government property
Private property
Recreation
Other

Land Tenure
Alcoa
Government
Karnet
Private
Reserve

Conservation Parks
Major Dams

Trails
Bibbulmun Track
Trail
Munda Biddi

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 8-1: Sensitive receptor locations - Huntly

Scale: 1:115,000

Date Printed: 7/10/2024

Teesdale
Holyoake
Murray Valley Circuit
Lane Poole Conservation
Murray Valley Trail
Bibbulmun Track
Nyingarn Bidi
Amphion
Lane Poole Conservation
Chudlitch
Waterous loop
Darling Scarp
Orion
Waterous loop
Unnamed Walk Trail
Captain Fawcett
East Murray
South Shore
King Jarrah
Munda Biddi
Nanga Heritage Circuit
Lane Poole Conservation
Arundel
Munda Biddi
Nanga Heritage Circuit
Laregо
Cornwall
Lake Brockman Shared Use Trail
Proposed area for MTB trail network
Munda Biddi
Bridge

Legend

Mining Regions
City/Town
24 Month Clearing Schedule
Rehabilitation
Cleared Areas

Sensitive Receptors
Alcoa property
Campsite
Private property
Recreation

Land Tenure
Alcoa
Government
Karnet
Private
Reserve

Major Dams
Conservation Parks

Trails
Bibbulmun Track
Trail
Munda Biddi

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 8-2: Sensitive receptor locations - Willowdale

Scale: 1:75,000

Date Printed: 2/10/2024

8.2 Potential environmental impacts

Clearing of native vegetation and soil disturbance from construction, operation and rehabilitation activities have the potential to impact air quality and associated amenity.

Dust is the primary air emission that could occur during mine development, mining and rehabilitation operations. Dust emissions occur from the following sources:

- Stripping, and stockpiling of topsoil and overburden.
- Drilling and blasting or ripping of caprock.
- Excavation and handling of caprock and friable/fragmental bauxite.
- Movements of excavators, dozers, loaders and scrapers in the mine pits
- Wheel generated dust from haul truck movements on unsealed surfaces.
- Transportation of material by conveyor.
- Graders maintaining haul routes.
- Loading and unloading at Run of Mine (ROM) stockpiles.
- Processing of bauxite material including crushing and sizing.
- Wind-blown dust emissions from uncovered stockpiles and cleared native vegetation/land and soil disturbance for mining activities.

Dust modelling has not been completed for the mine activities. The implementation of management measures, such as dust planning controls and targeted source mitigation measures (dust suppression) were considered to effectively reduce air quality impacts. Whilst sensitive receptors occur within 2 km, none are within 500m of haul roads or mine pits.

8.3 Mitigation

Alcoa's environmental management incorporates the mitigation hierarchy, which is in order of priority:

- Impact avoidance.
- Impact minimisation.
- Rehabilitation.

A risk-based approach has been undertaken to align with Alcoa's environmental management system and management plans. Associated mitigation actions are provided in Table 8-2 as a risk register and the risk assessment methodology is provided in Appendix 2.

Alcoa remains focussed on opportunities to continue to improve understanding of air quality impacts and further obtain data in that regard. Alcoa intends to achieve this opportunity by implementing the following:

- Development of an air quality model to confirm potential impacts to sensitive receptors.
- Development of a Dust Management Plan.

- Dust deposition monitoring in association with vegetation health as per FVMP (Appendix 10).

Table 8-2: Avoidance and minimisation of potential impacts to air quality

Risk	Description of Impact	Risk Controls	Residual Risk Rating
Uncontrolled emission of dust resulting in offsite impacts (including operations, blasting, conveyor trace and Refinery stacker)	Environmental pollution Non-compliance with legal and other requirements Non-compliance with internal standards Intensified regulatory scrutiny approvals / conditions to access ore Increase in community complaints Impaired vision for operators / community (dust close to boundaries) Health impacts (respiratory)	Minimise • Undertake dust suppression activities for high use of haul roads and conveyors as per internal dust management procedure. • Maximise efficiency of loads when transporting ore (including haul trucks and conveyers). • Use dust suppression measures on exposed areas where possible. • Investigate alternatives for the wood waste burning of clearing residues to reduce the particulate emissions in the local airshed. • Induction packages – the workforce will be made aware of dust generation and control measures. • Routine housekeeping practices around central facilities and workshops will be implemented to reduce dust generation. • Optimising blast charge sizing and spaces to avoid unnecessary energy releases which has the potential to generate dust. • The location of haul roads, conveyors, mine pits and other infrastructure gives consideration to separation distance from receptors to reduce air quality impacts. Rehabilitate • Minimise open area footprint and rehabilitate or cover (using vegetation, rock, water and/or dust suppressant) exposed areas as soon as practicable	Medium

8.4 Assessment of impacts

The mine activities are expected to have medium impacts to air quality. There is an absence of sensitive receptors within close proximity to the 24 month clearing schedule and management controls are considered adequate. Alcoa is committed to increasing monitoring associated with dust emissions.

9 Social Surroundings (Amenity)

9.1 Receiving environment

9.1.1 Baseline surveys

Alcoa has undertaken (or considered) key social surroundings (amenity) studies (Table 9-1). Historical noise modelling had also been completed for the Huntly region.

Table 9-1: Social Surroundings (Amenity) baseline studies

Year	Author	Survey name	Details
2015	SVT Engineering Consultants	Environmental Noise Impact Assessment for the proposed mining operations at Larego region	A draft report which assesses potential landscape and environmental noise impact assessment for the proposed mining operations at Larego Region. The objective of the assessment was to determine if compliance is achieved for the proposed operations with the Environmental Protection (Noise) Regulations 1997 (the Regulations) and to identify noise contours to facilitate operational planning in line with the environmental requirements of the Regulations. An acoustic model was developed, and nine sensitive receptors assessed for worst-case meteorological conditions. and visual impacts of mining within the O'Neil region
2021	GHD	Landscape and Visual Impact Assessment for Huntly Mine - Myara North and Holyoake	Landscape and visual impact assessment for the Revised Proposal
2021	Wood	Noise Assessment for Huntly Mine – Myara North and Holyoake	Noise modelling and assessment for the Revised Proposal
2022	Wood	Mining Operations Noise Management Maps	Noise modelling was completed for the Larego mine region based on various pit locations and worst-case noise propagation.
2023	GHD	Holyoake Mine Development – O'Neil East Landscape and Visual Impact Assessment	The assessment, covering a 10 km radius, involved a desktop review, site inspections, and analysis of landscape character units (LCUs) and visual impacts from five viewpoints. The study area includes mining earthworks, infrastructure, and construction activities, with progressive rehabilitation. The Darling Plateau Forest (LCU1) was identified as highly sensitive, with significant impacts due to valued forest areas, while the existing mining area (LCU2) showed low sensitivity and impact. Visual impacts were assessed from Mount Wells, Boonering Hill, Northeast Road, and Mount Cooke, with moderate to high-moderate impacts noted, especially from Boonering Hill. Mitigation measures include best

Year	Author	Survey name	Details
			practice siting, protection of existing landscape character, and rehabilitation of cleared areas. The report concludes that while significant impacts are anticipated, especially in LCU1, adherence to mitigation strategies can reduce these effects.

9.1.2 Townsites

Land use within the mine regions predominantly comprises State Forest and other forested land reserved for conservation and recreation and there are several towns in proximity to the mine regions:

- Dwellingup – Shire of Murray
- Jarrahdale – Shire of Serpentine Jarrahdale
- Keysbrook – Shire of Serpentine Jarrahdale.
- North Dandalup – Shire of Murray.
- Waroona – Shire of Waroona.
- Harvey – Shire of Harvey.

The towns are generally surrounded by pockets of rural properties. The townsites, surrounding rural properties and recreational trails and facilities are considered sensitive receptors to amenity impacts. Receptors associated with night-time occupation, including residences and recreational campsites, have a higher sensitivity, particularly with respect to noise levels.

There is a network of public roads, consisting of highways, roads and informal tracks throughout the mine regions. The road network is utilised for recreational, transport and land management purposes for a variety of users.

9.1.3 Recreational Trails and Facilities

The Huntly and Willowdale mine region interactions with the State Forest (DCBA 011) can be seen in Table 9-2. There are no interactions within the timber reserves for either Huntly or Willowdale mine regions.

Table 9-2 State Forest Interaction

Item	Huntly Mine Region Open Areas (ha)	Huntly Mine Region Rehabilitated Areas (ha)	Huntly 24 Month Clearing Schedule (ha)	Willowdale Mine Region Open Areas (ha)	Willowdale Mine Region Rehabilitated Areas (ha)	Willowdale 24 Month Clearing Schedule (ha)
State Forest Interaction	4,026	13,212	2,757	1,689	4,571	984

The conservation and recreation reserves within proximity to the mine regions include:

- Serpentine National Park.

- Lane Poole Conservation Park and Reserve.
- Monadnocks Conservation Park.

Recreation facilities within proximity to the mine regions include:

- The Bibbulmun Track.
- The Munda Biddi Trail.
- Logue Brook Dam (also known as Lake Brockman).
- Hoffman Mill.
- Lake Navarino (Waroona Dam) is located within the inactive Orion mine region.
- Harvey Dam.

Logue Brook Dam is a recreational water body approximately 10 km west-southwest of the Larego crusher that supports:

- Irrigation water.
- DBCA-managed campsites for overnight stays.
- A privately-owned tourist park for overnight stays, permanent dwellings and associated café.
- Recreation and water ski areas.
- The Munda Biddi Trail.

DBCA-managed camping and associated recreation activities at Hoffman Mill were closed in 2022 due to noise, public safety and amenity impacts of the Larego operations. Alcoa recognises the important timber-mill heritage of Hoffman Mill and has committed to not mine the area designated as camping facilities and facilitates the annual Back To Hoffman reunion event. Alcoa will facilitate ad-hoc day-use access process for people affiliated with the heritage of the area.

9.1.4 Landscape and Visual Amenity

Via the Landscape and Visual Impact Assessment studies detailed in Table 9-1, three Landscape Character Units (LCUs) have been described within the mine regions:

- LCU1 – Darling Plateau Forest - Land use typically includes State Forest used for logging, conservation and tourism such as camping, walking and cycling trails. Key reserves include Lane Poole Conservation Park and Reserve, Serpentine National Park and Monadnocks Conservation Park. There is tourism value associated with the forest, Lane Poole Reserve, Monadnocks Conservation Park, Serpentine Dam, Logue Brook Dam, Munda Biddi Trail and Bibbulmun Track. There are several gravel roads and 4WD tracks, walking and cycling trails, and large water-storage dams. Views are typically enclosed apart from elevated areas along the Bibbulmun Track, some of which have panoramic views. Alcoa considers LCU1 as having a high landscape character value.

- LCU2 – Previous and Existing Mining – land use predominantly includes mining and associated infrastructure such as the existing Alcoa mines, the Boddington Gold Mine, and associated vegetation clearing within the Jarrahdale State Forest and Dwellingup State Forest. There are open views across cleared vegetation and a mining landscape. There are no specific values associated with LCU2 and it is considered as having a low character value. Following rehabilitation, closure and relinquishment the mine areas will transition to State Forest with comparable landscape character to LCU1.
- LCU3 – Darling Uplands Peri-Urban - Land use is typically residential within the built-up areas of the towns of Jarrahdale and Dwellingup and rural residential properties are located on the outskirts. There are retail and commercial areas within Jarrahdale and Dwellingup including general stores, cafes, and pubs. Views into the surrounding forests and distant undulating terrain make up a key quality of the area's landscape character.

  Dwellingup and Jarrahdale are growing trails towns that support outdoor activities within the surrounding natural environment. The Dwellingup Trails and Visitors Centre provides linkages to the Hotham Valley Tourist Railway (located within LCU3), Munda Biddi Trail and Bibbulmun Track. LCU3 is considered as having a high landscape character value.

Table 9-3 summarises the LCU landscape values and impacts of change.

Table 9-3: Summary of impacts to landscape character

Landscape Character Unit	Name	Landscape value	Susceptibility to change	Sensitivity to change
LCU1	Darling Plateau Forest	High	High	High
LCU2	Previous and Existing mining	Low	Low	Low
LCU3	Darling Uplands Peri-Urban	High	High	High

The Darling Plateau contains multiple sensitive receptors of varying levels of significance due to the valued natural setting and the quality seen throughout the surrounding forest and landscape. These receptors include residents, track and trail users, recreational users, campers, tourists, and road users. The existence of these receptors raises concerns regarding the potential visual impact on the area generally, and on nearby communities, private properties, State Forest, tracks, trails, campsites, and roads.

Elevated viewpoints are considered to have a higher likelihood of visual amenity impacts.

A Desktop Review of potential impacts to landscape character has been completed for both mines.

The Willowdale mine region and surrounds are covered by forests and therefore views to mining will be effectively screened by vegetation. The following viewpoints were identified:

- The Mt William fire tower affords elevated views to the north and east over the Larego area.
- Zigzag, Willowdale and Driver Roads have visible clearing within proximity.

Within Huntly, various elevated viewpoints were identified:

- The Bibbulmun Track traverses the forested landscape, connecting Mount Cooke, elevated lookouts within the Monadnocks Conservation Park, Boonering Hill and Kimberling Hill.
- Mount Cooke (elevation of 582 m).
- Mount Solus (elevation of 572 m).
- Mount Wells (elevation of 542 m).
- Boonering Hill and Kimberling Hill (elevations of over 500 m).

Alcoa also considers viewpoints along public access roads in mine planning.

9.1.5 Noise and blast

An environmental noise model, developed for Myara mine region in 2009, identified the neighbouring properties most likely to be affected by mining operations. It was then used to assist the area's mine planning, with a 4 km buffer used for community consultation. Live operational noise monitoring is utilised to monitor and manage noise impacts.

The Willowdale Mine uses noise modelling to establish day and night mining areas and manage the risk of noise impacts on noise sensitive receptors. Equipment operating in noise sensitive mining areas is monitored by fixed noise monitors on or near private property in the Orion mining region.

Blast noise is monitored in the community and at neighbouring properties, which have been identified by the Blast Acoustic Model (BAM) as most likely to be impacted by a blast.

The Baseline Noise Monitoring prepared by GHD details the baseline ambient noise monitoring conducted in December 2023 and January 2024 for the proposed O'Neil and CMR-B mining areas within the Holyoake East mining region. The study focused on three noise-sensitive locations: White Horse Hills campsite (NSR1), Mount Wells campsite (NSR2), and Nerang Bibbulmun campsite (NSR3). Noise loggers recorded ambient noise levels at 15-minute intervals, and audio data were analysed at NSR1 and NSR2. The results indicated that nighttime LA90 values (equivalent continuous sound level over the measurement period) ranged from 20 to 44 dB(A) at NSR1, while daytime noise levels at NSR2 were influenced by the nearby Boddington gold mine, with low-frequency noise detected. NSR3's noise levels were consistent with a rural setting. The audio analysis revealed high-frequency insect noise at night and minimal traffic or aircraft noise

Sensitivity modelling has identified preliminary sensitivity zones (Table 9-4) and their zones of distances from sensitive receptors. Based on the above noise sensitivity zones, a 2 km distance has been adopted as a conservative screening criterion.

Sensitive receptors within 2 km of the 24 Month Clearing Schedule's mining and haul road activities were identified. Three sensitive receptors were identified for the Huntly mine and two for the Willowdale mine (Figure 8-1 and Figure 8-2) including:

- Serpentine Dam lookout and café.
- Mount Solus.
- Mt William recreation facility.
- Hoffman Mill recreation facility.

Alcoa owned properties were excluded from this assessment.

Table 9-4: Noise sensitivity zones

Zone	Sensitivity	Definition	Zone distance, m
Restricted mining zone	Severe	Zones adjacent to receivers. High risk of non-compliance and/or complaints. Compliance with Assigned Levels is likely to require no mining or highly restricted mining with extensive controls. Opportunistic mining may be possible under 'favourable' weather conditions. Careful management and noise monitoring will be required.	Day – 500 Night – 1,000
High specification low noise mining zone	High	Zones closest, but not adjacent, to receivers. Mining noise emissions are controllable through 'optimised mining' with a low noise fleet. Mining activities require evaluation through active modelling and customised noise control strategies for day and night.	Day – 1,000 Night – 1,500
Attenuated Mining Zone	Medium	Zones further away but still close to receivers. Mining required with noise controlled fleet. Activities require evaluation through active modelling to determine the risk of exceedance during night mining with customised noise control strategies	Day – 1,500 Night – 3,000
Standard Mining Zone	Low	Mining with Alcoa's existing fleet is possible without requiring additional noise controls or management	Day – >1,500 Night - >3,000

9.1.6 Informal Comprehensive Adequate Representative Reserves

Currently, Informal Comprehensive Adequate Representative (CAR) Reserves are mapped by 0.5 Ha pixels, representing a relatively coarse scale. As a result, some ore bodies and haul roads that have intersected mapped Informal CAR Reserves in the past have not actually impacted on the reserved ecosystem. Surrounding forest has been mapped as Informal CAR due to the mapping scale.

An environmental impact assessment (EIA) is completed when proposed clearing for mining intersects with CAR reserves. The EIA includes vegetation, fauna, and Aboriginal cultural heritage surveys. Mine plans are altered to minimise the impact of clearing on Informal CAR Reserve values.

ITAG is the delegated authority to assess the impact of disturbance of Informal CAR Reserve and makes a recommendation to BSEC. Potential Informal CAR interactions over the term of this plan are shown in Figure 9-1.

Towns
Serpentine National Park
Myara North
Monadnocks East
Monadnocks
Myara
Beryl
O'Neil
Duncan
McCoy
Willard
White
Darling Scarp
Huntly
Del Park
Holyoake
Teesdale
Lane Poole Conservation
Lane Poole Conservation
Amphion
Orion
Hotham
Marradong
Lane Poole Conservation
East Murray
Arundel
Saddleback
Larego
Bednall
Cornwall
Leach

Legend

- Mining Regions
- 24 Month Clearing Schedule
- Diverse Ecotype Zones CAR
- CAR
- Non-CAR
- Overnight campsites
- Trails
- Bibbulmun Track
- Trail
- Munda Biddi
- National Parks
- Conservation Parks
- Major Dams
- Forest Management Plan
- State forest
- Timber reserve

Alcoa

N

0 1 2 4 6 8 km

2025 - 2029 Mining and Management Plan

Figure 9-1: Recreational facilities

Scale: 1:230,000

Date Printed: 7/10/2024

9.2 Potential Impacts

The following activities have the potential to impact social surroundings (amenity):

- Clearing of native vegetation.
- Construction, mining, refining and other operational activities including transport.
- The physical presence of infrastructure.
- Rehabilitation activities.

The mine activities may result in the following potential impacts to social surroundings (amenity):

- Impacts to amenity through construction and operational noise.
- Impact to visual amenity and sense of place from mining and refining operations and associated infrastructure including lighting.
- Impact on recreational use of areas due to direct disturbance, access constraints, noise, dust deposition and traffic.

9.2.1 Impacts to amenity through operational noise

Potential noise generating sources during construction and mining activities include:

- Fixed plant: ROM, crusher, diesel generators and overland conveyors.
- Mobile plant in mine pits and haul roads: excavators, haul trucks, loaders, graders, dozers, scrapers, blast drills, road trains, ancillary trucks, rock breaking excavators, watercarts.

The dominant noise sources affecting the received levels at sensitive receptors are the operational mobile equipment within mine pits and haul roads and undertaking development and rehabilitation activities. Fixed plant is located relatively centrally within the mine regions and is generally further from sensitive receptors, thereby contributing less noise.

Noise levels will vary depending on the type of activity taking place and the environmental conditions. The Assigned Levels under the Noise Regulations vary depending on the time of day (Table 9-5).

Table 9-5: Assigned Levels at sensitive receptors

Time of Day	Assigned Level – L_{A10} dB(A)
0700 to 1900 hours Monday to Saturday	45
0900 to 1900 hours Sunday and public holidays	40
1900 to 2200 hours all days	40
2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35

Application of noise sensitivity zones (Table 9-4) is expected to prevent exceedance of nighttime Assigned Levels at any sensitive receptor. Whilst sensitive receptors occur within 2 km, no residential

or overnight campsites are within 500m of haul roads or mine pits associated with the 24 Month Clearing Schedule, therefore are not within the Restricted Mining Zone. Only recreational facilities exist within 500 m of haul roads or mine pits.

Blasting will occur on an approximately daily basis during mining, generating air blast noise and near field vibration. Mining associated with the 24 Month Clearing Schedule will not occur within 1.2 km of sensitive receptors. Based on daily assessments, a blast would not occur if the airblast noise maximum limit exceeds 120 dB(L).

9.2.2 Impacts to amenity from traffic

In the interest of safety, some public roads and forest access ways, within and adjacent to the mine regions, are closed and manned by sentries for short periods during blasting.

9.2.2.1 Huntly Mine

At Huntly, access along North Road remains open to allow public access from Huntly Road to the intersection with Whittaker Road. Access roads to the east of the McCoy and O'Neil mining regions will remain closed to the public until mining activity is complete.

Alcoa installed gates around the perimeter of the Myara region in April 2011. Access is closed to the public south of Kingsbury Drive and east of Scarp Road. Access plans were reviewed with DBCA and WC to determine an appropriate boundary prior to the installation of gates. An extension of the Myara region will require a new access and gating plan be developed with DBCA in coming years.

A sealed road has been constructed to access the Myara offices and the crusher. The road runs from Scarp Road to the west of the Myara crusher site and can be accessed via Hines Road in North Dandalup. Large service vehicles and machinery are not permitted to access Myara from this road to reduce heavy vehicle interaction with surrounding neighbours. These vehicles must access the site via the haul road system from McCoy instead.

Access to Disease Risk Areas (DRA) within the mine is by a permit system for all vehicles. This system was developed through the Alcoa/DEC Working Arrangements.

9.2.2.2 Willowdale Mine

At Willowdale, access around the mining region is provided by Scarp Road on the western flank from Nanga Brook Road through to Willowdale Road. Access from Nanga Brook Road through to Nanga Road on the eastern boundary of the Orion mining region has been maintained via an underpass beneath the northern arterial mine haul road. Nanga Road provides public access north and south along the western boundary of the Lane Poole Reserve, outside of the mining area. An underpass is in place to maintain north-south access along Nanga Road, as Gibber Road was extended to reach the Keats Mining Region. A section of King Jarrah Track was also closed to the public for the period of Keats mining. However, the underpass on Nanga Road has a safety barrier to allow the thoroughfare of pedestrians/cyclists. In 2015, Nanga Road was deviated to meet Driver Road.

Willowdale Road provides public access from the South Western Highway to Zig Zag Road, which now diverts onto Nanga Road and Driver Road to access forest regions to the east. East-west access has been maintained along Driver Road via an underpass to enable access to Logue Brook Road on the eastern boundary of the mine. From Willowdale Road the public can use Hoffman Road and then

Dandenong Formation to head south along the western boundary of the mine. Kevron Road and Clarke Road form the southern boundary of the Larego mine region. Official access to Willowdale mine is via the security gate at the Arundel offices on Willowdale Road. The Larego crusher site can be accessed via the Willowdale Road extension from Arundel. Approved personnel are granted access through the security gates using a personal identification number, which records personnel and contractor vehicular movement. Service vehicles and employees can also access the previous crusher region at Orion via Nanga Brook Road by using their personal identification number to operate the security gate.

9.2.3 Impacts to visual amenity from mining operations

Impacts to landscape character occur as a result of clearing and mine operation. Impacts to the Darling Plateau Forest and Darling Uplands Peri-Urban are expected as a result of additional clearing associated with the 24 Month Clearing Schedule. Both LCUs have high landscape value and are considered to have a high susceptibility and sensitivity to change. 1,703 ha of clearing associated with Huntly and 787 ha of clearing associated with Willowdale is expected to impact these LCUs.

Visual amenity impacts are also expected to occur and are considered to be higher at elevated viewpoints with public access and public access roads.

9.2.4 Direct impacts on recreational use of areas

The 24 Month Clearing Schedule and 5 Year Clearing Plan are not expected to have any direct impacts on recreational areas or prevent access to recreational facilities. Clearing is associated with current mining regions which have already implemented access controls.

9.2.4.1 Public Recreational Management - Willowdale

The relocation of Alcoa's mining operations to the Larego region at the Willowdale mine site in 2020 temporarily impacted formal public recreational areas like the Munda Biddi Trail. The relocation is also causing long-term closure of Hoffman Mill as a camping site and day use area. As referenced by the Minister for State Development's previous MMP approvals this closure will be at a cost neutral basis for DBCA. The Munda Biddi Trail traverses the Larego area, and any future realignment would be required to be negotiated with DBCA.

9.2.5 Impacts to amenity from light spill

There are existing light sources in the vicinity of the mine regions:

- Alcoa mine facilities including permanent lighting at mine facilities and conveyor transfer stations, vehicle headlights and mobile light towers at operating mine pits.
- Townsites including North Dandalup, Keysbrook and Waroona and surrounding rural properties (which emit limited light).
- Other mines.

Due to the distance from towns, rural properties and overnight campsites, it is unlikely that lighting for the new mine facilities will have a significant impact on nighttime amenity. Mine pit lighting may therefore cause impacts to nighttime amenity for rural properties close to the boundary of the mine

regions. Mine pit lighting is unlikely to cause impacts to nighttime amenity at townsites, Logue Brook Dam, Lane Poole Reserve or at campsites on the Bibbulmun Track due to separation distances.

9.3 Mitigation

Alcoa's environmental management approach incorporates the mitigation hierarchy, which is in order of priority:

- Impact avoidance
- Impact minimisation
- Rehabilitation.

A risk-based approach has taken to align with Alcoa's environmental management system and management plans. Associated mitigation actions are provided in Table 9-6 as a risk register and risk assessment methodology is provided in Appendix 2. Some key mitigations include:

- Noise and dust modelling for any encroachment within 2 km of a sensitive receptor will be implemented for O'Neil and the western portion of Larego, prior to inclusion in an FCA.
- A review of noise sensitivity zones will be undertaken as a result of revised noise and blast modelling.
- Visual Amenity Assessments for any encroachment within 2 km of a sensitive receptor will be implemented for O'Neil and the western portion of Larego, prior to inclusion in an FCA.
- Revision of the Recreational Trails and Facilities Management Plan (RTFMP), in consultation with DBCA and relevant stakeholders by 31 December 2024[148] to include the following:
  - A cumulative visual impact assessment for recreational trails with potential impacts
  - Consideration of additional mitigation measures
  - Stakeholder engagement register (Appendix 3)

[148] 2023-2027 MMP Ministerial Approval Condition 17

Table 9-6: Avoidance and minimisation of potential impacts to social surroundings (amenity)

Risk	Description of Impact	Risk Controls	Residual Risk Rating
Clearing and mining directly impacts and restricts access to conservation and recreational values.	Increased community and stakeholder concern in relation to social licence to operate. Changes to recreation and conservation facilities impacting local economies (eg, hospitality and ecotourism) and quality of life.	Avoid • No mining of ore in conservation reserves. • Establish and maintain mining avoidance zones within the region to prevent direct impacts, which will be clearly marked on construction and mining maps. • Where mine pits have been identified close to the Munda Biddi Trail, Alcoa will negotiate the trail realignment with DBCA prior to mining activity that may impact on trail user experience. Minimise • Community Consultation - 5 Year Mine Plan and drill plan consultation with, government and neighbours potentially affected by mining operations. • Reduce visual impact/visual amenity zone from public infrastructure. • Monitor broad sentiment to understand community concerns. • Tours and education. • Fencing, bunding & signage. • Visitor access protocols. • Complaints handling and response. • Providing interim and temporary agreement to community for ad hoc access • Provision of areas open (currently minimal) for recreation such as Marrinup Trail, Langford Park, Waterous Loop. • Prioritisation of mining in close proximity to significant recreational areas to facilitate continuity of community land use. • If mining proposed within 2 km of sites, then commission noise, dust and visual assessments • Amend road alignments to address community and stakeholder expectations in relation to waterway and wetland protection; recreation, landscape protection and public access • Recreational Trails and Facilities Management Plans (RTFMP) have been revised in consultation with DBCA and relevant stakeholders, and will be implemented. Rehabilitate • Prioritisation of mining and rehabilitation in close proximity to significant recreational areas to facilitate continuity of community land use. • Adherence to Completion Criteria - land use objectives.	Medium
Noise and vibration impacting upon sensitive receptors	Decrease in amenity values. Decline in social licence to operation. Increase in community concern. Non-compliance with legal and other requirements. Non-compliance with internal standards.	Avoid • Avoidance of sensitive receptors to minimise noise amenity impacts and low vibration from blast air overpressure Minimise • Neighbours are invited to be notified on blasting timing • Alcoa applies internal noise limits of 110 dB at Dwellingup and the Yamba sub-division in Keysbrook, and 115 dB at all other locations. • The main blast is preceded by a pilot shot which produces lower levels of noise than the main blast. If the pilot blast is above internal pilot noise limits, the main blast is postponed. • Willowdale schedules mining adjacent to neighbouring properties (on western and northern boundaries) during the daytime and/or when atmospheric conditions will minimise the noise levels received by neighbours • DBCA closed Hoffman Mill for public use with a cost-neutral compensation agreement • Noise sensitivity zones will be established. The zones restrict mining activities in more sensitive areas to manage noise impacts to sensitive receptors • Noise generated by mining operations is managed to meet the requirements of the Environmental Protection (Noise) Regulations 1997. Alcoa does not mine in areas where the pre-mining noise assessment identifies that noise impact on Noise Sensitive Premises (Highly Sensitive Area) cannot be managed below 35dB LA10. • Preliminary noise assessment and noise sensitivity zones incorporated into Long Term Mine Plan. • Operational noise is maintained below the noise limits identified in the Environmental Protection (Noise) Regulations 1997	Medium

Risk	Description of Impact	Risk Controls	Residual Risk Rating

		• If mining proposed within 2 km of a sensitive receptor, then commission noise assessments. If predicted noise levels at noise-sensitive sites may exceed assigned levels under the Environmental Protection (Noise) Regulations 1997, then prepare and implement a Noise Management Plan in consultation with key stakeholders
		• Noise emissions are managed through regular maintenance (including change out of conveyor rollers and idler cleaning)
		• Near-field noise monitoring
		• Quarterly noise monitoring results from the 371 conveyor are reported in the Environmental Review
		• As a requirement of an EP Act licence amendment in 2020 to transfer the crusher from Orion to Larego, Alcoa undertakes noise validation monitoring and provides a Noise Compliance Report on all mining infrastructure to DWER.
		• Alcoa's noise management system includes live noise modelling at an operation level with fixed and attended noise monitors, predictive modelling, procedures, training and audits.
		• All noise complaints received by Alcoa are investigated and a report is compiled detailing information about the location of mining equipment, the location of neighbouring properties and weather conditions at the time of the complaint. Report details and findings are communicated with the complainant.
		• Alcoa is implementing an Integrated Noise Management System (INMS) (completion in 2023) which consists of noise management software, fixed noise monitors, and data inputs. Data from multiple sources (e.g., noise monitoring stations, historic and real time weather, mine plan, and equipment and activity location) is utilised and consists of three main modules:
		  ○ Long term planning – this module uses historic weather and a range of mine plans to identify potential noise impacts for management. By assessing noise profiles early, the mine plan can be optimised to mitigate noise impacts and strategic decisions can be made.
		  ○ Scheduler – uses forecast weather data, mine and operations plans to assist in predicting noise levels across the operations. Scheduler uses a traffic light system to easily identify mine plans which may result in an exceedance of noise requirements. Planners can change the plan (i.e., change operational locations, or equipment) to develop a mining plan which is unlikely to result in noise exceedances.
		  ○ Execute – uses real time weather, real time noise monitoring data, current operational plan and equipment location to create a real time noise model. The model predicts noise levels at key receptors and provides an early warning system that allows operations to adjust the mining activities to prevent noise exceedances.
		• A blast may not proceed if the predicted impact at a neighbouring property is above the limit identified in the Environmental Protection (Noise) Regulations 1997.
		• Blast noise levels are monitored using portable sound level meters.
		• Blast noise is managed through a module within Alcoa's Integrated Noise Management tool. The module allows facilitation of detailed blast planning, taking into consideration weather forecasts and planned blast parameters to predict potential impacts at receivers. Where this indicates that the 120 dB(L) limits cannot be adhered to, alternative methods of exposing ore will be employed in order to manage noise emissions.	

Clearing visual amenity impacting upon sensitive receptors	Visual amenity impacts on sensitive receptors resulting in a decrease in amenity values	Avoid
		• Develop mining avoidance zones to prevent direct impacts to screening vegetation within 200m of public roads, where possible.
		Minimise
		• If mining proposed within 2 km of a sensitive receptor, then commission visual amenity assessments. If mining is predicted to be visible from visually sensitive sites, then prepare and implement a Visual Management Plan in consultation with key stakeholders.
		• The following additional controls are implemented for Logue Brook Dam:
		  ○ Visual amenity assessment to be undertaken for any clearing encroachment upon the area. The outcomes will determine any visual amenity buffers required.
		  ○ A clearing elevation buffer was generated based on topographic high points then implementing a 15m down the hillslope.
		• Minimise landscape and visual impacts to recreational facilities and road interfaces with the provision of screening corridors suitable to the area, where possible.
		• Screening corridors are based on existing vegetation density and topography to adequately screen clearing of mine pits, haul roads and other infrastructure.
		• The material and structural finishes for all built form elements will be compatible with surrounding visual environment to assist the built form to blend in with surrounding existing vegetation when viewed from elevated distant viewing locations.
		• Where mine pits, haul roads and other infrastructure are proposed to be located near existing road corridors, rehabilitation will be commenced as soon as practicable.
			Medium

Risk	Description of Impact	Risk Controls	Residual Risk Rating
		• Where mining occurs close to the Munda Biddi Trail, Alcoa will negotiate the trail realignment with DBCA prior to mining activity that may impact on trail user experience. Rehabilitate • During rehabilitation of mine pits, contouring of the excavated pits will tie them into the surrounding landform and rehabilitation planting will restore the vegetated character of the area when vegetation reaches suitable coverage.	
Dust deposition impacting upon sensitive receptors	Decrease in amenity values. Decline in social licence to operation. Increase in community concern.	Minimise • If mining proposed within 2 km of a sensitive receptor, then commission dust assessments. If predicted dust levels at dust-sensitive sites may exceed relevant criteria for dust deposition or 24 hour Ambient Air National Environmental Protection Measure (NEMP), then prepare and implement a Dust Management Plan in consultation with key stakeholders. • Refer to Flora and Vegetation Management Plan.	Low
Light spill impacting upon sensitive receptors	Decrease in amenity values. Decline in social licence to operation. Increase in community concern.	Minimise • Mine planning considers separation distances from sensitive receptors • Lighting is positioned sensitively to reduce risk of light spill to sensitive receptors	Low
Change to road access and increase in traffic	Increase in community concern.	Minimise • Any public road crossing will comply with all relevant standards and specifications as applied by Main Roads WA and other decision makers including relevant local governments. • To ensure safety during blasting, visitors to site (including government personnel) are required to access the mine through the main gate so that they can be informed of any proposed blasting activities. If this is not possible, the mine security staff must be notified by telephone. Details regarding access to particular areas must be arranged by contact between the relevant officers and the site manager. • The Mines Safety and Inspection Act 1994, Mines Safety and Inspections Regulations 1995, and Alcoa's safety procedures require all persons driving on the mine to obtain a mine driving permit and to comply with mine driving procedures.	Low

9.4 Assessment of impacts

Whilst the 24 Month Clearing Schedule does not directly impact upon any recreational areas or associated access, the potential impacts are considered to be high. This accounts for the cumulative impacts of current operations and the potential for community concern. The Huntly and Willowdale mines operate in a landscape which supports numerous recreational, aesthetic, economic and conservation values and community concern is reflective of the associated impacts. A draft Recreational Trails and Facilities Management Plan has been developed in consultation with DBCA (Appendix 14). The current version has been provided to JTSI and is publicly available on Alcoa's website. Alcoa is committed to improving transparency and consultation with the community and key stakeholders in future MMP submissions.

The potential noise impacts from the 24 Month Clearing Schedule to amenity are considered to be medium, as similar impacts to current operations are expected. A similar level of mitigation will be undertaken, including implementation of mining avoidance zones and noise sensitivity zones (if required) and operational noise management. Similar impacts from blast noise are expected.

Visual amenities impact from the 24 Month Clearing Schedule are considered to be medium. Visual impact assessments will be undertaken for any mining within 2 km of sensitive receptors. The 24 Month Clearing Schedule is within current mining regions and if required, a 200 m vegetated screening buffer will be implemented along public access roads.

Low potential traffic, dust and light spill impacts to amenity are expected, with the 24 Month Clearing Schedule occurring within current mine regions.

10 Social Surroundings (Heritage)

10.1 Receiving environment

10.1.1 Baseline surveys

A desktop review was undertaken to identify any historic heritage sites listed on the State Heritage Register within 5 km and 100 m of the Huntly and Willowdale mine areas, using the DPLH-006 (Heritage Council–WA - State Register) dataset (DPLH 2022c). In addition, a review of the Local Heritage Survey Inventory was undertaken, using the DPLH-008 (Heritage Council–WA - Local Heritage Survey) dataset (DPLH 2022b). This was supplemented by archival research undertaken by specialist heritage consultants that was followed by ground-truthing surveys to verify the findings of this research.

Alcoa has completed numerous Aboriginal cultural heritage surveys over the area subject to this MMP, as summarised in Table 10-1. Since Gnaala Karla Boodja Aboriginal Corporation's nomination as Heritage Service Provider under the Noongar Standard Heritage agreement in early 2024, all surveys have been conducted through the Corporation. The results of these surveys inform Alcoa's mine planning and are utilised to direct on-ground activities through Alcoa's internal Ground Disturbance Permit process.

Alcoa Mineral Lease 1SA (ML1SA) is in the Northern Jarrah Forest where ground visibility is limited due to the dense forest understorey vegetation and leaf litter. Owing to both the size of the mining region and this lack of visibility, a GIS based Archaeological Predictive Model (APM) was initially developed in 2001 to inform the methodology and approach to archaeological surveys preceding commencement of exploration or mining in ML1SA. The predictive model has been refined and independently peer reviewed several times since 2001, most recently in early 2024, to ensure it remains aligned with GIS and archaeological best practice. The most recent independent peer review was completed in April 2023.

Initially, large scale site avoidance surveys are undertaken with Traditional Owners ensuring all locations identified in:

a) the APM of high archaeological site probability,
b) a randomly generated area of low to medium archaeological probability , and
c) any additional areas of cultural concern.

This allows a continual assessment of the reliability of the predictive model. When requested by Traditional Owner survey participants, additional areas are added to the survey plan and the results also incorporated into APM validation. Ethnographic site avoidance surveys, driven by the concerns of Traditional Owner participants, are also completed prior to any ground disturbing activities commencing.

Alcoa issues Activity Notices under the Noongar Standard Heritage Agreement for all activities that have the potential to impact on cultural heritage places. The initial use of Site Avoidance level surveys for the exploration program is aligned with the advice Alcoa has received from the South West Aboriginal Land and Sea Council (as the Central Service provider for Gnaala Karla Booja) in response to Alcoa's Activity Notices.

Gnaala Karla Booja has been consulted and is comfortable with this approach. Alcoa will continue to work with Gnaala Karla Booja, including via the co-development of a Cultural Heritage Framework for ML1SA[149], to ensure that Alcoa has an appropriate understanding of the area's heritage values to inform appropriate mitigation.

Recognising the importance of water and waterways to Noongar people, Alcoa specifically requests survey coverage of all waterway crossings to ensure both archaeological and ethnographic values and any potential impacts are understood at the design phase.

Archaeological and ethnographic site identification surveys are undertaken on an ongoing basis to refresh the results of site avoidance level surveys and ensure that on-ground activities are informed by precise cultural heritage information. These surveys are undertaken prior to clearing activities and to ensure that any Aboriginal cultural heritage places within 100 m of the proposed clearing boundary have appropriate management controls identified.

In preparation for commencement of the Aboriginal Cultural Heritage Act 2021, Alcoa presented an Aboriginal cultural heritage due diligence process to Gnaala Karla Booja Aboriginal Corporation in August 2023; and at this time no issues or concerns were raised regarding Alcoa's proposed approach, and internal due diligence process. Since the repeal of this legislation, the due diligence process referred to here is no longer relevant and its use has been discontinued. In its place, Alcoa has created an integrated heritage team to provide expert advice across the business on cultural heritage matters.

Prior to the establishment of the Gnaala Karla Booja Aboriginal Corporation, heritage surveys were conducted with representatives nominated by Bilya Noongar Organisation and more recently, via South West Aboriginal Land and Sea Council. Since the establishment of the Gnaala Karla Booja Cultural Advice Committee, all nominations are now sought via that Committee. Since April 2024, all heritage surveys are engaged through the Gnaala Karla Boodja Aboriginal Corporation, which is when the Corporation nominated to be the Principal Heritage Consultant under the NSHA .

Alcoa has entered into Noongar Standard Heritage Agreements (NSHAs) over various project areas. Prior to the full establishment of the Gnaala Karla Booja Aboriginal Corporation, the Southwest Aboriginal Land and Sea Council managed heritage processes under these NSHAs, including nomination of Traditional Owner survey participants through the Gnaala Karla Booja Cultural Advice Committee (which was established ahead of the Gnaala Karla Booja Aboriginal Corporation). The Southwest Aboriginal Land and Sea Council has gradually devolved most responsibilities under these agreements to Gnaala Karla Booja Aboriginal Corporation. As part of this process, Gnaala Karla Booja Aboriginal Corporation has formally nominated to be the Aboriginal Heritage Service Provider under these NSHAs (through GKB Impact from March 2025). In line with this nomination, all Alcoa's cultural heritage surveys are coordinated through Gnaala Karla Booja Aboriginal Corporation. At the invitation of the Corporation, Alcoa also engages with the Gnaala Karla Booja Cultural Advice Committee to ensure that the members are fully briefed before nominating Traditional Owner participants for heritage surveys.

[149] 2023-2027 MMP Ministerial Approval Condition 17 requires the development of a Cultural Heritage Management Plan. However, at the scale of ML1SA, this would be ineffective and in discussions with Gnaala Karla Boodja Aboriginal Corporation are ongoing to co-develop a Cultural Heritage Management Framework for ML1SA (which is a more appropriate instrument to guide development of resource model scale Cultural Heritage Management Plans).

Alcoa will ensure that all potential Aboriginal Sites under the *Aboriginal Heritage Act 1972* identified in the survey reports in Table 10-1, and future surveys, will be submitted to the DPLH via Heritage Information Submission form or equivalent, following consultation with, and agreement from, Gnaala Karla Booja Aboriginal Corporation.

Table 10-1: Aboriginal cultural heritage studies

Year	Author	Study Name
1995	Edwards, K. & Hammond, M.	Report of an Aboriginal Heritage Survey Proposed Alcoa Mining Operations Area, Wagerup (Willowdale North)
2006	Rapley, S., Hook, F., Hammond, C. & Veitch, B.	The Report of an Aboriginal Archaeological Assessment of the McCoy and Orion Mining Regions, Huntly and Willowdale Mines, Near Dwellingup, South-Western Australia
2007	Rapley, S., Di Lello, A. and Hook, F.	The Report of and Indigenous Archaeological Assessment – Larego Mining Envelope, near Willowdale, Willowdale, South Western Australia
2009	Hammond, C and McHarg, K.	The Report of an Aboriginal Archaeological Assessment of the Myara Region, near McCoy mine, Karnet, South-Western Australia
2010	Hammond, C. & Doering, J.	The Report of an Aboriginal Archaeological Assessment of the O'Neil Region, near McCoy Mine, Karnet, South-Western Australia.
2016	Archae-aus Pty Ltd	A report on Aboriginal archaeological assessments within the Jarrahdale South and Myara East project areas, Jarrahdale and Myara, WA
2016a	Randolph, P.	Ethnographic Survey of the Myara and O'Neil Mining Regions: Focussing on Serpentine River (DIA 3582)
2016b	Randolph, P.	Addendum: Ethnographic Survey of the Myara and O'Neil Mining Regions: Focussing on Serpentine River (DIA 3582)
2018a	Archae-aus Pty Ltd.	Addendum to a report on an Aboriginal Archaeological assessment of an area for the proposed Larego Crusher and associated infrastructure near Willowdale, Western Australia.
2018b	Archae-aus Pty Ltd.	A Report on an Aboriginal Archaeological Assessment of an area for the proposed Larego crusher and associated infrastructure, near Willowdale, Western Australia
2022	Archae-aus Pty Ltd.	A Report on an Aboriginal Archaeological Sample Survey of the Larego Project area near Willowdale, Western Australia
2023	Archae-aus Pty Ltd.	Report on Aboriginal Archaeological and ethnographic Site Avoidance Heritage Surveys of the O'Neil East Project Area, Darling Scarp, Western Australia (Draft)
2024	Archae-aus Pty Ltd.	Aboriginal archaeological Site Identification level recording of previously identified Aboriginal Cultural Heritage sites within the Myara and O'Neil Regions of Huntly Mine and the Larego Region of Willowdale Mine. Alcoa has applied conceptual clearing alignments to known ore bodies and require an archaeological assessment to determine whether the alignments conflict with the previously identified Aboriginal archaeological sites. The thirty-seven (37) Aboriginal Cultural Heritage sites comprise artefact scatters which have previously been recorded to Site Avoidance level. The fieldwork was undertaken over five weeks in September and October 2023
2024	Archae-aus Pty Ltd.	A targeted archaeological and ethnographic site identification heritage survey was commissioned to inspect 11 proposed stream crossing locations for haul road infrastructure. No heritage places were identified during survey.

10.1.2 Aboriginal Cultural Heritage

The Huntly and Willowdale mine areas are located within the South West Native Title Settlement area. Under the terms of the South West Native Title Settlement, Noongar groups surrendered their native

title (thus finalising all current and preventing future claims) in exchange for Statutory recognition of the Noongar people as the Traditional Owners of the region. In addition, the Settlement contained a comprehensive benefits package, comprising payments by the State into a Trust and the provision of a land bank for cultural preservation and future development.

The area to which this MMP applies is located within the area of the Gnaala Karla Booja ILUA, which encompasses the lands of the Binjareb/Pinjarup, Wilman and Ganeang Noongar language or dialectical groups. The ILUA established the Gnaala Karla Booja Aboriginal Corporation as the entity through which the rights and benefits conferred under the Settlement are managed for the benefit of Noongar People in this region. Alcoa is committed to undertaking regular and ongoing engagement with Gnaala Karla Booja Aboriginal Corporation in relation to Alcoa's existing operations and proposed future activities within the Corporation's area of responsibility.

With the appointment of its inaugural CEO in March 2023, Alcoa commenced formal engagements with Gnaala Karla Booja Aboriginal Corporation regarding Alcoa's operations and proposed Mining Management Program. This has included engagements with the Gnaala Karla Booja Board of Directors, Cultural Advice Committee and Executive leadership team with senior Alcoa leadership, operations, environment and Indigenous Engagement team members. Engagement has included:

- Meeting with the Board of Directors on 4 March 2023 to discuss ongoing engagement relating to current operations and future approvals.
- Meeting with the Cultural Advice Committee on 5 July 2023 regarding MMP approval processes.
- Meeting with the Executive Leadership Team on 4 August 2023 regarding MMP approval and then current heritage due diligence processes.
- Holding a full day workshop in May 2024 with key Corporation staff on Alcoa's approvals frameworks, which included a familiarisation session on the MMP.
- Issuing a draft Cultural Heritage Management Plan/Framework for GKB review in June 2024
- Holding a half-day workshop on the Cultural Heritage Management Plan/Framework in November 2024 to consider GKB's feedback on the draft and MMP condition generally
- Offers of further workshops on the Cultural Heritage Management Plan/Framework in January, February and March 2025;
- Regular and ongoing engagement through cultural heritage survey processes.

10.1.2.1 Aboriginal Cultural Heritage Places

All identified Aboriginal cultural heritage places recorded within the Huntly and Willowdale mine regions to date are shown in Figure 10-1 and Figure 10-2.

10.1.3 Historic Heritage

There is one place on the State Heritage Register within the Huntly and Willowdale mine regions:

- The Marrinup Prisoner of War Camp which is in the Del Park region.
- The analysis indicates that there are four local European heritage sites within the Huntly and Willowdale mine regions:
- The Bodhinyana Buddhist Monastery
- Falls Brook Homestead
- Harvey Weir
- Logue Brook Dam

No World Heritage Sites or Commonwealth Heritage Sites occur within 5 km of the Huntly and Willowdale mine areas.

All State and Local European heritage sites are shown in Figure 10-1 and Figure 10-2.

In addition to these documented heritage places, the forests within which Alcoa operates have a long history of post-settlement forestry use. Alcoa is progressively documenting the remains of these activities (including temporary timber railways, timber camps, survey trees etc) in its areas of operations and seeks to preserve as much of this heritage as is practicable. If any places are discovered that may meet the requirements for local or State Heritage listing (as advised by the specialist heritage consultants engaged to undertake this work applying the criteria in the *Heritage Act 2018*), Alcoa will submit the necessary documentation.

Serpentine
National Park

Legend

- 24 Month Clearing Schedule
- Site Avoidance Surveys
- Top Water Line 1km Buffer (1km RPZ)
- National Parks
- Major Dams

Alcoa Aboriginal Heritage Sites
- Heritage Site
- Aboriginal Heritage Sites 10m Buffer
- Aboriginal Heritage Sites 60m Buffer
- European Heritage Sites 10m Buffer
- European Heritage Sites 60m Buffer

Government European Heritage Sites
- DPLH006
- DPLH008
- Government Aboriginal Heritage Sites
- Government Aboriginal Heritage Sites 10m Buffer
- Government Aboriginal Heritage Sites 60m Buffer
- Government European Heritage Sites 10m Buffer
- Government European Heritage Sites 60m Buffer

Alcoa

0 1 2 4 km

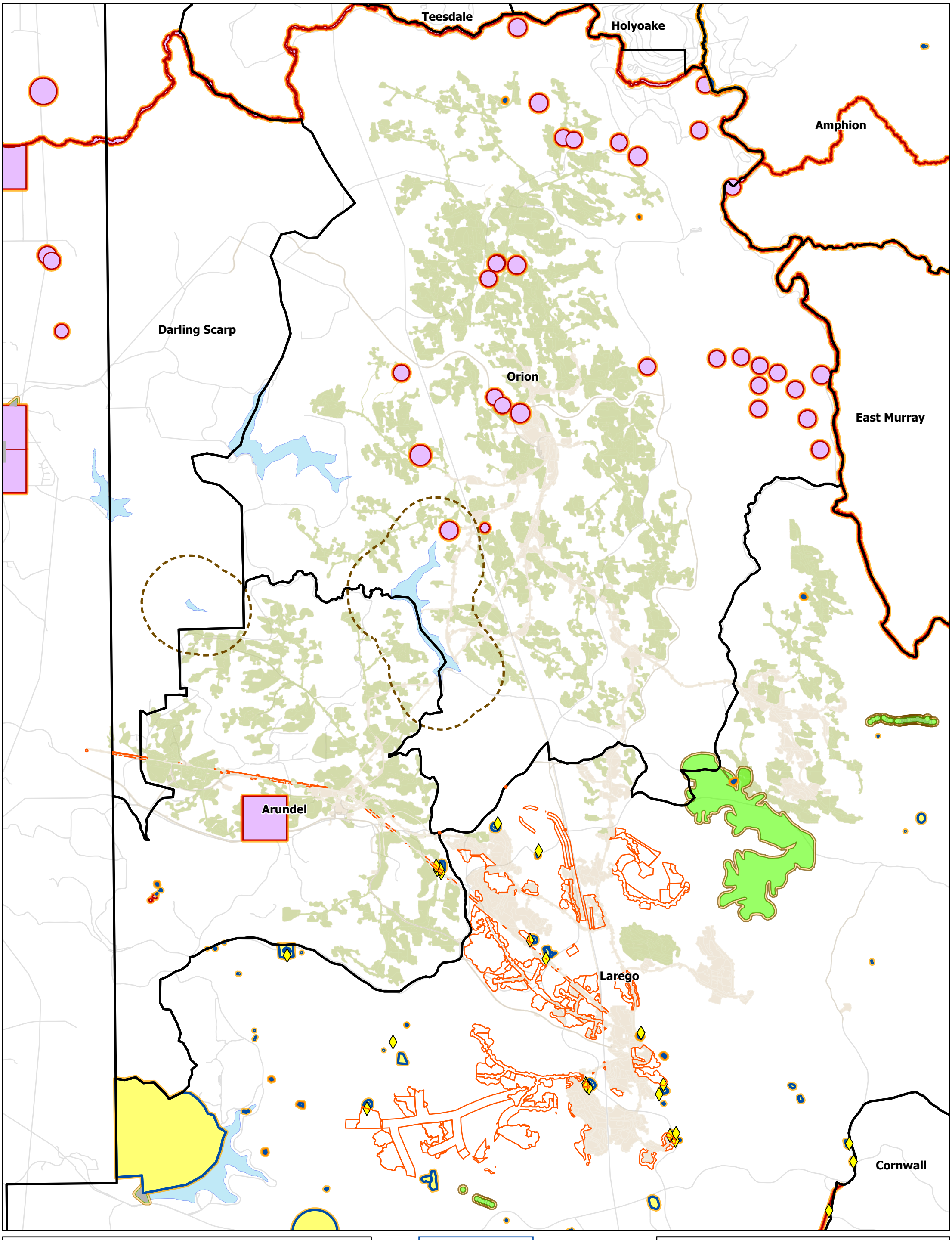
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2025 - 2029 Mining and Management Plan

Figure 10-1: Aboriginal cultural heritage sites and places and local European heritage places - Huntly

Scale: 1:115,000

Date Printed: 13/05/2025



Legend

- 24 Month Clearing Schedule
- Site Avoidance Surveys
- Mining Regions
- Top Water Line 1km Buffer (1km RPZ)
- Rehabilitation
- Cleared Areas
- Major Dams

Alcoa Aboriginal Heritage Sites
- Heritage Site
- Aboriginal Heritage Sites 10m Buffer
- Aboriginal Heritage Sites 60m Buffer
- European Heritage Sites 10m Buffer
- European Heritage Sites 60m Buffer

Government European Heritage Sites
- DPLH008
- Government Aboriginal Heritage Sites 10m Buffer
- Government Aboriginal Heritage Sites 60m Buffer
- Government European Heritage Sites 10m Buffer
- Government European Heritage Sites 60m Buffer

Alcoa

N

0 1 2 4 km

2025 - 2029 Mining and Management Plan

Figure 10-2: Aboriginal cultural heritage sites and places and local European heritage places - Willowdale

Scale: 1:75,000

Date Printed: 2/10/2024

10.2 Potential Impacts

The following mine activities have the potential to directly or indirectly impact heritage values:

- Clearing of native vegetation
- Construction, mining, refining and operational activities
- Physical presence of infrastructure.

There is the potential for direct and indirect impacts to heritage sites as a result of construction and operation. Direct impacts can occur from clearing and construction. Indirect impacts include stormwater runoff, erosion and sediment from nearby construction areas.

10.2.1 Disturbance to Aboriginal cultural heritage

All Aboriginal cultural heritage located within 100 m of the 24 Month Clearing Schedule will be the subject of site identification surveys prior to clearing, to confirm site location and avoidance buffer. The following DPLH Heritage Places and Alcoa Heritage Sites have been identified as being within 100 m of the 24 Month Clearing Schedule:

- Huntly – 9 Archaeological Artefact Scatters and two artefact scatter and grinding.
- Huntly – 12 additional unknow Archaeological sites.
- Huntly – one Archaeological and Ethnographic consisting of Corroboree Ground, Modified Tree, Artefact Scatter, Grinding, Cermonial.
- Huntly – two Ethnographic sits consisting of Dandalup River and Serpentine river.
- Places (consisting of 16 artefacts / scatters and one mythological site) and one Stored data
- Willowdale – 8 Heritage sites which are Archaeological artefact scatters
- Willowdale – 6 unknown Archaeological sites.

All Aboriginal cultural heritage cultural and places identified will be avoided by the 24 Month Clearing Schedule apart from waterways crossings and the installation of the turbidity monitors as detailed below.

The 24 Month Clearing Schedule intersects one known registered Aboriginal cultural heritage site, the Serpentine River (DPLH 3582). The Serpentine River is listed on the AHIS as having a ‘closed’ status resulting in its boundary being dithered to a series of 1 km boxes. Previous ethnographic consultation undertaken by Alcoa with Gnaala Karla Booja Traditional Owners has indicated that the area of ethnographic concern equates to a 100m buffer around the Serpentine River. This consultation ‘buffer’ has been incorporated into Alcoa’s GIS and is used to inform mine planning.

Mining activities are located outside the ethnographic boundary for the Serpentine River. However, Alcoa’s 24 Month Clearing Schedule includes the installation of water quality turbidity monitors within the Serpentine River. Alcoa has undertaken further engagement with Gnaala Karla Booja Aboriginal Corporation and DPLH regarding the need for Aboriginal Heritage and ensure appropriate approvals (e.g., Section 18 consent).

In October 2024, Alcoa presented on the proposed turbidity monitoring network to the Gnaala Karla Boodja Aboriginal Corporation Cultural Advice Committee and secured a resolution supporting a request for authorisation under Regulation 10 of the *Aboriginal Heritage Regulations 1974* for a first tranche of turbidity monitors focused on the South Dandalup River. A Regulation 10 authorisation was issued in February 2025. These turbidity monitors were installed in late March 2025 with the support of Cultural Monitors nominated by the Gnaala Karla Boodja Cultural Advice Committee.

A further resolution of support for a Regulation 10 authorisation was obtained from the Cultural Advice Committee in February 2025 to cover installation of turbidity monitors and ground water monitoring bores in and around the Serpentine River. This authorisation request has not been lodged at the time of writing. As with the South Dandalup monitoring network, installation will be supported by Cultural Monitors (already nominated by the Cultural Advice Committee).

10.2.2 Disturbance to European heritage sites

European heritage sites comprise the physical remnants of the former timber industry, railway and former POW camps.

The identified local European heritage sites are not within proximity to the 24 Month Clearing Schedule. The sites have been avoided and will not be impacted by the 24 Month Clearing Schedule.

10.3 Mitigation

Alcoa is committed to ensuring understanding of all potential impacts to heritage over the areas subject to this MMP. This includes both Aboriginal cultural heritage and European heritage.

A risk-based approach has been taken to align with Alcoa's risk and environmental management processes. The Risk assessment methodology is provided in Appendix 2. The associated mitigation actions are provided in Table 10-2 as a risk register.

Some key mitigations include:

- Co-designed Cultural Heritage Framework with Traditional Owners (through Gnaala Karla Booja Aboriginal Corporation) to ensure appropriate management principles are in place for Aboriginal cultural heritage within ML1SA. This framework will inform the development of Cultural Heritage Management Plans at a more appropriate scale than the entirety of ML1SA. The Cultural Heritage Management Plans will be live operational documents that are regularly updated and reviewed to correspond with Alcoa's activities. Alcoa is committed to preparing the ML1SA Cultural Heritage Management Framework and subsidiary Cultural Heritage Management Plans with Gnaala Karla Booja. The co-design process adopted has meant that the work to develop the Framework was not completed by 31 December 2024 (Commitment 22). Discussions are ongoing with Gnaala Karla Booja Aboriginal Corporation on the Framework, including a plan for its completion.
- Following the completion of the archaeological and ethnographic Aboriginal cultural heritage surveys, any identified Aboriginal cultural heritage is included in Alcoa's GIS system as a

constraint to enable it to be considered and avoided during exploration and mine planning processes.

- Ensuring all heritage surveys are conducted through Gnaala Karla Booja Aboriginal Corporation.
- Where avoidance to Aboriginal cultural heritage is not possible, Alcoa will consult with Gnaala Karla Booja Aboriginal Corporation and seek approval under the *Aboriginal Heritage Act 1972* or Regulations as appropriate.
- Aboriginal cultural heritage sites located with 100 m of proposed clearing boundaries will have the following additional controls:
  - Site identification level recording to confirm boundaries and appropriate buffers
  - heritage demarcation, where this would not cause additional threats to the heritage values (for example in parts of ML1SA that remain publicly accessible)
  - Detailed heritage assessments for all internal Alcoa Ground Disturbing Permit applications
  - work exclusion zones
  - inclusion of heritage in applicable safety toolbox discussions and job hazard assessments
  - heritage awareness inductions of personnel and contractors

Alcoa continues to improve understanding of heritage values (Aboriginal and European) and obtain data in that regard. Alcoa has identified that the inclusion of heritage survey outcomes (survey extent and sites identified) in FCA submissions would support this aspiration. However, further consultation with Gnaala Karla Booja Aboriginal Corporation is required to ensure it is comfortable with using and supplying cultural information in this way.

Table 10-2: Avoidance and minimisation of potential impacts to Aboriginal Cultural Heritage

Risk	Description of Impact	Risk Controls	Residual Risk Rating
Damage or harm to / loss of Aboriginal cultural heritage	Non-compliance with Alcoa's Aboriginal Cultural Heritage Standard (Global Standard) Impact to unidentified Aboriginal cultural heritage	Avoid • Compliance with Cultural Heritage Mitigation Hierarchy – Avoid, Minimise - based on site avoidance survey outcomes. • Site avoidance survey for proposed areas of exploration drilling and other ground disturbing activities. • An internal due diligence process to be undertaken as per Alcoa Aboriginal Cultural Heritage Due Diligence Procedure. • Exploration – Aboriginal archaeological and ethnographic site avoidance surveys will be undertaken prior to exploration drilling. Avoidance surveys identify any sites within the proposed area so avoidance can occur. Minimise • Mine clearance, construction and operations will have Aboriginal archaeological and ethnographic site identification surveys undertaken prior to clearing. • Aboriginal cultural heritage survey results will be used to inform mine planning and infrastructure design. Direct and indirect impacts to identified Aboriginal cultural heritage sites will be avoided, where possible. • Co-development of Aboriginal Cultural Heritage Management Framework for ML1SA with Gnaala Karla Booja Aboriginal Corporation • Engagement of Cultural Monitors, through Gnaala Karla Booja Aboriginal Corporation, to ensure particularly sensitive cultural heritage places are managed appropriately • Alcoa's GIS Constraints Layer – holding the spatial component of Aboriginal cultural heritage survey results, which includes a 10m non-negotiable buffer. Any additional buffer requirements will be decided in consultation with traditional owners. • Aboriginal cultural heritage included in the Alcoa One induction training package to all employees and contractors. • Specific training for those involved in clearing activities which includes Aboriginal cultural heritage flagging requirements. • Prior to any ground disturbing activities, an activity notice as per the Noongar Standard Heritage Agreement (NSHA) will be provided to SWALSC for their review (if required), and to determine if a heritage survey might be required. • Where it is agreed with Gnaala Karla Booja Aboriginal Corporation that Aboriginal cultural heritage surveys are required, Alcoa will undertake archaeological and ethnographic Aboriginal cultural heritage surveys in consultation with nominated Aboriginal representatives. • If there is a risk of harm to Aboriginal Cultural Heritage, then an impact assessment and consultation with Gnaala Karla Booja Aboriginal Corporation will occur prior to relevant approvals being sought.	Medium

Risk	Description of Impact	Risk Controls	Residual Risk Rating
Damage to / loss of European heritage sites	Impact to unidentified European heritage site	Minimise • Desktop reviews of European heritage followed by field verification; training to advance field personnel, collation of their reports followed by field verification/field survey • Mine plan designed to avoid European heritage places where possible. • Consultation with stakeholders prior to disturbance and development of a European Heritage Management Plan will be considered.	Low

10.4 Assessment of impacts

Alcoa is confident that through the involvement of Traditional Owners in on-ground activities (through Cultural Monitoring programs), and ongoing engagement with Gnaala Karla Booja Aboriginal Corporation that, the potential for impact to Aboriginal cultural heritage is low. An exception is the potential impact arising from the installation of water quality turbidity monitors within the Registered Site boundary for the Serpentine River, including within the channels of tributaries and the river itself. A resolution in support of an application under Regulations 7 and 10 of the Aboriginal Heritage Regulations 1974 was obtained from the Gnaala Karla Boodja Cultural Advice Committee in February 2025, which will facilitate gaining appropriate approval to install these monitoring stations. Once approval is received, installation will be supported by Cultural Monitors, in the same way as the recent installation of similar monitors on the South Dandalup River.

We are committed to ensuring both Aboriginal archaeological and ethnographic site identification surveys are completed for all sites and places identified within 100 m of the proposed clearing boundary. This will ensure that avoidance and management measures are underpinned by up-to-date and accurate survey data.

Based on the findings of surveys and consultation, Alcoa will implement avoidance, minimisation and management measures to ensure no risk of harm to Aboriginal cultural heritage outside of any statutory impact approvals under the AHA.

No impacts to local or State European heritage will occur, with the risk of impacts considered to be low.

11 Summary of GIS Dataset

Table 11-1: Summary of GIS Dataset

Name	Area	Description	File Name
Exploration Disturbance Footprint	All	Areas Previously approved and Subject to Approval for Exploration activities	Exploration_Disturbance_Footprint_25_29MMP_Rev1
24 months clearing	Huntly	Spatial representation of 24 months of Clearing	Huntly_24MonthClearing_25_29MMP_Rev0
	Willowdale		Willowdale_24MonthClearing_25_29MMP_Rev0
5 Year Mine Plan	Huntly	Spatial representation of 5 Year Mine Plan	Huntly_5YearClearing_25_29MMP_Rev0
	Willowdale		Willowdale_5YearClearing_25_29MMP_Rev0
10 Year Mine Plan	Huntly	Spatial representation of 10 Year Mine Plan	Huntly_10YearMinePlan_25_29MMP_Rev0
	Willowdale		Willowdale_10YearMinePlan_25_29MMP_Rev0
Rehabilitation Plan	Huntly	Spatial representation of indicative Rehabilitation Plan	Huntly_rehab_plan_25_29MMP_Rev0
	Willowdale		Willowdale_rehab_plan_25_29MMP_Rev0
Historic data – Open areas	All	Shapefile of areas previously cleared by Alcoa and not rehabilitated	Open_Areas_25_29MMP_Rev0
Historic data – Rehabilitation areas	All	Shapefile of areas previously cleared by Alcoa and rehabilitated	Rehabilitation_25_29MMP_Rev0

Name	Area	Description	File Name
FCA endorsed	All	Shapefile of areas previously endorsed through an FCA, but not cleared	FCA_Endorsed_25_29MMP_Rev0
FCA endorsed	All	Shapefile of areas previously endorsed through an FCA, but were relinquished	FCA_Endorsed_Relinquised_25_29MMP_Rev0
Ecological Survey	All	Shapefiles of vegetation mapping and fauna habitat. IBSA data for ecological surveys included Appendix 4 and Appendix 5.	Vegetation_mapping_25_29MMP_Rev0 Fauna_habitat_25_29MMP_Rev1 Appendix 4_IBSA_Data_Rev1.zip Appendix 5_IBSA_Data_Rev1.zip
Groundwater bores	All	Groundwater bore locations (proposed and current)	Groundwater_Bores_25_29MMP_Rev0
Surface water monitoring	All	Surface water turbidity locations (proposed and current)	Turbidity_Locations_25_29MMP_Rev0
Heritage Data	All	Shapefiles of Alcoa heritage sites and places	HeritageSites_25_29MMP_Rev0
Mining Avoidance Zones and Limited Disturbance Areas	All	Shapefiles of current Mining Avoidance Zones and Limited Disturbance Areas, noting spatial extent and features may change as a result of further surveys.	Mining_Avoidance_Zones_25_29MMP_Rev0 Limited_Disturbance_Areas_25_29MMP_Rev0
Proposed FCA Relinquished Areas	All	Shapefiles of proposed FCA Relinquished areas previously harvested or proposed to	FCARelinquished_PreviouslyHarvested_25_29MMP_Rev0 FCARelinquished_ONeilHR_25_29MMP_Rev0

Name	Area	Description	File Name
		be cleared and additional Proposed FCA Relinquished Areas.	Proposed_FCARelinquished_25_29MMP_Rev0

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Appendix 1 – Exploration Disturbance Footprint

Appendix 2 – Risk Assessment Methodology

Appendix 3 – Stakeholder Engagement Register

Appendix 4 – Flora and Vegetation Reports

Appendix 5 – Fauna Reports

Appendix 6 – Fauna Management Plan

Appendix 7 – Threatened and Priority Ecological Community Assessment

Appendix 8 – Long Term Fauna Management Plan

Appendix 9 – Rehabilitation Management Plan and Schedule

Appendix 10 – Flora and Vegetation Management Plan

Appendix 11 – Water Reports

Appendix 12 – Water Resource Management Plan

Appendix 13 – WA Mining and Haul Road Design Manual

Appendix 14 – Recreational Trails and Facilities Management Plan

Appendix 15 – Environmentally Hazardous Material Management Plan

Appendix 16 – TEC Survey Methodology

Appendix 17 – TEC Survey report

Appendix 18 – TEC Water Impact Assessment

Appendix 19 – TEC Action Plan