

4 Object and Principles of the EP Act

Section 15 of the EP Act establishes the objective of the EPA (Authority):

It is the objective of the Authority to use its best endeavours:

To protect the environment; and

To prevent, control and abate pollution and environmental harm.

Section 16 of the Act establishes the functions of the EPA. One of these functions, and the function which is the primary subject of this Statement, is to conduct EIA.

4.1 Environmental Principles

Section 4A of the EP Act identifies the objective to protect the environment of the State having regard to the following principles:

- The Precautionary Principle;
- The Principle of Intergenerational Equity;
- Principles in relation to Improved Valuation Pricing and Incentive Mechanisms;
- The Principle of the Conservation of Biological Diversity and Ecological Integrity; and
- The Principle of Waste Minimisation.

The EPA is required to consider these principles in assessing the environmental acceptability of significant Proposal.

Alcoa has taken these principles into account for the Proposal, integrating them into ongoing operations. The details are presented in Table 4-1 below.

Table 4-1: Principles of the Western Australian Environmental Protection Act 1986

Principle	Consideration of Principle in the Proposal
<p>1. The precautionary principle</p> <p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In the application of the precautionary principle, decisions should be guided by –</i></p> <p><i>(a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i></p> <p><i>(b) an assessment of the risk-weighted consequences of various options.</i></p>	<p>The precautionary principle applies when “<i>there is plausible evidence of possible harm, but scientific uncertainty and ignorance makes it impossible to reliably quantify and characterise the risks</i>” (UNESCO, 2005).</p> <p>Considering these Proposal were a third-party referral, the Exemption Order is in place to allow ongoing operations whilst the Proposal assessment is underway. The Exemption Order includes stipulated provisions to ensure potential impacts are acceptable. In addition, the Minister for State and Industry Development has stipulated additional Ministerial Conditions associated with approved MMPs. The Exemption Order and MMP Ministerial Conditions provide the framework for the Alcoa Transitional Approval Framework (approved and regulated by other mechanism (refer Section 2.3.2), until EPA assessment is completed.</p> <p>The EPA has developed the ESD to take into account:</p> <ul style="list-style-type: none"> • The rolling nature of the MMPs and current operational implementation of the Proposal; • The short term nature of the Proposal, whereby Proposal implementation is relevant to 31 December 2027; • Stipulated provisions associated with the Exemption Order; • Concurrent EPA assessment of Assessment 2253, noting that Proposal impacts post 31 December 2027 will be considered as part of Assessment 2253, therefore cumulative impacts are more effectively considered in Assessment 2253; and • The majority of the Willowdale Mine DE is part of the Existing Proposal (previously EPA referred) and a future Part IV EP Act referral is expected. <p>Alcoa has undertaken a series of environmental studies and impact assessments in relation to Alcoa’s broader operations which have been used to derive the environmental context (including determination of Key Environmental Factors and significant species) and associated impacts for the Proposal. Alcoa has developed this ERD in alignment with the ESD and any uncertainty has been addressed through a reliance upon avoidance measures.</p> <p>As per ESD Item 1, where information does not meet relevant policies and guidance, justification has been provided that demonstrates that EPA’s objectives have been met. Given the precautionary principle, Alcoa has relied upon:</p> <ul style="list-style-type: none"> • Implementation of Mining Avoidance Zones and Limited Disturbance Areas to address any uncertainty of impacts; • Commitment to further pre-clearance surveys to identify key significant environmental values; • Measurable outcomes for key significant environmental values. Management Plans will be updated to include outcomes and mitigations detailed within this ERD; • Management Plans which include objective-based provisions to ensure transparency on management actions to minimise impacts to key environmental values, whereby outcomes are not definable; and • Offsets for significant residual impacts for greenhouse gas emissions and relevant Terrestrial Fauna species.

Principle	Consideration of Principle in the Proposal
	<p>Alcoa has carefully evaluated potential environmental and social impacts associated with the Proposal (forming the content of this ERD) and have avoided impacts where practicable. Potential impacts for the Proposal have been assessed for each Environmental Factor throughout Section 5.</p> <p>The mitigation hierarchy of avoidance, minimisation, and rehabilitation has been applied to reduce residual impacts to as low as practicable. Project design and planning process also identifies areas considered to be LDAs as listed below:</p> <ul style="list-style-type: none"> • Granite outcrops greater than one hectare and a 50 m buffer; • Streamzone vegetation and a 100 m buffer; • Conservation significant flora (as far as practicable); • Carter’s Freshwater Mussel Population; • 1 km of any reservoir Top Water Level from 1 July 2024 (Minister for State Development, 2023) & (Government of Western Australia, 2023); • Areas with an average slope greater than 16% within Reservoir Protection Zones (RPZs) from December 2023 (Minister for State Development, 2023); • OCA1 (Top Water Line 200 m); • Confirmed Conservation Category Wetlands and Resource Enhancement Wetlands; • Yamba Catchment; • Logue Brook Dam; and • Groundwater protection: Maintain a minimum clearance of 2 m between pit base and groundwater. <p>Additionally, the below MAZ are considered in design and planning:</p> <p>Aboriginal and European Heritage and social amenity:</p> <ul style="list-style-type: none"> • Registered Aboriginal heritage sites (buffered 10 m); • Aboriginal heritage sites identified during surveys (buffered 10 m); • European heritage sites (buffered 10 m); • Dwellingup, Kingsbury Drive area, Hoffman Mill, Bibbulmun Track, portions of Lane Poole Recreation Reserve, and other significant conservation areas as shown in relevant maps; and • 200 m public roads or recreational trails buffers (or as determined by visual impact assessments) to prevent impacts on screening vegetation within Hoffman Mill, Logue Brook Dam, Balmoral POW Camp, and Dwellingup Recreation Reserve. <p>Flora and Fauna Protection:</p> <ul style="list-style-type: none"> • Old Growth Forest as identified by DBCA (Alcoa, 2023b); • National Parks and Nature Reserves (Alcoa, 2023b) including: <ul style="list-style-type: none"> ○ Lane Poole Conservation Reserve and portions of Formal Recreation Reserve;

Principle	Consideration of Principle in the Proposal
	<ul style="list-style-type: none"> ○ Falls Brook Nature Reserve; and ○ Dwellingup Reserve. ● Threatened flora and fauna individuals: Protection applies unless regulatory consultation and appropriate approvals are obtained (Alcoa, 2023b). Recorded populations of Carter’s Freshwater Mussel, as far as practicable: <ul style="list-style-type: none"> ○ Black Cockatoo protection zones; ○ Black Cockatoo Nest, confirmed night roosting and significant trees² (buffered 30 m); ○ known Woylie populations; ○ Active breeding Chuditch dens; and ○ Where identified, Numbat and WRP populations. Water Catchments and Reservoirs: <ul style="list-style-type: none"> ● Serpentine Pipehead Dam Catchment (Alcoa, 2023b): <ul style="list-style-type: none"> ○ Top Water Line of Serpentine Dam (buffered 2 km); ○ No clearing or mining activities (excluding rehabilitation) within this area from December 2023; and ○ Clearing within this zone must be rehabilitated, stabilized, or have drainage controls in place within the first available rehabilitation season. <p>An assessment of the risk-weighted consequences of the various options were considered via:</p> <ul style="list-style-type: none"> ● Various management plans as outlined in Section 2.2.3 and preclearance surveys as required under Fauna MP and FVMPs; ● The Exemption Order, which includes controls on clearing amounts, and clearing of native vegetation within the Willowdale Mine are limited; ● The MMPs which are submitted and agreed by the Minister of State Development under commitment 2 of Schedule 2, MS 728. The MMPs, and the supporting data, demonstrates that all potential risks and impacts are well understood and will be adequately managed as reasonably practicable; ● FCA required to obtain endorsement for clearing and timber harvesting activities within Conceptual Clearing Areas, as approved by MMPs. Alcoa submits these FCAs to the MOG at an average rate of twice a year. This process allows for more detailed, technical-level discussions between Alcoa and the MOG without superseding the MMP approval process. Alcoa will only undertake clearing activities that have been approved in the MMP after receiving FCA endorsement from the MOG; ● DCMPs provided during the FCA process, and sediment controls provided for all disturbed areas including mine pits and haul roads; ● Rehabilitation processes. All native vegetation cleared is rehabilitated to the Jarrah Forest ecosystem, using Alcoa’s rehabilitation methods developed over five decades of research and practice;

² For critical infrastructure (e.g., haul roads), a reduced buffer zone of 10 m may be implemented subject to the Minister for State Development approval as part of the State Agreement Administrative Framework. Excludes exploration, rehabilitation and groundwater bores.

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	<ul style="list-style-type: none"> Alcoa implements key measures including the use of PFAS (Perfluoroalkyl and Polyfluoroalkyl Substances) -free firefighting foams, refuelling haul trucks at designated fuel bays in mine facilities, providing secondary containment for all fuel, oil, and hazardous material storage, and ensuring off-site disposal of all wastes (except for on-site sewage treatment at mine facilities); Predictions of Mine air quality impacts are based on conservative assumptions of worst-case mining operations and exclude natural dust suppression from rainfall; Mining operations within Mining Sensitivity Zones will be restricted or managed to avoid noise impacts to sensitive receptors; Visual screening will be maintained to prevent foreground and mid ground visual impacts to receptors within the Jarrah Forest; and Where there are potential significant residual impacts from Alcoa’s clearing, these are counterbalanced by an ecological offset proposal. <p>Alcoa considers that the Proposal has been developed in accordance with the precautionary principle and does not pose a risk of serious or irreversible damage.</p>
<p>2. The principle of intergenerational equity <i>The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</i></p>	<p>Alcoa has a fully integrated business planning process which incorporates in its design, mechanisms to protect ecosystems and minimise biodiversity impacts. This includes land management activities such as conservation of high biodiversity value areas, pre-clearance surveys, and progressive rehabilitation, as summarised below.</p> <p>Ecosystem Restoration and Biodiversity Conservation:</p> <ul style="list-style-type: none"> Comprehensive forest rehabilitation (refer to Section 2.2.4): All native vegetation cleared for mining will be rehabilitated to a biodiverse Jarrah Forest ecosystem. This rehabilitation process, developed over five decades of research and practice, aims to restore the ecosystem to a state that benefits future generations; and Climate resilience: Long-term research and monitoring demonstrate that Alcoa’s rehabilitation maintains biodiversity and ecological integrity and is resilient to climate change impacts such as drought and heat waves (refer Section 6.1). This resilience is crucial for ensuring the longevity of the restored ecosystems. <p>Water Resource Protection:</p> <ul style="list-style-type: none"> Water quality preservation – Long-term research, water quality monitoring, and numerical modelling indicate that mining and rehabilitation are unlikely to substantially increase salinity or turbidity, or significantly reduce inflows into drinking water reservoirs; and Erosion control – Conservative estimates of erosion, even assuming no mitigation measures, suggest that mining is unlikely to cause significant siltation of reservoirs over the long term. This helps preserve water quality for future generations.

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	<p>Visual and Recreational Impact Management:</p> <ul style="list-style-type: none"> Limited visual impact: Mine rehabilitation is expected to have moderate to high visual impact to elevated viewpoints until rehabilitation establishes, noting a significant reduction from 5 years of age (GHD, 2025a). Mining is not anticipated to be visible from other viewpoints, including Jarrahdale and Dwellingup townsites, rural properties, Serpentine National Park and Lane Poole Reserve; and Recreational access: Alcoa commits to maintaining or reinstating access to recreational trails and facilities within mine regions upon mine closure and handover, as far as practicable and as agreed with the DBCA. <p>Climate Change Considerations:</p> <p>Alcoa acknowledges the changing climate of the southwest region:</p> <ul style="list-style-type: none"> The region has experienced warming and drying since the 1970s, with an increase in annual mean temperature of approximately +0.15°C per decade, a reduction in early winter (May to July) rainfall, and an absence of very high rainfall years that were common throughout much of the 20th century; and Alcoa’s rehabilitation strategies take these climate trends into account, aiming to create resilient ecosystems that can withstand future climate challenges. <p>Alcoa asserts that its Proposal will not significantly impact the health, diversity, and productivity of the environment over the long term, aligning with the principle of intergenerational equity.</p>
<p>3. The principle of the conservation of biological diversity and ecological integrity</p> <p><i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p>	<p>The following outlines how Alcoa has previously considered and will continue to consider the conservation of biological diversity and ecological integrity:</p> <p>Habitat Protection and Connectivity:</p> <p>Commitments to habitat protection include:</p> <ul style="list-style-type: none"> The Proposal has limited direct interface with swamps, valleys, and granite outcrops; Preservation of large continuous tracts of fauna habitat with high connectivity; and Protection of riparian zones and swamps as preferred habitats for medium-sized mammals. <p>Vegetation mapping over the existing and historic mine regions of the Huntly Mine indicates that the clearing from 1989 to 2022 has avoided:</p> <ul style="list-style-type: none"> More than 91% of granite outcrop habitat; More than 98% of swamps; and More than 96% of streamzone habitat. <p>Introduction of more stringent requirements will provide additional management for these habitat types.</p> <p>Fauna Conservation:</p> <p>Alcoa’s mine rehabilitation efforts show that most terrestrial fauna, including several conservation-significant species known or likely to inhabit the Mine DEs, return within approximately 5–10 years after rehabilitation is completed. Examples include (Alcoa, 2022a):</p>

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	<ul style="list-style-type: none"> • Carnaby’s and Baudin’s Cockatoo (foraging on proteaceous plants) within 4 years; • Forest Red-tailed Black Cockatoo’s (FRTBC) (foraging on myrtaceous plants) within 7 years; • Chuditch and Quenda within 2 years; • Western Brush Wallaby within 4 years; and • Brush-tailed Phascogale within 10 years. <p>Efforts to conserve fauna species include:</p> <ul style="list-style-type: none"> • Feral animal control programs, such as Operation Foxglove and Western Shield; • Successful recovery of species like Woylie, Chuditch, and Quokka via relevant recover plans; and • Monitoring of fauna return to rehabilitated areas, with most terrestrial fauna returning within 5-10 years. <p>Additionally, mine infrastructure alignments will be subject to detailed surveys and designed to avoid populations of conservation significant flora, Black Cockatoo nesting trees and populations of Carter’s Freshwater Mussel, as far as practicable.</p> <p>Water Quality and Soil Management:</p> <p>Measures to maintain water quality and manage soil contamination include:</p> <ul style="list-style-type: none"> • Monitoring of surface water quality, which shows relatively unimpacted conditions; • Currently no recorded contaminated sites within the Mine DEs as recorded in the DWER Contaminated Sites Database under the <i>Contaminated Sites Act 2003</i>; and • Investigation and management of potential soil contamination from past land uses. <p>Mining is not expected to cause hydrological impacts to potential groundwater dependent vegetation and is expected to provide a temporary offset to the decline in groundwater levels and streamflows since the 1990s resulting from declining rainfall over the Jarrah Forest (Alcoa, 2022a).</p> <p>Rehabilitation and Biodiversity Conservation:</p> <p>Alcoa’s rehabilitation program (developed over five decades of research and practice) plays a crucial role in conserving biological diversity and ecological integrity. The program focuses on:</p> <ul style="list-style-type: none"> • Restoring mined areas to a biodiverse Jarrah Forest ecosystem; • Addressing key aspects such as species composition and density; • Long-term ecosystem development; • Use of reference sites and long-term monitoring; and • Rapid assessment and feedback for adaptive management. <p>These efforts, along with legislative requirements, align with ecosystem restoration principles and aim to re-establish self-sustaining native ecosystems. As such, Alcoa considers that the Proposal will not significantly impact biological diversity or ecological integrity and is consistent with this principle.</p>

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<p>4. Principles relating to improved valuation, pricing and incentive mechanisms</p> <p><i>a. Environmental factors should be included in the valuation of assets and services.</i></p> <p><i>b. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement.</i></p> <p><i>c. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.</i></p> <p><i>d. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.</i></p>	<p>a. Environmental factors should be included in the valuation of assets and services:</p> <p>The MMP approval conditions require Alcoa to consider environmental factors in their operations such as;</p> <ul style="list-style-type: none"> • Condition 4 which states that Alcoa must implement operations to meet environmental objectives like avoiding clearing near Black Cockatoo nesting trees and minimising discharge of hazardous materials; and • Alcoa must submit DCMPs for pits or haul roads within public drinking water catchment areas (Condition 11). <p>b. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement:</p> <ul style="list-style-type: none"> • Alcoa must provide a \$100 million financial guarantee to help fund the Government’s response in case of impacts to Perth’s drinking water dams; • The MMP approval, to which these areas comply, conditions require Alcoa to stabilise and rehabilitate disturbed areas at their own cost (Conditions 7 and 12); and • Alcoa is responsible for greenhouse gas emissions from their operations, with Scope 1 and 2 emissions either managed through the Safeguard Mechanism or lower than levels that would trigger consideration by the EPA. <p>c. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes:</p> <ul style="list-style-type: none"> • Alcoa is required to conduct life cycle planning, including rehabilitation of all cleared areas “to establish a self-sustaining jarrah forest ecosystem”; and • Alcoa must manage drainage and stabilise disturbed areas, indicating they must account for full life cycle impacts. <p>d. Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems:</p> <ul style="list-style-type: none"> • The MMP approval sets environmental objectives and limits but allows Alcoa flexibility in how to achieve them; • The state government has implemented a transitional approvals framework to allow Alcoa to continue operating while moving towards contemporary environmental regulation, indicating a cost-effective approach to achieving environmental goals; and • Where there are potential significant residual impacts from the Proposal, these are counterbalanced by an offset proposal.

Principle	Consideration of Principle in the Proposal
<p>5. The principle of waste minimisation <i>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</i></p>	<p>Waste Reduction and Reuse: Alcoa implements several strategies to minimise waste generation and promote reuse:</p> <ul style="list-style-type: none"> • Mine overburden and topsoil management: All mine overburden and topsoil are locally reused for mine rehabilitation. Non-topsoil overburden is stockpiled and reused within each mine pit, minimising the need for off-site disposal and reducing environmental impact; and • Infrastructure utilisation: Mining operations are designed to maximise the use of existing mine facilities and infrastructure. This approach significantly reduces waste generation associated with constructing new facilities. <p>Hazardous Waste Reduction: Alcoa takes steps to minimise hazardous waste:</p> <ul style="list-style-type: none"> • PFAS-free fire-fighting foams: The company has committed to using PFAS-free fire-fighting foams for mine regions within the DE. This reduces the generation of persistent organic pollutants that can harm the environment. <p>Waste Management and Disposal: Proper waste management practices are implemented:</p> <ul style="list-style-type: none"> • Off-site waste disposal: All wastes, except for treated sewage effluent, are transported off-site for recycling or disposal at licenced waste facilities. This ensures proper handling and minimises environmental discharge; and • Wastewater treatment: Alcoa operates wastewater treatment plants to treat and recycle process water, reducing the volume of wastewater discharged to the environment. <p>Greenhouse Gas Emissions Reduction: Alcoa recognises the importance of minimising greenhouse gas (GHG) emissions and the Proposal will not increase GHG emissions beyond the current authorised limit.</p> <p>Additional Waste Minimisation Measures: Alcoa implements several other strategies to minimise waste:</p> <ul style="list-style-type: none"> • Bauxite residue management: The company employs dry stacking techniques for bauxite residue disposal, which reduces water content and overall waste volume; • Recycling programs: Alcoa has implemented comprehensive recycling programs for materials such as scrap metal, paper, and plastics across its operations; and • Water conservation: The company employs water recycling and conservation measures to reduce freshwater consumption and minimise wastewater generation.
<p>Description of how the object of the EP Act has been considered</p>	
<p>Alcoa has planned the Proposal to incorporate measures to protect the environment of Western Australia, including consideration of the EP Act principles as presented above. The Proposal includes impact avoidance and minimisation measures and an offset strategy to counterbalance significant residual impacts.</p>	

4.2 Key Environmental Factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a proposal or scheme (EPA, 2020b). There are 14 environmental factors listed by the EPA and they have been organised into five themes: Sea, Land, Water, Air and People.

The ESD (EPA, 2024a) has identified six preliminary Key Environmental Factors. The impacts assessed against each factor are presented in Table 4-2, as identified in the approved ESD. The factors to be addressed in the ERD for the Proposal are:

- Flora and vegetation;
- Terrestrial fauna;
- Inland waters;
- Terrestrial environmental quality;
- Greenhouse gas emissions; and
- Social surroundings.

Consistent with the EPA's Instructions on how to prepare an ERD (EPA, 2024c), this document presents a detailed assessment of the Key Environmental Factors and a summary assessment of the other environmental factors.

Table 4-2: Key Environmental Factors

Key Environmental Factor	Impacts Assessed	Section of this ERD
Flora and Vegetation	<ul style="list-style-type: none"> • Direct impacts to flora and vegetation as a result of clearing. • Indirect impacts to flora and vegetation as a result of: <ul style="list-style-type: none"> ○ Fragmentation of vegetation; ○ Introduction and/or spread of weeds; ○ Introduction and/or spread of <i>Phytophthora</i> dieback or other forest diseases; ○ Spills and/or leaks from storage and handling of hazardous materials and waste; ○ Dust emissions; ○ Water use for dust suppression; ○ Altered hydrology/groundwater regimes; and ○ Change in fire regimes. 	Section 5.2
Terrestrial Fauna	<ul style="list-style-type: none"> • Direct impacts to terrestrial fauna as a result of: <ul style="list-style-type: none"> ○ Habitat loss from clearing; ○ Injury/mortality from fauna entrapment or vehicle/equipment collisions; and ○ Clearing of fauna habitat types leading to potential loss of fauna habitat. • Indirect impacts to fauna as a result of: <ul style="list-style-type: none"> ○ Introduction and/or spread of weeds; ○ Introduction and/or spread of <i>Phytophthora cinnamomi</i> Dieback potentially leading to habitat degradation; ○ Attraction of feral animals potentially leading to increased predation by introduced fauna species; ○ Altered hydrological regimes potentially leading to degradation/alteration of foraging and dispersal habitat; ○ Disturbance from light, noise and/or vibration, and possible displacement of fauna associated with construction activity and mining operations; ○ Spills and/or leaks from storage and handling of hazardous materials and waste; ○ Habitat fragmentation and barriers to fauna movement; and ○ Habitat degradation associated with construction activities or mining activities and/or increased human activity including transmission of weeds and dust. 	Section 5.3

Key Environmental Factor	Impacts Assessed	Section of this ERD
Terrestrial Environmental Quality	<ul style="list-style-type: none"> • Direct impacts to terrestrial environmental quality as a result of: <ul style="list-style-type: none"> ○ Soil salinisation as a result of mining-induced saline groundwater rise; ○ Disturbance of potential ASS; ○ Erosion of cleared and post-mining landforms; ○ Vegetation removal; and ○ Degradation and erosion formation during rehabilitation. • Indirect impacts to fauna as a result of: <ul style="list-style-type: none"> ○ Contamination from spills and/or leaks from storage and handling of hazardous materials and waste. 	Section 5.4
Inland Waters	<ul style="list-style-type: none"> • Direct impacts to inland waters as a result of: <ul style="list-style-type: none"> ○ Changes to surface water regimes because of alteration of landscape and drainage from mining operations; ○ Changes to groundwater regimes as a result of increased infiltration (causing mounding) and removal of vegetation; and ○ Contamination from spills and/or leaks from storage and handling of hazardous materials and waste. • Indirect impacts to inland waters as a result of: <ul style="list-style-type: none"> ○ Increases in stream salinity as a result of mining-induced saline groundwater discharge; ○ Increased sediment from erosion of post-mining landforms; ○ Potential impacts to public health; ○ Water quality deterioration in streams and reservoirs (for example, turbidity, salinity, pathogens, hydrocarbons, PFAS, nutrients, pesticides), including cumulative impacts from existing mining operations; and ○ Contamination of surface water or groundwater with PASS compounds. 	Section 5.5

Key Environmental Factor	Impacts Assessed	Section of this ERD
Social Surroundings	<ul style="list-style-type: none"> • Direct impacts to heritage values as a result of: <ul style="list-style-type: none"> ○ Disturbance (direct or indirect) to Aboriginal heritage sites; and ○ Disturbance (direct or indirect) to European heritage sites. • Indirect impacts to heritage values as a result of: <ul style="list-style-type: none"> ○ Restriction of access to sites; and ○ Impact to the amenity of value of a site. • Direct impacts to social amenity values as a result of: <ul style="list-style-type: none"> ○ Clearing of natural vegetation and alteration of the terrain. ○ Dust and noise generation; and ○ Restriction of access. • Indirect impacts to social amenity values as a result of: <ul style="list-style-type: none"> ○ Impacts to visual amenity and sense of place from clearing of vegetation, mining and construction activities and dust generation; ○ Impacts to amenity and sense of place from construction and operational noise and audibility of machine derived tones; and ○ Impacts on recreational use of areas due to direct disturbance, noise, dust deposition and traffic. 	Section 5.6 (Heritage) Section 5.7 (Amenity)
Greenhouse Gas Emissions	<ul style="list-style-type: none"> • Increased net greenhouse gas emissions from mining and refining activities. 	Section 5.8

4.3 Impact Assessment Approach

A systematic approach to identify and assess potential environmental and social impacts has been undertaken to determine the mitigation and management measures to prevent or minimise potential impacts. The assessment approach has been developed to address the requirements of the EP Act by ensuring the assessment has been completed in accordance with the approved ESD (EPA, 2024a) and the EPA instructions for preparing an ERD (2024c).

In addition to defining the environmental factors and objectives relevant to assessment of the Proposal, the ESD provides a detailed scope of work to be addressed in the ERD (this document), including a detailed assessment of impacts (direct, indirect and cumulative), and identification of mitigation and management measures. Impact assessments often include a level of uncertainty which may be a result of limited available data, the complexity of a factor, or the complexity of an interconnected system. The impact assessment has been undertaken utilising available information sourced from the public domain, Alcoa's internal and published reports and articles, technical and ecological reports, and data obtained from Alcoa's historic and current practices, operational performance, and broad studies encompassing the Mine DEs.

A conservative approach, consistent with the precautionary principle, has been applied where there is uncertainty surrounding potential impacts. The assessment acknowledges a number of data gaps where additional information is required to be obtained during planning and operations.

The assessment has been undertaken for portions of the Huntly and Willowdale mines, whereby following a third-party referral of Alcoa's 2022–2026 MMP and 2023–2027 MMP, the EPA determined select areas of operations (as defined by the Mine DEs) to be a significant amendment to the following Ministerial Statements:

- MS 646 – Pinjarra Refinery Efficiency Upgrade Pinjarra, approved 3 March 2004 and last amended 21 September 2015; and
- MS 728 – Wagerup Alumina Refinery – Production to a Maximum Capacity of 4.7 Million tonnes per annum and Associated bauxite mining, approved 14 September 2006 and last amended 27 September 2016.

The EIA has incorporated the mitigation hierarchy consistent with Western Australian guidance, which is in order of priority:

- Impact avoidance;
- Impact minimisation; and
- Rehabilitation.

Alcoa's framework for impact avoidance includes a commitment to protecting key environmental values and areas identified by environmental studies and stakeholder consultation, as detailed in Section 3.

Alcoa has a mature environmental management system for its WA Operations, which is compliant with international standards. Alcoa's environmental management system is detailed in Section 2.2 and includes preventative risk management to protect drinking water quality in accordance with the Australian Drinking Water Guidelines.

Alcoa is an acknowledged world leader in mine site rehabilitation and has evolved its rehabilitation program over more than five decades of research and development. Alcoa's rehabilitation program is detailed in Section 2.2.4.

Where, after applying the mitigation hierarchy a significant residual impact is identified, Alcoa has proposed an offset strategy to counterbalance the impacts, in accordance with the Western Australian Environmental Offsets Framework. Alcoa's offset strategy is detailed in Section 8.6 and provided in Appendix 13 and for further information refer to the Pinjarra Alumina Refinery Revised Proposal (Assessment 2253) ERD.

4.3.1 Mine Disturbance Footprint

Alcoa has developed disturbance areas for the Proposal, covering the Huntly Mine DE (Figure 1-2) and the Willowdale Mine DE (Figure 1-3), based on the preliminary mine plan and concept design of mine facilities and infrastructure presented in the 2022–2026 and 2023–2027 MMPs. The disturbance is conservative, reflecting conceptual mining planned for the next 5-year iteration.

The actual locations of the mine pits, facilities, and infrastructure may be subject to change within the Mine DEs in response to detailed mine planning. This planning will occur on a progressive basis over intra-annual and inter-annual timeframes, and the detailed design of mine infrastructure. This flexibility ensures efficient mining and optimal resource recovery for a given disturbance area and enables adjustment to mine infrastructure in response to pre-clearing surveys and impact avoidance measures. The retained flexibility in the actual disturbance footprint within the Mine DEs allows for adaptive management of environmental factors and is, therefore, consistent with the principles of conservation of biodiversity and ecological integrity, and waste minimisation.

Mine disturbance consists of bauxite mining and associated supporting infrastructure (roads, conveyors, stockpiles, monitoring, and management equipment), cleared areas, and rehabilitation activities. The Proposal and subsequent impact assessment assesses both proposed and existing operations noting aspects of the Proposal have already been implemented and Alcoa continues to operate under the Exemption Order (see Section 2.1.2).

Knowledge and assessment of the historic clearing, mine activity, and rehabilitation improves the confidence in the estimated distribution of direct impacts to vegetation communities and associated values within the Mine DEs, including potential Priority Ecological Communities (PECs), groundwater dependent ecosystems, and habitat for conservation significant species.

4.3.2 Commitments to Protect Key Environmental Values

In planning the Proposal, Alcoa has committed to the protection of key values and areas identified by environmental studies and stakeholder consultation. This approach is consistent with the principle of conservation of biological diversity and ecological integrity. Alcoa's framework for the protection of key values and areas, in relation to these Proposal, involves three core measures:

- Limited Disturbance Areas;
- Mining Avoidance Zones; and

- Other avoidance measures.

The process of development of these components and the protection of the key values and areas are discussed below.

4.3.2.1 Protection Measure 1 – Limited Disturbance Area

Alcoa has developed Limited Disturbance Areas (LDA) which will act to minimise direct impacts to areas of environmental and social value. The LDA defines areas within the Mine DEs where no mining pits will be located. The LDA does not limit the activities associated with the construction of haul roads or facilities. The following areas, as identified in the 2023–2027 MMP (Alcoa, 2023b), are considered of high environmental and social value that guide the identification and development of the LDA:

- Major granite outcrops (>1 ha + buffered by 50 m) (Alcoa, 2023b);
- Streamzone vegetation and a 100 m buffer;
- Confirmed PECs;
- Conservation significant flora (as far as practicable);
- Carter’s Freshwater Mussel Population;
- 2 km of any reservoir Top Water Level from 1 July 2024 (EPA, 2023d); and
- Areas with an average slope greater than 16% within Reservoir Protection Zones (RPZs) from December 2023 (Minister for State Development, 2023).
- No new mine pit clearing within:
 - 1 km of any reservoir Top Water Level from 1 July 2024 (EPA, 2023c) & (EPA, 2023d)
 - Areas with an average slope greater than 16% within Reservoir Protection Zones (RPZs) from December 2023 (EPA, 2023c)
 - 100 m buffer zone for mapped Stream Vegetation
 - OCA1 (Top Water Line 200 m)
 - Yamba Catchment
 - Logue Brook Dam.
- Confirmed Conservation Category Wetlands and Resource Enhancement Wetlands
- Groundwater protection: Maintain a minimum clearance of 2 m between pit base and groundwater.

4.3.2.2 Protection Measure 2 – Mining Avoidance Zones

Alcoa has developed Mining Avoidance Zones (MAZ) within the Mine DEs which will avoid the direct impacts of mining activities. Mining activities are inclusive of all disturbance, such as clearing for pits, construction of haul roads, mine infrastructure and facilities, stockpiles and ROM pads etc. Some minor clearing for monitoring, management or rehabilitation purposes may occur. As mine planning progresses, the area to be considered within the MAZ may be further expanded to protect additional areas and are seen below.

Aboriginal and European Heritage and social amenity:

- Registered Aboriginal heritage sites (buffered 10 m).
- Aboriginal heritage sites identified during surveys (buffered 10 m).
- European heritage sites (buffered 10 m).

- Dwellingup, Kingsbury Drive area, Hoffman Mill, Bibbulmun Track, portions of Lane Poole Recreation Reserve, and other significant conservation areas as shown in relevant maps
- 200 m public roads or recreational trails buffers (or as determined through visual impact assessments) to prevent impacts on screening vegetation within Hoffman Mill, Logue Brook Dam, Balmoral POW Camp, and Dwellingup Recreation Reserve

Flora and Fauna Protection:

- Old Growth Forest as identified by DBCA (Alcoa, 2023b)
- National Parks and Nature Reserves (Alcoa, 2023b) including:
 - Lane Poole Conservation Reserve and portions of Formal Recreation Reserve.
 - Falls Brook Nature Reserve
 - Dwellingup Reserve
- Threatened flora and ecological communities (Alcoa, 2023b).
- Recorded populations of Carter's Freshwater Mussel, as far as practicable.
- Black Cockatoo protection zones;
- Black Cockatoo Nest, confirmed night roosting and Significant trees (buffered 30 m³);
- Identified Woylie populations;
- Active breeding Chuditch dens; and
- Identified Numbat and WRP populations.

Water Catchments and Reservoirs:

- Serpentine Pipehead Dam Catchment (Alcoa, 2023b):
 - Top Water Line of Serpentine Dam (buffered 1 km).
 - No clearing or mining activities (excluding rehabilitation) within this area from December 2023.
 - Clearing within this zone must be rehabilitated, stabilized, or have drainage controls in place within the first available rehabilitation season.

4.3.2.3 Protection Measure 3 – Other Avoidance Measures

The third element of Alcoa's framework for protecting key values and areas is specific avoidance measures for certain mine elements or avoiding key values/areas where practicable. These measures aim to avoid and/or manage potential impacts to environmental and social values, which occur outside mining avoidance zones.

While these measures cannot be mapped over specific avoidance zones, they are expected to provide a high level of protection to key environmental and social values in the Mine DEs. These avoidance measures are listed below.

³ For critical infrastructure (e.g., haul roads), a reduced buffer zone of 10 m may be implemented subject to the Minister for State Development approval as part of the State Agreement Administrative Framework. Excludes exploration, rehabilitation and groundwater bores.

Flora and Vegetation / Terrestrial Fauna

- Avoid or minimise clearing of restricted range vegetation types as far as practicable, including:
 - Granite outcrop vegetation, which is a potential PEC and potential habitat for conservation significant flora
 - potential groundwater dependent ecosystems and potential habitat for conservation significant flora and fauna (e.g., Quokka);
- Avoid clearing conservation significant flora communities as far as practicable; and
- Avoid populations of Carter's Freshwater Mussel.

The avoidance of restricted range vegetation types and limited crossing of streams is therefore predicted at a high confidence and will protect the associated conservation significant flora and fauna populations, contributing to the maintenance of the ecological integrity of the NJF.

Inland Waters

- Construction compounds and mine facilities, including sewage treatment plants and fuel farms, are located outside of reservoir protection zones;
- Minimise crossing of mapped swamp and streamzones as far as practicable; and
- Groundwater protection: Maintain a minimum clearance of 2 m between pit base and groundwater.

Since 1972, clearing in the Huntly Mine has avoided approximately 97% of the mapped stream length within the mine regions, including 96% of the mapped third and fourth order streams.

Social Surroundings

- Social impact assessments undertaken and appropriate Management Plans developed if required; and
- Maintain visual screening corridors along recreational trails, facilities and public road interfaces.