

**Alcoa of Australia
Limited**



**Environmental
Referral Supporting
Document**

June 2020

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Acronyms

Abbreviation	Definition
AHIS	Aboriginal Heritage Inquiry System
AMSL	Above mean sea level
AQMP	Air Quality Management Plan
Alcoa	Alcoa of Australia Limited
ASI	Aluminium Stewardship Initiative
ASS	Acid sulfate soil
BC Act	<i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
CCN	Community Consultative Network
CO	Carbon monoxide
CARIREC	CAR Informal Reserves Evaluation Committee
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWE	Department of Agriculture, Water and Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
DJTSI	Department of Jobs, Tourism, Science and Innovation
DMA	Decision-making authority
DMIRS	Department of Mines, Industry Regulation and Safety
DMP	Dust Management Plan
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EAD	Environmental Assessment Document
EIA	Environmental impact assessment
EIP	Environmental Improvement Plan
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
EPS	Pinjarra Refinery Efficiency Upgrade, Environmental Protection Statement
EMM	Environmental Management Manual
ERD	Environmental Review Document
ESA	Environmentally Sensitive Area
FMP	Forest Management Plan
FPC	Forest Products Commission

Abbreviation	Definition
GHG	Greenhouse Gas
IBRA	Interim Biogeographic Regionalisation of Australia
ICMM	International Council on Mining and Metals
IRZ	Intermediate Rainfall Zone
JIRZRP	Joint Intermediate Rainfall Zone Research Program
km	Kilometre
KPC	Key Proposal Characteristic
LTFMP	Long Term Fauna Monitoring Program
LTRMS	Long Term Residue Management Strategy
mbgl	Metres below ground level
ML1SA	Mineral Lease 1SA
MMP	Mining and Management Program
MMPLG	Mining and Management Planning Liaison Group
MNES	Matters of National Environmental Significance
MOG	Mine Operations Group
Mtpa	Million tonnes per annum
MSR	Mining sub-region
NO _x	Nitrous oxide
PDWSA	Public Drinking Water Source Areas
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
RFA	Regional Forest Agreement
RIWI Act	<i>Rights in Water and Irrigation Act 1914 (WA)</i>
RSA	Residue Storage Area
RPLG	Residue Planning Liaison Group
SWALSC	South West Aboriginal Land and Sea Council
SWIS	South West Interconnected System
SO ₂	Sulfur dioxide
SRE	Short Range Endemic
TDS	Total dissolved solids
TEC	Threatened Ecological Community
TMP	Trial Mining Project
tpa	tonnes per annum
VOC	Volatile organic carbon
WA	Western Australia
WONS	Weed of National Significance

Executive Summary

Alcoa of Australia Limited (Alcoa) is seeking to modernise its environmental approvals framework for its Huntly Bauxite Mine (the mine) and Pinjarra Alumina Refinery (the refinery) in the Peel region of Western Australia (WA). In doing so, Alcoa is seeking approval to primarily increase production at the refinery and secondly continue the supply of bauxite for export (the Proposal). The Proposal comprises the following components:

- an increase in alumina production at the Pinjarra Alumina Refinery by 5% from 5.0 million tonnes per annum (Mtpa) to 5.25 Mtpa, and an
- increase in the rate of mining within ML1SA to supply up to 2.5 Mtpa of bauxite for export.

Alcoa is referring the Proposal to the Environmental Protection Authority (EPA) for assessment under Part IV of the *WA Environmental Protection Act 1986* (EP Act) and to the Commonwealth Department of Agriculture, Water and Environment (DAWE) for consideration under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

This referral is part of the long history of Alcoa's operations in WA. Alcoa commenced its operations in Western Australia in 1963 under an agreement with the State of Western Australia to build and run the Kwinana Alumina Refinery. The same agreement also granted a right to mine for bauxite in the nearby Darling Scarp. Operations expanded under subsequent State Agreements which supported two additional alumina refineries in Pinjarra and Wagerup, with bauxite mining continuing in the original mining lease area. The historical growth of Alcoa's operations has occurred against the backdrop of evolving environmental legislation and management policies, which have been complemented by successive Ministerial Statements and the provision of environmental licences tailored to each of our operations.

Throughout this period, Alcoa has built strong relationships with the people and environment of the Peel Region. Alcoa recognises the Aboriginal Traditional Owners of the land on which it operates, the Noongar people of the Gnaala Karla Booja region, and acknowledge that this referral relates to land over which they are traditional custodians.

Alcoa has the privilege of operating in an area of southwest WA characterised by Jarrah forests, a range of flora and fauna and a vast number of waterways. Alcoa has accumulated considerable expertise in managing its impact on this unique ecosystem. For decades, Alcoa has invested in research into local flora and fauna and has developed a deep understanding of Jarrah forest management techniques which have supported its leading forest rehabilitation practices. Alcoa's efforts are recognised both locally and internationally by government and academics alike. To date, less than 4% of the Jarrah forest within the mining lease area has been mined; Alcoa expects to mine less than 8% of this area over the life of its WA operations. Of the areas that have been mined, 77% has been rehabilitated to date. Importantly, Alcoa does not mine in gazetted national parks, nature conservation reserves, old growth forest or other areas of high conservation value, including rock outcrops.

In addition to fulfilling its business objectives, Alcoa recognises the opportunity this process affords to work with state and federal regulators and the broader community to shape Alcoa's future mining assessments and approvals processes. Building from the foundation of its existing environmental assessment and approvals framework, Alcoa sees the potential to incorporate modern elements of environmental management practice, ensuring that our environmental assessment and approvals framework continues to grow and change with public and regulator expectations. We aim for this process to provide greater transparency for all stakeholders, increased regulatory confidence, and improved business certainty.

This document outlines the work Alcoa will undertake during this assessment process including detailed flora and fauna surveys, surveys for species covered by federal legislation, air quality and noise monitoring, a greenhouse gas assessment, visual amenity and recreational use management plans, and the engagement Alcoa is committed to in order to discuss the proposed activities with communities and other stakeholders.

1 Introduction

1.1 Purpose and scope of referral

Alcoa of Australia Limited (Alcoa) is seeking approval to increase production at the Pinjarra Alumina Refinery (the refinery) and increase the rate of bauxite mining within Mineral Lease 1SA (ML1SA) to supply bauxite for export to third party customers (the Proposal). The Proposal is located in the Peel Region of Western Australia (WA), approximately 100 km southeast of Perth, (see Figure 1-1) and comprises the following components:

- an increase in alumina production at the Pinjarra Alumina Refinery by 5% from 5.0 Mtpa to 5.25 Mtpa, and an
- increase in the rate of mining within ML1SA to supply up to 2.5 Mtpa of bauxite for export.

Alcoa is referring the Proposal to the Environmental Protection Authority (EPA) for assessment under Part IV of the *WA Environmental Protection Act 1986* (EP Act) and to the Commonwealth Department of Agriculture, Water and Environment (DAWE) for consideration under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). The resulting Environmental Impact Assessment (EIA) will inform stakeholders on long-term mine plans and environmental management requirements and facilitate the setting of contemporary approval conditions.

The refinery is subject to approvals under environmental legislation including Ministerial Statement 646 (MS 646) under Part IV of the EP Act. Mining operations at Huntly Mine are undertaken in accordance with a five-year Mining and Management Program (MMP) that is approved by the Minister for State Development on advice of the Minister for Environment and the Mining and Management Program Liaison Group (MMPLG).

This supporting document has been prepared to support the EP Act and EPBC Act referrals and provides an overview of the Proposal, the existing and proposed approval framework, key environmental values, potential impacts and management regime.

1.2 Alcoa background

Alcoa is owned 60% by Alcoa Corporation (a US listed company) and 40% by Alumina Limited (an Australian listed company).

Alcoa commenced operations in Western Australia in 1963 with the commissioning of its Kwinana Refinery, pursuant to the *Alumina Refinery Agreement Act 1961*. The State Agreement between Alcoa and the WA Government granted Alcoa the bauxite mining lease area (ML1SA), which extends from Mundaring to Collie, and initially supported development of Kwinana Refinery.

Alcoa has agreed to two further substantive State Agreements covering the 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*

These State Agreements support the breadth of Alcoa's operations in Western Australia. Alcoa's Western Australian operations support approximately 3,750 direct jobs, predominantly in regional areas, and include:

- two bauxite mines (Huntly and Willowdale)
- three alumina refineries (Kwinana, Pinjarra and Wagerup), and
- two dedicated port facilities (Kwinana and Bunbury).

Alcoa also operates an aluminium smelter in Victoria (Portland).

Alcoa's Australian operations represent one of the world's largest integrated bauxite mining, alumina refining and aluminium smelting systems and add value to Australia's local, state and national economies at each stage of production. In 2018, Alcoa's Australian operations injected approximately AU\$690 million into Australia's local, state and federal governments through the payment of royalties, taxes, rates and charges. Approximately AU\$114 million was paid to Western Australian local and state governments. More than 65% of Alcoa of Australia's total annual revenue stays in Australia through wages, local purchasing, taxes, royalties and dividends to Australian shareholders.

1.3 Environmental performance overview

Since mining commenced in 1963, Alcoa has mined less than 4% of the Jarrah forest within ML1SA. Alcoa expects over the lifetime of operations in Western Australia to mine less than 8% of the overall area of ML1SA. Alcoa does not mine in gazetted national parks or nature conservation reserves, or in old growth forest or other areas of high conservation value such as rock outcrops, and has worked collaboratively with government in the development of a comprehensive reserve system in the Northern Jarrah Forest (Gardner and Stoneman 2003).

Inherent to Alcoa's core values is the protection of the environment and our commitment to the highest standards of environmental performance (Alcoa 2020a). Two of Alcoa's key environmental priorities are mine rehabilitation and bauxite residue management (Alcoa 2020b). Alcoa puts sustainability at the heart of our strategic agenda and recognises that sustainable operations support key business drivers and deliver better outcomes for the environment and the communities where we operate.

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

Alcoa has a multi-decade record of mine site rehabilitation and is the first mining company in the world to achieve 100% plant species richness in rehabilitated mine site areas. Alcoa has led research into innovative techniques for best-practice restoration including ways to overcome seed dormancy and development of propagation protocols for 'recalcitrant' species (Koch, 2007; Grant and Koch, 2007). Alcoa's objective for rehabilitation is to re-establish a self-sustaining Jarrah forest ecosystem that fulfils forest land uses that include conservation, timber production, water catchment and recreation (Alcoa 2020c). To this end,

Alcoa has developed standards, or Completion Criteria, for its bauxite mine rehabilitation in conjunction with regulatory authorities and other stakeholders.

Alcoa's efforts in returning biodiversity to areas of mine rehabilitation have received widespread recognition, including the prestigious Golden Gecko Award in 2002, 2007 and a Certificate of Merit in 2018 from the Department of Mines Industry Regulation and Safety, and in 2003 the Model Project Award from the Society for Ecological Restoration International, for leadership in ecological restoration. In 1990, Alcoa was the first mining company in the world to be listed on the United Nations Environment Programme's Global 500 Roll of Honour for excellence in mine rehabilitation.

Alcoa has been working toward more sustainable residue storage practices at our refineries for many years, transitioning from a traditional wet disposal practice to a dry stacking process. Dry stacking increases the volume of residue that can be stored within a given footprint and significantly reduces the potential for impacts on the surrounding environment.

Alcoa has extended this work at Pinjarra Refinery through the installation of a residue filtration facility to process about 50% of the mud component of Pinjarra's residue stream. In the facility, bauxite residue is forced through very large filters that squeeze the water from the mud. The resulting filter cake has a moisture content low enough to allow for more conventional materials handling (conveying) and stacking. Residue filtration is expected to provide improvements to the residue management process including a reduction in water usage and in the future residue footprint.

1.4 Previous assessments and approvals

1.4.1 State Agreements

The Proposal is primarily subject to two State Agreements; the *Alumina Refinery Agreement Act 1961* and the *Alumina Refinery (Pinjarra) Agreement Act 1969*. These detail the rights, obligations, terms and conditions in relation to the operation of the refinery and the mine.

Alcoa's State Agreements, read together, and in conjunction with a range of Ministerial Statements issued under the EP Act, create a regulatory framework that Alcoa has operated under since it first began operations in Western Australia.

Alumina Refinery Agreement Act 1961

As noted in Section 1.2, Alcoa was granted approval to mine bauxite within mineral lease ML1SA, under the *Alumina Refinery Agreement Act 1961*. ML1SA covers 7,129 square kilometres across Darling Plateau and extends from east of Perth to east of Bunbury (Figure 1-1). ML1SA includes several mining areas comprising the Huntly Mine (1976 to present), the former Jarrahdale Mine to the north (1963 to 1998), and the Willowdale Mine to the south (1984 to present) which supplies the Wagerup Alumina Refinery. The western boundary of ML1SA comprises the Swan Coastal Plain and the eastern boundary adjoins the Worsley mining lease ML258SA.

Under Clause 13(3) of the *Alumina Refinery Agreement Act 1961*, Alcoa pays compensation to the State Government (Conservator of Forests) for forest impacted by or in connection with the Company's mining activities. The amount of compensation is paid based on the planned clearing for the calendar year, with a reconciliation of the actual clearing from the

previous year. Over the past 10 years, Alcoa has paid between \$3.82M - \$8.54M compensation per year, with total compensation paid equal to \$55.93M.

Since 1961 a series of reviews of conservation reserves have been undertaken to improve biodiversity protection across the region. As a result of the reviews, Alcoa has agreed not to mine in conservation areas, an agreement incorporated into the *Alumina Refinery Agreement 1961* through a 1986 amendment. Additional reserves have been established under the Regional Forest Agreement between the State and Commonwealth and the Forrest Management Plan review process.

Alumina Refinery (Pinjarra) Agreement Act 1969

Alcoa was granted approval to develop the refinery under the *Alumina Refinery (Pinjarra) Agreement Act 1969*. The refinery was commissioned in 1972, prior to the introduction of environmental protection legislation in WA. The refinery is now subject to approvals under environmental legislation including MS 646 under Part IV of the EP Act (see Section 1.4.2) and environmental and water abstraction licences (see Section 1.5).

1.4.2 Environmental Protection Act 1986 (WA)

As the Pinjarra refinery and associated mining at Huntly were established before the introduction of environmental legislation in WA (and had existing approvals under the *Alumina Refinery Agreement Act 1961* and *Alumina Refinery (Pinjarra) Agreement Act 1969*), these operations were not originally subject to Ministerial conditions pursuant to Part IV of the EP Act. In 2003 the State Agreement exemption in the EP Act was removed. At that time, refinery production was approximately 3.5 Mtpa with associated mining production of approximately 11.5 Mtpa.

In December 2003, Alcoa referred a change to the refinery under Part IV of the EP Act. The referral document (Pinjarra Refinery Efficiency Upgrade, Environmental Protection Statement (EPS)) set out the change to the project, which was essentially to increase production from 3.5 Mtpa to 4.2 Mtpa. The referred proposal included an increase in the rate of bauxite mining at the mine to supply the increase in production capacity and linked the operation of the mine and the refinery.

The EPS sets out the extent of the refinery and associated mining at the mine that comprised the proposal referred in December 2003.

Following assessment, the pre-existing and proposed production at the refinery and the associated mining were approved by MS 646, which was granted in March 2004. Schedule 1 of MS 646 set out the following Key Proposal Characteristics:

- Alumina production 4.2 million tonnes per annum (Mtpa)
- Bauxite mining rate 22.6 Mtpa¹; and
- Project life > 45 years

1: approx 14.5 Mtpa associated with supply of bauxite to Pinjarra Alumina Refinery

A number of changes have been approved to the proposal under s 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)). Attachment 2 took the maximum production of the proposal to 5 Mtpa with associated bauxite mining.

A key aspect of the proposal referred in 2004 was that bauxite mining would continue to be carried out in accordance with a Mining and Management Program (MMP) approved by the Minister for State Development on advice from the Minister for Environment and the MMPLG. This was provided as a commitment in the EPS document. The MMPLG is recognised by the Minister for Environment in Ministerial Statements (95, 390, 564, 728, 897 and 1069) regarding expansion of Alcoa operations.

Alcoa's mining operations within ML1SA are also conducted in accordance with the Environmental Protection (Alcoa – Huntly and Willowdale Mine Sites) Exemption Order 2004 (Exemption Order) made by the Minister for the Environment. The Exemption Order is consistent with the *Alumina Refinery (Wagerup) State Agreement and Acts Amendment 1978* that established the MMPLG and MMP processes. It also reflects the procedures of Ministerial Statement 728 that sets out the MMPLG's responsibility to review annual rolling 5-year mine plans for Alcoa's operations.

The MMPLG was first established in 1978 and consists of representatives of the Department of Jobs, Tourism, Industry and Resources (JTSI), Department of Water and Environment Regulation (DWER), Water Corporation, Department of Biodiversity, Conservation and Attractions (DBCA), and the Department of Mines Industry Regulation and Safety (DMIRS).

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

The current approved MMP for 2020-2024 authorises mining, for supply of bauxite to the Pinjarra refinery, of an average of just over 16.0 Mtpa (dry tonnes) per year at Huntly mine with associated clearing at an average of approximately 350 ha/year over the five-year period. This includes mining for up to 2.0 Mtpa (dry tonnes) of bauxite for export in 2020 and 2021.

1.5 Other approvals and regulation

1.5.1 Land tenure

The mine lies predominantly in State Forest, within Alcoa's mineral lease ML1SA granted under the *Alumina Refinery Agreement Act 1961* (see Section 1.4.1, Figure 1-1). The refinery lies on freehold land owned by Alcoa.

1.5.2 Commonwealth Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act protects Matters of National Environmental Significance (MNES) within Australia. Section 67 of the EPBC Act defines a 'controlled action' as one that is likely to cause a significant impact to a MNES and which must be approved under the EPBC Act. Parts 7 and 8 of the EPBC Act provides for the referral and assessment of controlled actions.

Commencement of the refinery and the mine predate the EPBC Act and have not previously required referral or assessment under the EPBC Act.

Alcoa is choosing to refer the Proposal to DAWE under the EPBC Act for a decision on whether or not the Proposal is a controlled action.

Should the Proposal be determined a controlled action, Alcoa will apply for the assessment of MNES to be undertaken as part of the EPA's assessment of the Proposal, under the Bilateral Agreement between the Commonwealth and WA Governments. The EPA's assessment under the EP Act will then inform a decision by the Federal Minister for the Environment and conditions for the Proposal under the EPBC Act.

1.5.3 Licences

The refinery operates subject to an Environmental Licence (L5271/1983/14) granted under Part V of the EP Act, which is administered by DWER. The Licence is valid to 2025 and authorises the prescribed premises of bauxite refining, electric power generation, fuel burning, and class II/III putrescible landfill.

The refinery has water abstraction licences granted under Section 5C of the *Rights in Water and Irrigation Act 1914* (RIWI Act) as follows:

- GWL 98936: 4 GL/year groundwater, Cattamarra Aquifer, 2016-2026
- GWL 167867: 2.5 GL/year groundwater, Cattamarra Aquifer, 2012-2016
- GWL 150586: 0.4 GL groundwater, Superficial Aquifer, 2016-2026
- SWL 98937: 3 GL/year surface water, Oakley, 2012-2022
- SWL 98940: 4 GL/year surface water, Oakley, 2012-2022
- SWL 98939: 2 GL/year surface water, Barritt/Tate, 2012-2022

The mine operates subject to an Environmental Licence (L6210/1991/10) granted under Part V of the EP Act. The Licence is to 2035 and authorises the prescribed premises of processing or beneficiation of metallic or non-metallic ore.

The mine has water abstraction licences granted under the RIWI Act, including SWL 83356 (70 ML/yr) and 153635 (30 ML/yr) from 2014-2024.

The refinery and mine operate in accordance with Dangerous Goods Storage Licences (DGS004240 and DGS008201) granted under the *Dangerous Goods Safety Act 2004*.

1.5.4 Bauxite export

Alcoa has the right under the *Alumina Refinery Agreement Act 1961* to request permission from the State to export bauxite from ML1SA. Alcoa currently is permitted to export up to 2.5 Mtpa of bauxite to December 2021 pursuant to an approval by the Minister for State Development under s 9(8) of the *Alumina Refinery Agreement Act 1961*. Alcoa intends to request an extension to this arrangement at a limit of 2.5 Mtpa.

1.6 Proponent details

The Proponent for this Proposal is Alcoa.

ABN: 93 004 879 298

Address: 181 – 205 Davy Street, Booragoon WA, 6154

The contact for Alcoa in relation to the Proposal is:

Soolim Carney

Regional Environment Manager - Australia

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Telephone: 08 9316 5887

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Figure 1-1 Locality plan and mine development envelope

2 The Proposal

2.1 Background

Alcoa of Australia Limited (Alcoa) is proposing to increase production at the Pinjarra Alumina Refinery (the refinery) and increase the rate of bauxite mining at the existing Huntly Mine (the mine) within Mineral Lease 1SA (ML1SA) to supply 2.5 Mtpa bauxite for export to third party customers (the Proposal).

Alcoa has gradually increased alumina production at the refinery through ongoing efficiency upgrades and expects that production will exceed the 5.0 Mtpa authorised under MS 646, reaching 5.25 Mtpa over the next decade. The current rate of alumina production at the refinery is approximately 4.7 Mtpa.

The current approved MMP for 2020-2024 authorises mining associated with Pinjarra refinery at an average of just over 16.0 Mtpa (dry tonnes) of bauxite per year at Huntly Mine with associated vegetation clearing at an average of approximately 350 ha/year over the five-year period. The MMP also includes mining for up to 2.0 Mtpa (dry tonnes) of bauxite for export in 2020 and 2021.

2.2 Basis for referral

Alcoa is referring the Proposal as a revised proposal to the previous Pinjarra Refinery Efficiency Upgrade, to enable an increase to alumina production and inclusion of 2.5 Mtpa bauxite mining for export. Alcoa is referring the Proposal to the EPA as a 'significant proposal', to facilitate an Environmental Impact Assessment that will inform stakeholders on the longer-term mine planning (2025-2035) and environmental management requirements and facilitate the setting of contemporary approval conditions.

2.3 Proposal description

2.3.1 Overview

In addition to providing certainty for future mining operations, this Proposal is an opportunity for Alcoa, in seeking to respond to discussions with regulators, including the EPA, to modernise parts of the environmental approvals framework. While the current framework that Alcoa has operated under for some time has been effective in supporting responsible environmental management within ML1SA, Alcoa recognises that there are opportunities for this framework to be updated.

By making this referral, Alcoa has the opportunity to work with regulators to revisit the role and function of the MMPLG, the MMP process and provide greater transparency for nearby communities and other stakeholders on the Pinjarra refinery and Huntly mine operations plans through to 2035. This would be characterised by an upfront assessment by the EPA for future mining areas, better reflecting the standard across our industry, while retaining elements of the current framework.

2.3.2 Overview of existing environmental management regime

The Proposal represents a graduated increase and continuation of existing refinery and mining operations that have grown since the establishment of the refinery in 1972 and the mine in 1976. These operations are subject to a mature environmental management regime that has evolved over the past four decades, including developments with the introduction of

environmental protection legislation, the Regional Forest Agreement (RFA) and Forest Management Plan (FMP) in the 1980s and 1990s.

As outlined in Section 1.4.2, environmental management of Huntly Mine is principally undertaken in accordance with the approved five-year rolling Mining and Management Program (MMP) as defined in the *Alumina Refinery (Wagerup) State Agreement and Acts Amendment 1978*, the Clearing Exemption conditions and Ministerial Statement 728. The MMPLG has two subcommittees: the Mining Operations Group (MOG); and the CAR Informal Reserves Evaluation Committee (CARIREC).

The role of MOG is to oversee and report to the MMPLG on the environmental (including forest clearing) and community issues arising from the day-to-day operational activities conducted at Alcoa's mine sites, as part of the Clearing Advice process (see Section 4.2.3).

The CARIREC was set up as a result of a process agreed to by the MMPLG and the EPA to evaluate Alcoa's planned incursions into CAR Informal Reserves within Alcoa's mining lease, as required under the Regional Forest Agreement. The CARIREC reports its findings and recommendations to the MMPLG which, in turn, makes its recommendations direct to the EPA on the acceptability of Alcoa's proposals.

Management of mining operations are also guided by the principles and procedures set out in two separate Working Arrangements agreed between Alcoa and the DBCA, and the Water Corporation and DWER respectively. The Working Arrangements were established jointly between Alcoa and the relevant agencies and are reviewed every five years. The intent of the Working Arrangements is to maintain a coordinated approach to the management of mining operations (including rehabilitation), protection of biodiversity and water resources within ML1SA.

Alcoa also has a Forest Compensation and Works Agreement in place with DBCA that sets out the requirements for compensation payments for clearing in relation to Alcoa's mining operations, funding of services provided by DBCA and payments for the DBCA and Alcoa joint Forest Enhancement Programme. The Forest Enhancement Programme is a funding system between Alcoa and DBCA through which both parties agree to fund specific forest management activities or projects within the Northern Jarrah Forest within ML1SA on an annual basis. This funding is used for projects such as Western Shield, Bibbulmun Track upgrades and weed control programmes. Alcoa provides annual funding of \$350,000-\$400,000 per year.

Alcoa undertakes progressive rehabilitation of its mining areas and has completed a total of 20,381 ha of rehabilitation since operations commenced in 1966 (77% of total mined area to date, including areas reserved for long-term infrastructure). Rehabilitation standards are set out in Alcoa's Bauxite Mine Rehabilitation Completion Criteria as agreed between Alcoa and the State (Alcoa 2016). Completion Criteria were first developed in the 1990s, with periodic revision to incorporate changing community expectations and improvements in knowledge. The Completion Criteria set out a process of assessment leading to an agreement between Alcoa and the state government that all rehabilitation requirements have been met.

Environmental management of the refinery is undertaken in compliance with MS 646 conditions and commitments and the Environmental Licence under Part IV and V of the EP Act. The MS 646 conditions and commitments include implementation of:

- Air Quality Management Plan (AQMP)
- Dust Management Plan (DMP)
- Emissions Reduction Program
- Greenhouse Gas Emissions Management Plan
- Water Efficiency Management Plan

The Environmental Licence includes stack emission limits, testing and reporting, and monitoring of surface water and groundwater.

Alcoa operates the refinery Residue Storage Areas (RSAs) in accordance with a Long-Term Residue Management Strategy (LTRMS), which is developed in consultation with a Stakeholder Reference Group and the Residue Planning Liaison Group (RPLG). The LTRMS is endorsed by the Minister of the Environment. The RPLG was formed in 1992 as part of the EIA and approvals for the Wagerup Alumina Refinery unit two expansion. As with the MMP and MMPLG, Alcoa agreed to extend the requirement for LTRMS and RPLG reviews to the Pinjarra and Kwinana alumina refineries.

Alcoa developed the Pinjarra Alumina Refinery LTRMS in 1997, with reviews in 2005, 2011 and 2016. The RPLG comprises agency representatives including DJTSl, DWER, DMIRS and DBCA. The refinery also operates in accordance with a five-year Environmental Improvement Plan (EIP) that was developed in consultation with community members, local government representatives, regulators and Alcoa employees. The EIP is publicly available on the Alcoa website.

Alcoa abstracts surface and groundwater for the Pinjarra Alumina Refinery in accordance with relevant water abstraction licences and the Pinjarra Alumina Refinery Surface Water and Groundwater Licences Refinery Operating Strategy approved under the RIWI Act.

Both the refinery and mine have Environmental Management Systems that have been certified to International Organisation for Standardisation ISO14001:2015 requirements for many decades. In 2006, Alcoa released an EIP for each of its operations in Western Australia. EIPs are a voluntary initiative by Alcoa that outlines the Company's commitment to continuously improve environmental performance, reduce environmental impacts and develop more sustainable operating practices.

2.3.3 Local and regional context

The Proposal is located in the Peel Region of Western Australia. The refinery lies on cleared land on the Swan Coastal Plain and the mine is located within Jarrah Forrest on the Darling Plateau (see Figure 1-1). The refinery lies within the Shire of Murray and the mine lies predominantly within the Shires of Murray, Serpentine-Jarrahdale and Boddington.

The refinery is located approximately 6 km east of Pinjarra town site on freehold land owned by Alcoa, including RSAs and an approximately 6000 ha buffer zone comprising freehold land surrounding the operation. Surrounding land uses are predominantly rural, with most of the land between South Western Highway and the Darling Scarp cleared of natural vegetation. The major agricultural activities in the region are beef cattle and sheep grazing.

The closest residential receptors are located off North Spur Road, approximately 3.5 km north-northeast. Other residential receptors are located on Napier Road, 4 km to the south of the refinery.

The current approved MMP covers operations at Huntly Mine through to 2024. From 2025 to 2030 mining operations at Huntly Mine will occur to the north of the current mining area (Figure 1-1). From 2030 operations will occur to the south of the current mining area (Figure 1-1). Huntly Mine lies predominantly within State Forest, managed for multiple uses under the RFA and FMP including conservation, recreation, timber production and water supply. The northern mining area is adjacent to Jarradale townsite and is bordered by Monadnocks Conservation Park to the north-east and Serpentine National Park to the west. This area lies within the drinking water catchment area of the Serpentine Dam. The southern mining area lies approximately 5 km to the east of Dwellingup and is located within the drinking water catchment of the South Dandalup Dam.

2.3.4 Key characteristics

Table 2-1 and Table 2-2 present the key elements of the Proposal proposed revised extent.

Table 2-1 Summary of the Proposal

Proposal title	Pinjarra Alumina Refinery and Huntly Mine extension
Short description	The proposal is to increase production rate at the Pinjarra Alumina Refinery located on South West Highway, Pinjarra, and supply of bauxite for export.

Table 2-2 Authorised extent of physical and operational elements

Ministerial Statement 646			
Element	Current Authorised extent	Proposed change to the Proposal	Final approved extent
Alumina production	5 Mtpa	0.25 Mtpa	5.25 Mtpa
Project life	>45	2045	2045
Development envelope refinery	3241 ha	Incorporate existing disturbance (1664 ha) and additional clearing (10 ha) ¹	Clearing of no more than 1674 ha ¹ within the 3241 ha development envelope
Development envelope mining	Clearing authorised under Part V of the EP Act	Clearing of no more than 6,700 ha within the 42,415 ha development envelope	Clearing of no more than 6,700 ha within the 42,415 ha development envelope ²
Bauxite export	2.0 Mtpa	2.5 Mtpa	2.5 Mtpa

Ministerial Statement 646			
Element	Current Authorised extent	Proposed change to the Proposal	Final approved extent
Refinery outputs (atmospheric emissions)			
Particulates (from stacks)	140 tpa	Refinery outputs to be estimated in Environmental Review Document to inform EPA assessment	Refinery outputs to be estimated in Environmental Review Document to inform EPA assessment
NO _x	860 tpa		
CO	900 tpa		
VOCs	162 tpa		
Greenhouse gases	2,581,700 tpa		
Net CO ₂ – Refinery with Alinta Cogeneration Project	564 kgCO ₂ / t alumina		
Bauxite residue	10 Mtpa		

1: Previous clearing approved under Part IV (Ministerial Statement 646) and Part V of the EP Act.

2: Clearing approved under Section 6 of the EP Act is not included in the 6,700 ha approved extent.

2.3.5 Pinjarra Alumina Refinery

Alcoa proposes an incremental increase to alumina production at the refinery up to 5.25 Mtpa (5% increase from existing 5.0 Mtpa approved rate) through ongoing efficiency upgrades. Alumina will continue to be refined from bauxite using the Bayer process as described in the Pinjarra Refinery Efficiency Upgrade EPS (Environ 2003). The Alinta Cogeneration project will continue to supply some of the refinery's steam requirements and generate electrical power for customers in the South West Interconnected System (SWIS). Alumina product will continue to be transported via rail to Bunbury Port and Kwinana Refinery for transportation to international markets and to the Portland Aluminium Smelter in Portland, Victoria. Bauxite will also be transported via rail to the Kwinana Bulk Terminal for export to third party customers.

Alcoa proposes to continue storing bauxite residue at the refinery. Alcoa has installed a residue filtration system that will decrease the potential storage area of residue produced by the refinery.

2.3.6 Huntly Mine

The Huntly Mine currently produces approximately 16.0 Mtpa (dry tonnes) of bauxite to supply the Pinjarra refinery. The current approved MMP for 2020-2024 authorises mining of an average of just over 16.0 Mtpa (dry tonnes) of bauxite per year at Huntly Mine with associated vegetation clearing at an average of approximately 350 ha/year over the five-year period. This includes mining for up to 2.0 Mtpa (dry tonnes) of bauxite for export in 2020 and

2021. Mining for 2.5 Mtpa of bauxite export would require approximately 50 hectares of clearing per year.

Alcoa propose to continue to operate the Huntly Mine through an initial extension into the mining area north of the existing operations in 2023 with a further extension to the south in about 2030 (Figure 1-1). This will enable continuity of bauxite supply to the Pinjarra Alumina Refinery as well as bauxite export.

The development of new mining areas will require new processing hubs, overland conveyors, haul roads, heavy vehicle access roads, public access roads, power generation and transmission equipment and supporting infrastructure. Construction in the northern mining region is scheduled to occur between 2023 and 2025, with operations occurring from 2025 to 2030.

Bauxite occurs as tabular ore bodies averaging 3.5 metres in depth and varying approximately 0.5 to 150 hectares in area. The ore is overlaid with gravel and soils varying in depth from 0 to 1.5 metres. The upper part of the ore frequently presents as cemented caprock, ranging in thickness from 0 to 2.5 metres. Beneath the caprock is a friable zone which merges into clay with uneconomic quantities of alumina.

Following completion of timber harvesting by the Forest Products Commission and vegetation clearing activities, the topsoil and overburden are removed and either stockpiled separately for re-use at a later time or re-used immediately on an area undergoing rehabilitation. Stockpiles are preferentially located on ore bodies, to reduce the amount of required vegetation clearing. Caprock is broken by drilling and blasting and in some areas by bulldozers. The ore is removed by mass excavators and trucks which haul the ore to central processing facilities, for primary and secondary crushing, via a network of haul roads. Ore will then be transported on a conveyor or by haul trucks to the existing conveyor feeding the refinery.

Surface water management structures (diversions) will be required to redirect the surface water flows which would otherwise be captured by the mining pits, to maintain the continuation of natural surface water flows in each mining region. Other surface water management infrastructure including but not limited to culverts may also be required to ensure appropriate surface water management.

Support facilities including but not limited to workshops, hydrocarbon storage, explosives storage, laydown areas, offices, wastewater treatment may be required. Power generation infrastructure will be required including, but not limited to, local power generation equipment with the option to include a wind turbine, diesel or gas fuel storage, above and below ground electrical transmission lines, substations, transformers and control equipment.

Following mining, mine pits are rehabilitated to Jarrah forest by removing compaction of pit floors, recontouring the surface, returning of gravels and soil, seeding, planting of nursery-raised seedlings and fertilising. Coarse woody debris in the form of logs and stumps is also returned as fauna habitat.

3 Stakeholder Engagement

3.1 Overview

Developing and maintaining strong, mutually beneficial relationships with our stakeholders, including in the communities where we operate, is fundamental to Alcoa's business model. We believe it is important to maintain transparent and regular dialogue with stakeholders to ensure a mutual understanding of issues, concerns and opportunities. A Stakeholder Engagement Framework guides engagement practices across our global operations, including consultation for ongoing operations and projects.

Alcoa has developed its neighbour relations and stakeholder engagement program in Western Australia over many years. Dedicated community relations representatives at each location are responsible for managing local engagement programs, including responding to local questions and concerns, as well as Alcoa's community investment and volunteer programs.

Engagement with community members and other stakeholders occurs via a range of channels and forums as outlined below.

- **Stakeholder briefings** – with local, state and federal government representatives and other stakeholders occur on a regular basis. The meetings provide an opportunity for Alcoa to update on business developments and for questions and concerns to be raised with the company.
- **One-on-one neighbour engagement** – is ongoing, with community relations personnel at each of Alcoa's operations available to meet with neighbours to discuss questions and concerns. Each year, as part of the preparation of the five-year MMP, Alcoa invites mine neighbours to participate in discussions about the mine plan.
- **Community Consultative Network (CCN) meetings** – provide a forum for two-way discussion with interested parties residing or working in and around the communities near Alcoa's operations. The Pinjarra CCN has been operating since 1994 and meets every two months. The forum is attended by individuals as well as representatives from local community groups and businesses, Pinjarra Senior High School and the Shire of Murray. This forum will be an important mechanism for information sharing about the Proposal and related studies.
- **Dedicated working groups** – are convened as required to explore particular topics with stakeholders. For example every five years, a working group is formed to review long term residue management strategies for each of Alcoa's refineries.
- **Open house/community forums** – provide an opportunity for broader community engagement in an open setting. This format is typically used to share information about specific projects with relevant subject matter experts available to share insights and answer questions. It will be used as part of consultation on the Proposal.
- **Site tours** – have been offered by Alcoa for more than 40 years, providing opportunities for people to visit and see our operations first hand. They continue to provide an important role in Alcoa's stakeholder engagement activities.
- **Advertorials** – published in community newspapers where Alcoa operates provide a regular information flow to the broader community about the company's activities.
- **Employee and contractor communications** – occur via a variety of channels including townhall meetings, newsletter articles and briefings.

3.2 Engagement related to the Proposal

A key aim of referring this Proposal to the EPA for assessment is to improve transparency regarding Alcoa's operations and to engage stakeholders in the establishment of more contemporary environmental approvals. The environmental impact assessment process will provide an opportunity to build understanding of Alcoa's current and proposed environmental management practices, as well as future operations.

Alcoa has been engaging with a broad range of stakeholders regarding future operations, in particular the proposed future mine areas, for several years. More recently, targeted stakeholder engagement has focussed on the Proposal in preparation for submission of this referral. A summary of consultation undertaken to date regarding future mining and the Proposal is provided in table 1. The table also provides details of engagement that will occur via letter upon submission of the referral to the EPA to ensure key stakeholders are aware of Alcoa's request for environmental assessment of the Proposal.

Alcoa will continue to undertake consultation with identified stakeholders and other interested parties throughout the environmental impact assessment process

Key stakeholders in relation to the Proposal include but are not limited to:

- State Government agencies, including the EPA, DWER, DBCA, DMIRS, Department of Planning, Lands and Heritage, DJTSl, Water Corporation and Peel Development Commission
- The Commonwealth Department of Agriculture, Water and Environment
- Members of State and Federal parliament
- Local Governments including Shires of Murray, Serpentine Jarrahdale and Boddington
- Traditional Owners and Heritage representative groups including the Gnaala Karla Booja and SWALSC
- Landholders in the Pinjarra, Dwellingup, North Dandalup, Keysbrook and Jarrahdale communities
- Community members including participants in Alcoa's Pinjarra CCN
- Community and non-government organisations including Peel Harvey Catchment Council, Dwellingup Community Compact, Jarrahdale Forest Protectors, Jarrahdale Heritage Society, Jarrahdale Community Collective, Munda Biddi Trail Foundation, Bibblumun Track Foundation
- Alcoa employees and contractors

3.2.1 Jarrahdale and the proposed North Myara mine region

The Proposal includes a future mine area referred to as Myara North located south east of the town of Jarrahdale in the Shire of Serpentine Jarrahdale.

Alcoa previously mined near Jarrahdale from 1963 to 1998. In 2017, given plans to move mining operations to Myara North, communication was initiated with local stakeholders including the Shire of Serpentine Jarrahdale, Jarrahdale Forest Protectors, Jarrahdale Community Collective and Jarrahdale Heritage Society. Since that time Alcoa has met regularly with stakeholders to update on, and discuss questions and concerns about our future mine plans, including as outlined below.

Traditionally, Alcoa initiates consultation with landowners near future mine areas approximately five years prior to the commencement of mining as part of the preparation of the five-year MMP. Given the timing of this referral and plans for mining to commence in Myara North in 2025, consultation with landowners in the region will be initiated and continue as part of the environmental impact assessment process. The process will provide a platform from which to build relationships as the mine plan for the region develops.

3.2.2 Dwellingup and the proposed Holyoake mine region

The Proposal includes a future mine area referred to as Holyoake. The western border of this region is located approximately 5 kilometres east of Dwellingup in the Shire of Murray and extends into the Shire of Boddington.

Alcoa has long held relationships with members of the Dwellingup community and been a regular supporter of community initiatives, including for example the redevelopment of the Dwellingup Trails and Visitors Centre. Alcoa is also a participant of Dwellingup Futures – a government, industry and community stakeholder group working to identify and support sustainable development in and around the Dwellingup area.

Alcoa has been engaging with Dwellingup landowners and other stakeholders specifically about potential future mining in the vicinity of the town since 2014. At this time, Alcoa initiated discussions about an exploration drilling program in lease areas near Dwellingup and invited stakeholders to attend an open house forum to learn more about the program. Since then, there have been regular updates about the results of the drilling program and Alcoa's future mine plans, as outlined below. As part of these communications, Alcoa has consistently indicated that mining would commence in the broader Holyoake mine region sometime around 2030, which is aligned with current plans relative to this referral.

These stakeholders will continue to form part of Alcoa's engagement program. Stakeholders will be invited to learn more about the environmental assessment process and related studies and activities as part of this review.

Table 3-1 Stakeholder engagement summary, including engagement activities planned to occur on submission of the referral

Stakeholder	Date	Topics raised	Feedback
Environmental Protection Authority	28 April 2020	Pre-referral meeting to discuss the assessment scope, relevant factors and timeline.	
	8 May 2020	Pre-referral to discuss MMPLG arrangements	
	22 May 2020	Pre-referral meeting to clarify scope and referral content.	
	3 June 2020	Pre-referral meeting to clarify scope and referral content	
Department of Water and Environmental Regulation	8 May 2020	Pre-referral meeting to discuss the assessment scope and technical studies. Also attended by DBCA.	Further meetings to be held to define scopes of technical studies. Cumulative impacts of mining area to be considered in scope of assessments.
	12 May 2020	Pre-referral meeting to discuss the assessment scope and technical studies with Water Quality Branch representatives. Included Water Corporation representatives.	Briefing appreciated. General guidance provided on broader aspects of the technical studies which included haul road crossings and sump management to minimise water quality impacts. Further meetings to be held to define scopes of technical studies.
Department of Water and Environmental Regulation	14 May 2020	Pre-referral briefing to discuss the assessment scope and technical studies with Air Quality Services Branch and Process Industries Branch representatives.	Briefing appreciated. Noise considerations to be included in assessment process.
	14 May 2020	Pre-referral briefing to discuss the assessment scope and technical studies with Kwinana Peel Region Water Branch representatives.	Informing only.

Stakeholder	Date	Topics raised	Feedback
	27 May 2020	Pre-referral briefing to discuss the assessment scope and technical studies with Environmental Noise Branch representatives.	Briefing appreciated. Noise management strategy for the refinery to be defined.
Department of Jobs, Tourism, Science and Innovation	20 May 2020	Pre-referral meeting to discuss assessment scope, process and MMPLG arrangements. Meeting was also attended by representatives from the EPA.	Briefing appreciated Ongoing discussions required regarding Mining and Management Program process in transition. Further meetings to be held to brief on scope of technical studies.
Water Corporation	12 May 2020	Pre-referral meeting to discuss assessment scope and technical studies. Also attended by DWER Water Quality Branch representatives.	Briefing appreciated. General guidance provided on broader aspects of the technical studies which included haul road crossings and sump management to minimise water quality impacts. Further meetings to be held to define scopes of technical studies.
Department of Biodiversity, Conservation and Attractions	8 May 2020	Pre-referral meeting to discuss the assessment scope and technical studies. Also attended by DWER representatives.	Further meetings to be held to define scopes of technical studies. Cumulative impacts of mining area to be considered in scope of assessments.
Shire of Murray	Various 2014 – current	Alcoa meets regularly with the Shire of Murray to discuss a range of matters including current and future operations. Potential mining near Dwellingup has been a significant topic of discussion due to community interest and potential intersection with other community projects.	Engagement has resulted in many outcomes including participation in Dwellingup Futures and various tracks and trails working groups.
	29 May 2020	Business update with the Shire CEO and President during which a briefing on the Part IV referral was provided.	Briefing appreciated. Noted that referral process should provide more clarity for stakeholders regarding mining near Dwellingup. Alcoa committed to provided ongoing updates.

Stakeholder	Date	Topics raised	Feedback
Pinjarra CCN	8 June 2020	Letter advising of Part IV referral, outlining process and ongoing engagement opportunities. Invited recipients to contact Alcoa to raise questions or for additional information.	Not yet received. Briefing on assessment will be provided at the next CCN meeting.
Shire of Serpentine Jarrahdale	27 May 2020	Business update with the Shire CEO and President during which a briefing on the Part IV referral was provided.	Briefing appreciated. Tour of Alcoa's operations to be arranged when COVID-19 conditions permit.
Shire of Boddington	27 August 2019	Meeting with Shire representatives and a range of stakeholders regarding potential future trail connecting Boddington and Dwellingup using the existing rail formation.	Alcoa advised lease area to the east of Dwellingup and west of Boddington was subject to exploration drilling. Confirmed mining was estimated to commence in the Holyoake mine region circa 2030.
	8 June 2020	Letter sent to the Shire CEO and President advising of Part IV referral, outlining process and ongoing engagement opportunities. Included description of future mine areas. Invited recipients to contact Alcoa to raise questions or for additional information.	Not yet received.
Dwellingup community members and landowners	14 October 2014	Letter inviting landowners (>400) to attend an open house regarding an exploration drilling program in areas near Dwellingup commencing in March 2015.	See below.
	8 November 2014	Open House forum to share information about exploration drilling program commencing in March 2015. Attended by approximately 100 people.	Alcoa subject matter experts were in attendance to answer wide-ranging questions.
Dwellingup community members and landowners	December 2014 – December 2019	Regular communication updating landowners on the exploration drilling program, outlining timeframes for potential future mining. Latest letter indicated potential mining in the Holyoake area from about 2029.	Correspondence has prompted questions from landowners which have been responded to by Alcoa's community relations personnel. Key areas of interest have included environmental management, mining impacts and related issues.

Stakeholder	Date	Topics raised	Feedback
	8 June 2020	Letter sent to landowners (>400) advising of Part IV referral, outlining process and ongoing engagement opportunities. Included description of future mine areas. Invited recipients to contact Alcoa to raise questions or for additional information.	Not yet received.
Dwellingup Community Compact	Various 2014 – ongoing	Extensive engagement with the organisation’s members including from the sub-group known as the Dwellingup Protection Group. Topics range from updates on exploration drilling, potential mining, environmental management, community sponsorships and events.	The Dwellingup Protection Group would like an extensive area of the mineral lease excluded from mining due to a range of concerns including environmental and recreational impacts. This area takes in Holyoake.. Alcoa has advised that it is an untenable proposal that would have a significant impact on the life of mine and refineries. It would also be contrary to Alcoa’s obligations under the State Agreement. A representative from the group is a participant in Dwellingup Futures.
	8 June 2020	Letter sent to President advising of Part IV referral, outlining process and ongoing engagement opportunities. Included description of future mine areas. Invited recipients to contact Alcoa to raise questions or for additional information.	Yet to be received.
Myara North landowners	8 June 2020	Letter sent to landowners advising of Part IV referral, outlining process and ongoing engagement opportunities. Included description of future mine areas. Invited recipients to contact Alcoa to raise questions or for additional information.	Yet to be received.
Jarrahdale Forest Protectors (JFP) Jarrahdale Heritage Society	May 2017 – ongoing	Alcoa has met with representatives from the group at least annually, to discuss a range of matters including current and future operations, forest protection and environmental management and potential intersection of operations with tracks and trails.	Engagement continues regarding areas of concern related to mining in the Myara North area.

Stakeholder	Date	Topics raised	Feedback
Jarrahdale Community Compact			
MMPLG	8 June 2020	Letter sent to Phil Knight (Chair of the MMPLG) advising of the Part IV referral process.	Informing only.
Traditional owners	Various	Alcoa has undertaken Aboriginal Heritage surveys in the Holyoake and Myara North regions between 2013 and 2017. Heritage surveys were completed with assistance, and in consultation with, the Bilya Noongar Organisation, a group of local presentatives of the Gnaala Karla Booja region.	
Munda Biddi Trail Foundation	Various	Alcoa consults regularly to discuss a range of matters including Alcoa's support for the Foundation's on the ground trail volunteers, Alcoa volunteers assisting with trail maintenance and trail re-alignments due to intersect with operations.	
Bibblumun Track Foundation	2 July 2017	Meeting with Bibblumun Foundation Board at the Huntly Mine. Discussion included Dwellingup exploration results and future mining plans.	Alcoa confirmed that it would work with the Foundation and DBCA on trail re-alignment should future mining impact the trail into Dwellingup.
Various State and Federal members of parliament including: Hon. Mark McGowan MLA Hon. Bill Johnston MLA Hon. Dave Kelly MLA Hon. Stephen Dawson MLC Donna Faragher MLC Matt Swinbourn MLC	8 June 2020	Letter sent advising of Part IV referral, outlining process and ongoing engagement opportunities. Included description of future mine areas. Invited recipients to contact Alcoa to raise questions or for additional information.	Yet to be received.

Stakeholder	Date	Topics raised	Feedback
Tim Clifford MLC Charles Smith MLC Hon. Roger Cook MLA Robyn Clarke MLA Hon. Diane Evers MLC Hon. Dr Steven Thomas MLC Alyssa Hayden MLC			

4 Environmental factors

4.1 Identification of environmental factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a proposal. The EPA has 14 environmental factors, organised into five themes: Sea, Land, Water, Air and People.

Alcoa has identified six factors as preliminary key factors relevant to the Proposal, based on the factors assessed in the Pinjarra Refinery Efficiency Upgrade EPS (Environ 2003, EPA 2003), MS 646, and recent mining and industrial developments in the south-west region.

The six preliminary key environmental factors are:

1. Flora and Vegetation
2. Terrestrial Fauna
3. Inland Waters
4. Air Quality
5. Greenhouse Gases
6. Social Surroundings.

Greenhouse Gases is considered as a factor distinct from Air Quality, consistent with EPA guidance (EPA 2020).

The preliminary environmental factors are presented in Sections 4.2 to 4.7. Matters of MNES are identified where relevant under each factor and are summarised in Section 5.

Alcoa has undertaken environmental studies and established management arrangements for the refinery and the mine across the six preliminary key environmental factors identified above. These studies and management arrangements are broadly described under each factor in Sections 4.2 to 4.7 and will be referenced and incorporated in detail in the proposed technical studies, impact assessment and management for the Proposal. The technical studies described in Sections 4.2 to 4.7 will enable assessment of the full 6700 ha clearing footprint described in Table 2-2.

Since 2003, Alcoa has undertaken air quality and human health risk assessments for the refinery in support of approvals under Part IV and V of the EP Act. Since the 1980s, Alcoa's research and development team has collaborated with universities, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), government agencies and experts to conduct a portfolio of research on ecosystem establishment and recovery in rehabilitated bauxite mining areas. This research has covered a broad range of topics including restoration of flora and vegetation, terrestrial fauna recolonisation, hydrology and salinity.

4.2 Flora and vegetation

4.2.1 EPA objective

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

For the purposes of EIA, the EPA (2016c) defines flora as native vascular plants. The EPA defines vegetation as groupings of different flora patterned across the landscape that occur in response to environmental conditions.

4.2.2 Receiving environment

The mine lies within Jarrah (*Eucalyptus marginata*) forest as part of the Northern Jarrah Forest subregion. Jarrah occurs with Marri (*Corymbia calophylla*) where soils are shallow over granite, and Wandoo (*Eucalyptus wandoo*) where dolerite dikes occur, or soils are deep and rich in clay. Watercourses and swamps may have minor stands of Blackbutt (*Eucalyptus patens*), Flooded Gum (*Eucalyptus rudis*) or Bullich (*Eucalyptus megacarpa*) and the middle storey includes Banksia, Sheoak (*Allocasuarina*) and Persoonia species. The understorey is rich and varied containing many endemic species.

The Jarrah forest has diverse flora. Alcoa has previously identified nearly 300 flora species in pre-mining surveys, including priority flora listed by DBCA. Alcoa does not mine in old growth forest and conservation areas as defined in the RFA. Many flora species in the Jarrah forest are susceptible to the introduced plant disease, dieback (*Phytophthora cinnamomi*), which has been present in the Jarrah forest for at least 100 years.

The refinery and its surrounding freehold landholdings are located on a flat coastal plain with heavy clay soils overlain by thin sandy loams. These areas were cleared of native vegetation for cattle grazing prior to the construction of the refinery. Since 1992, substantial revegetation work has been conducted within the refinery and on the surrounding landholdings to re-establish native vegetation corridors, primarily along natural watercourses. Wetlands have also been created at various locations along these corridors (Environ 2003).

Matters of National Environmental Significance

The Jarrah forest in the mining lease area has potential to support threatened flora species listed under the EPBC Act, however no threatened ecological communities (TEC) are known to occur. Table 4-1 presents EPBC Act listed flora species that have the potential to occur in the mine area, based on a search of the Commonwealth Protected Matters Search Tool (PMST).

Table 4-1 Potential EPBC Act listed flora in the Proposal development envelope

Species	EPBC Act Status	Likelihood of occurrence
<i>Anthocercis gracilis</i> (Slender Tailflower)	Vulnerable	Species or species habitat <i>may occur</i> within area
<i>Diuris micrantha</i> (Dwarf Bee-orchid)	Vulnerable	Species or species habitat <i>may occur</i> within area
<i>Grevillea flexuosa</i> (Zig Zag Grevillea)	Vulnerable	Species or species habitat <i>likely to occur</i> within area

Species	EPBC Act Status	Likelihood of occurrence
<i>Diuris purdiei</i> (Purdie's Donkey-orchid)	Endangered	Species or species habitat <i>may occur</i> within area
<i>Lasiopetalum pterocarpum</i> (Wing-fruited Lasiopetalum)	Endangered	Species or species habitat <i>likely to occur</i> within area
<i>Thelymitra dedmaniarum</i> (Cinnamon Sun Orchid)	Endangered	Species or species habitat <i>may occur</i> within area
<i>Thelymitra stellate</i> (Star Sun-orchid)	Endangered	Species or species habitat <i>may occur</i> within area

4.2.3 Existing studies and management

Huntly Mine flora and vegetation surveys

The mine is subject to pre-mining flora and vegetation surveys for all mining areas. Pre-mining flora and vegetation surveys involve vegetation mapping and targeted searches for conservation significant flora. The surveys inform mine planning to minimise the risk of impacts to conservation significant flora and poorly represented vegetation types. The pre-mining flora surveys inform Alcoa's biannual submission of Forest Clearing Advice to the Mine Operations Group (MOG), a sub-committee of MMPLG.

Huntly Mine clearing management

The Forest Clearing Advice process involves:

- Alcoa submits clearing proposal to MOG, specifying the mining and infrastructure footprint and significant environmental and heritage features avoided by clearing.
- Alcoa consults with DBCA, DWER, DMIRS and Water Corporation regarding potential environmental impacts of the clearing proposal.
- Any clearing in informal CAR reserves is subject to an environmental impact assessment that addresses vegetation, fauna and Aboriginal heritage and is assessed by the CAR Informal Reserve Evaluation Committee (CARIREC).
- Chairman of MOG endorses clearing proposals, as amended during the assessment process.
- Alcoa proceeds with clearing and developing the approved mining areas.

Huntly Mine rehabilitation and research

Alcoa maintains a progressive rehabilitation program, averaging around 420 ha per year over the past ten years at Huntly Mine. Concurrent with rehabilitation, Alcoa has developed rehabilitation methods, technologies and completion criteria for the Jarrah forest over a period of more than 40 years (Gardner and Bell 2007). Early rehabilitation consisted of *Eucalyptus* or pine plantations selected for their resistance to Phytophthora dieback, then evolved to include ground preparation treatments (e.g. deep ripping) and restoring native understorey species. Since 1988, rehabilitation has involved the re-establishment of only

native species with Jarrah and Marri as dominant tree species, with the following rehabilitation objective:

‘Establish a self-sustaining Jarrah forest ecosystem, planned to enhance or maintain water, timber, recreation, conservation and other nominated forest values. Rehabilitated areas must become amenable to similar management practices employed in the surrounding Jarrah forest.’

Alcoa maintains a rehabilitation monitoring program, with evaluation against Completion Criteria approved by the MMPLG including standards for plant densities, plant species richness, erosion and weeds in the early establishment phase and standards for longer-term ecosystem development and integration with standard forest management such as prescribed burns. Since 1996 Alcoa has pursued an internal target of 100% species richness return to rehabilitated areas, a target that is higher than that required through the Rehabilitation Completion Criteria.

4.2.4 Potential impacts

The Proposal may cause direct impacts to flora and vegetation as a result of additional clearing associated with bauxite export (approx. 50 ha of clearing per year). The Proposal may result in approximately 10 ha of vegetation clearing at the refinery associated with infrastructure such as access tracks. The Proposal may cause the following potential impacts:

- Introduction and/or spread of weeds.
- Introduction and/or spread of dieback.
- Spills and/or leaks from storage and handling of hazardous materials and waste.

4.2.5 Proposed studies for impact assessment

Alcoa proposes to undertake a detailed flora and vegetation survey (including weeds) over mining areas associated with the operation of the Huntly Mine from 2025 to 2035 (Figure 1-1) to inform mine planning to avoid and minimise impacts to conservation values, to enable quantification of impacts, and to inform mine management arrangements.

Alcoa has already undertaken a dieback assessment over the northern mining area to inform mine planning and hygiene management and will complete dieback assessments of the southern mining area in Figure 1-1.

4.3 Terrestrial Fauna

4.3.1 EPA objective

To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

For the purposes of EIA, the EPA (2016e) define terrestrial fauna as animals living on land or using land (including aquatic systems) for all or part of their lives. Terrestrial fauna includes vertebrate (birds, mammals including bats, reptiles, amphibians, and freshwater fish) and invertebrate (arachnids, crustaceans, insects, molluscs and worms) groups.

4.3.2 Receiving environment

The mine lies within a large continuous extent of Jarrah forest that has a high native fauna diversity, providing habitat for approximately 240 terrestrial vertebrate fauna species, including 29 mammals, 45 reptiles, 11 frogs, four fish and about 150 birds. The forest is known to support populations of threatened fauna listed under the *Biodiversity Conservation Act 2016* (BC Act) and priority fauna listed by DBCA.

The refinery is surrounded by predominantly cleared land and has a lower fauna diversity. Since development of the refinery and Alcoa’s land management program, more priority species have been found to occur in the refinery landholdings, such as the Chuditch, Peregrine Falcon, Baudin’s Cockatoo and Carpet Python (Environ 2003), which are listed under the EPBC Act.

Matters of National Environmental Significance

The Jarrah forest over the mine has potential to support threatened and migratory fauna species listed under the EPBC Act. Table 4-2 presents EPBC Act listed threatened and migratory fauna species that have the potential to occur in the mine area, based on a search of the PMST.

Table 4-2 Potential EPBC Act listed terrestrial fauna in the Proposal development envelope

Species	EPBC Act Status	Likelihood of occurrence
Birds		
<i>Calidris ferruginea</i> (Curlew Sandpiper)	Critically Endangered, Migratory	Species or species habitat <i>may occur</i> within area
<i>Calyptorhynchus banksii naso</i> (Forest Red-tailed Black-Cockatoo)	Vulnerable	Species or species habitat <i>known to occur</i> within area
<i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo)	Endangered	Roosting <i>known to occur</i> within area
<i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo)	Endangered	Species or species habitat <i>known to occur</i> within area
<i>Leipoa ocellata</i> (Malleefowl)	Vulnerable	Species or species habitat <i>known to occur</i> within area
<i>Numenius madagascariensis</i> (Eastern Curlew)	Critically Endangered, Migratory	Species or species habitat <i>may occur</i> within area
<i>Rostratula australis</i> (Australian Painted Snipe)	Endangered	Species or species habitat <i>may occur</i> within area

Species	EPBC Act Status	Likelihood of occurrence
<i>Apus pacificus</i> (Fork-tailed Swift)	Migratory	Species or species habitat <i>likely to occur</i> within area
<i>Motacilla cinerea</i> (Grey Wagtail)	Migratory	Species or species habitat <i>may occur</i> within area
<i>Actitis hypoleucos</i> (Common Sandpiper)	Migratory	Species or species habitat <i>may occur</i> within area
<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)	Migratory	Species or species habitat <i>may occur</i> within area
<i>Calidris melanotos</i> (Pectoral Sandpiper)	Migratory	Species or species habitat <i>may occur</i> within area
<i>Pandion haliaetus</i> (Osprey)	Migratory	Species or species habitat <i>likely to occur</i> within area
<i>Rostratula benghalensis</i> (<i>sensu lato</i>) (Painted Snipe)	Endangered	Species or species habitat <i>may occur</i> within area
<i>Atrichornis clamosus</i> (Noisy Scrub-bird)*	Endangered	Species or species habitat <i>may occur</i> within area
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	Endangered	Species or species habitat <i>known to occur</i> within area
Mammals		
<i>Bettongia penicillata ogilbyi</i> (Woylie)	Endangered	Species or species habitat <i>known to occur</i> within area
<i>Dasyurus geoffroii</i> (Chuditch)	Vulnerable	Species or species habitat <i>known to occur</i> within area
<i>Pseudocheirus occidentalis</i> (Western Ringtail Possum)	Critically Endangered	Species or species habitat <i>may occur</i> within area
Setonix brachyurus (Quokka)	Vulnerable	Species or species habitat <i>known to occur</i> within area

* Occurrence of the Noisy Scrub-bird is known to have been exclusively related to translocation to the Willowdale Mine. Searches in 2015 failed to detect presence and the species is now considered absent from the Northern Jarrah Forest.

4.3.3 Existing studies and management

Huntly Mine fauna studies and long term monitoring

Alcoa has undertaken studies into terrestrial fauna (vertebrates and invertebrates) of the Jarrah forest for over 40 years, with particular emphasis on fauna recolonisation into rehabilitated mine areas (Nichols and Grant 2007, Majer et al 2007). The studies have

indicated a high recolonisation by birds and most reptiles, and varying recolonisation by mammals depending on their habitat preferences and distribution within the Jarrah forest (Nichols and Grant 2007, Majer et al 2007). The studies have provided knowledge on species ecology including habitat needs such as coarse woody debris (e.g. stumps and logs) and rockpiles, as well as improving survey methods for invertebrate fauna.

Alcoa established a Long Term Fauna Monitoring Program (LTFMP) to assess progress towards Alcoa's rehabilitation objectives of establishing self-sustaining Jarrah forest ecosystems including the full diversity of fauna that typically occurred pre-mining. Monitoring commenced at Huntly Mine in 1992 and was repeated in 1995, 1998, 2001, 2006 and 2011 (Alcoa 2012). Monitoring involved representative control (upland forest and stream zone) sites and rehabilitated mine sites.

The LTFMP findings indicated that stream zones were the most species rich, diverse and abundant sites for birds compared to upland forest and rehabilitated sites. Mammal species recorded a similar community composition between rehabilitated and un-mined sites, with stream zones identified as important habitat. Chuditch was recorded at very low densities at the mine during targeted surveys, and quokkas were recorded at Huntly and Jarrahdale mines including a rehabilitated site. Reptiles were recorded at lower diversity and abundance in rehabilitated sites compared to un-mined sites, suggesting a lack of thermal conditions and habitat. Coarse woody debris was identified as important habitat for some reptile and invertebrate species that were absent from rehabilitation sites (Alcoa 2012).

Huntly Mine fauna management

Alcoa manages impacts to fauna through pre-mining fauna surveys and the Clearing Forest Advice process described in Section 4.2.3, as well as Threatened Species Management Plans (Alcoa 2010). Elements of the Threatened Species Management Plans have included:

- Contribution of funding to the Chuditch recovery plan, which succeeded in moving the species from Endangered to Vulnerable in 2001.
- Contribution of funding to the Western Shield feral animal control program since its inception in 1998.
- Contribution of funding to Black Cockatoo research.
- Construction of at least one (and up to two) habitat sites per hectare in rehabilitated sites, comprising woody material, rocks and soil.
- Trial of a fauna underpass for a haul road (Alcoa 2015).
- Prescribed burning (excluding swamps) to minimise species and habitat loss from large scale, hot wildfires.

4.3.4 Potential impacts

The Proposal may cause direct impacts to terrestrial fauna in the mining areas, as a result of additional clearing of fauna habitat and injury/mortality from fauna entrapment or vehicle/equipment collisions. The Proposal will not result in direct impacts to terrestrial fauna at the refinery.

The Proposal may cause potential impacts to terrestrial fauna as a result of:

- Introduction and/or spread of weeds.
- Introduction and/or spread of dieback.
- Attraction of feral animals.
- Noise emissions from construction and operational equipment.
- Spills and/or leaks from storage and handling of hazardous materials and waste.

4.3.5 Proposed studies for impact assessment

Alcoa proposes to undertake the following terrestrial fauna surveys over mining areas:

- Level 2 terrestrial vertebrate fauna survey (including feral animals).
- Black cockatoo habitat assessment.
- Level 2 short range endemic (SRE) invertebrate fauna survey.

The surveys will inform mine planning to avoid and minimise impacts to conservation values, enable quantification of impacts, and inform mine management arrangements.

4.4 Inland Waters

4.4.1 EPA objective

To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.

For the purposes of EIA, the EPA (2016f) define inland waters as the occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality).

4.4.2 Receiving environment

Topography and geology

The Huntly Mine lies on the Darling Plateau, which has elevations ranging from about 240 m to 370 m above sea level. The mine is characterised by Cainozoic deposits dominated by laterite, formed at least in part during the Tertiary era by in situ weathering of underlying rocks. The laterite surface is flat to undulating, strongly dissected by streams on the western margin of the Plateau, and extends through a zone of variable thickness to weathered bedrock. Overlying soils are mostly skeletal ironstone gravels with deeper pockets of soil along drainage lines and in depressions in the cap rock.

The refinery lies on the Pinjarra Plain and is surrounded by relatively flat topography at elevations of 25 m to 50 m above sea level. The geology comprises superficial Cainozoic formations (sands, clays and silts) to depths of 12 m, the Cretaceous Leederville Formation (sands, clays and silts) to depths of about 90 m, and deeper Cattamarra Coal Measures (sandstone, siltstone and shale).

Surface hydrology

The proposed mining areas contain first order streams that are mostly ephemeral. These streams flow only after winter rains have saturated surrounding soils causing runoff and

seepage to occur. Some higher order streams in the high rainfall zone have historically supported perennial base flows, except when droughts occur when they may dry up over late summer and autumn. However, there has been a widespread reduction in annual flows across the Jarrah forest, with an increasing proportion of ephemeral flows, related to a drying climate (Petroni et al 2010). There are no natural perennial watercourses within the mine development envelope. The ephemeral waterways and artificial reservoirs (e.g. Serpentine Dam) support aquatic fauna species including native fish and macroinvertebrates. Ephemeral damplands lie over the valley floors, containing vegetation communities distinct from the upland Jarrah forest and providing important habitats for terrestrial fauna (see Section 4.3.3).

The proposed mining areas lie over the catchment areas of developed reservoirs, including the Serpentine, North Dandalup and South Dandalup Dams that are used for drinking water (Figure 1-1).

The refinery has surface water abstraction licences to take water from Oakley Brook and Barritt Brook, which are natural, ephemeral creek systems (Environ 2003).

Groundwater

The mine lies over the Darling Plateau which comprises of a weathered profile typically 20 m to 30 m in depth with an unconfined saturated profile. In the higher rainfall areas of the Plateau, depths to groundwater in stream zones range from 0 m to 10 m. Groundwater saturated thickness decreases on hill slopes away from stream zones with limited groundwater above bedrock on hilltops and ridgelines. Groundwater exists in rock fractures within the first few metres of unweathered bedrock and in sediments laid down along creek lines or which have accumulated in valleys. There may be localised areas of groundwater held in seasonally perched water tables in ferruginised zones overlying impermeable pallid zone clays. Due to the clayey nature of the weathered profile nearly all water bores have very low yields.

The refinery lies on the Swan Coastal Plain, which supports substantial regional groundwater aquifers including (with increasing depth) the superficial aquifer, Leederville Aquifer and Cattamarra Aquifer. The superficial aquifer has limited groundwater supply potential and is recharged by rainfall, with salinity varying from fresh adjacent to the Darling Scarp to brackish close to the Murray River. The Leederville Aquifer comprises thin, laterally extensive sand beds. Groundwater salinity in these sand beds increases towards the west and is highly variable at depth. The Cattamarra Aquifer is recharged from leakage from the overlying Leederville aquifer and the superficial aquifer adjacent to the Darling Scarp where it overlies the Cattamarra Aquifer. Groundwater salinity in the sandstone layers of the Cattamarra aquifer generally increases with depth (Environ 2003). Alcoa has developed a detailed groundwater model of the Cattamarra Aquifer to investigate scenarios and options for groundwater supply to the refinery.

Matters of National Environmental Significance

The natural waterways and forested catchments over the mining areas have potential to support the freshwater mussel species *Westralunio carteri* (Carter's Freshwater Mussel), which is listed as Vulnerable under the EPBC Act.

4.4.3 Existing studies and management

Overview of research

Alcoa, in association with the former Water and Rivers Commission, has researched the hydrology and salinity in the Jarrah forest since the 1970s (Mauger et al 1998; Croton and Reed 2007), as part of the Joint Intermediate Rainfall Zone Research Program (JIRZRP). The JIRZRP has included monitoring of surface water, groundwater and salinity as well as analysis and modelling of the Intermediate Rainfall Zone (IRZ). The JIRZRP was overseen by the Bauxite Hydrology Committee, formerly an MMPLG subcommittee, with respect to impacts on hydrology and stream zone ecology from Alcoa's bauxite mining in the Jarrah forest. The committee's objectives were to:

- Minimise salinity risks associated with mining in the Intermediate Rainfall Zone, where clearing of the natural vegetation could cause secondary salinity if not properly managed.
- Minimise impacts of mine rehabilitation on catchment water yields and riparian ecosystems caused by high water use of dense, regrowth forests.

Trial Mining Project

The Trial Mining Project (TMP) was a key investigation into the impact of bauxite mining in the IRZ. The TMP covered the Cameron experimental catchments, located approximately 15 km north-east of Dwellingup (Croton et al 2011). The TMP comprised a long-term monitoring program (1988-2016) for streamflow, salinity and groundwater responses to bauxite mining. Mining occurred from 2003 to 2011 and rehabilitation from 2006 to 2013. Prior to mining the Cameron catchment was managed as State forest including timber harvesting and prescribed burning in the 1990s up to 2002 (Croton et al 2011). The Cameron experimental catchments comprised three catchments subject to mining, varying from approximately 190 ha to 4580 ha and involving mining over 13% to 33% of their extent. A fourth catchment of approximately 210 ha was not subject to mining and was used as a control (Croton et al 2011).

The TMP monitoring results indicated no response in streamflow or salinity over the Cameron experimental catchments that could be attributed to mining. The lack of stream response to mining was attributed to declining rainfalls in the WA south-west region since 1975, which resulted in groundwater levels below the stream zones to decline despite mining-related groundwater mounding on hillslopes. It was concluded that further monitoring was not warranted unless rainfall exceeded 1150 mm/year to generate substantive stream flows, which had not occurred for approximately four decades (Croton et al 2011).

Salinity and flow modelling of Serpentine Reservoir

DWER, in collaboration with Alcoa, investigated the potential flow and salinity changes in the Serpentine Reservoir as a result of bauxite mining (Dixon et al 2019). The investigation was undertaken using the LUCICAT catchment model, which is used by DWER for water allocation planning in Western Australia. The modelling considered two potential mining proposals (either 9% or 12% of the catchment) and a no-mining comparison, in the context of two future climates ('average' 914 mm/year and 'dry' 841 mm/year over the Serpentine Dam catchment) to give a total of six future (2011–2050) scenarios. The modelling indicated that mining would result in a change in Dam inflows no greater than approximately 2 GL/year in any one year, or 5% of flow on an annual average basis (Dixon et al 2019). The modelling indicated that mining would result in an increase in salinity of 5.4 mg/L or 3% of reservoir salinity on an annual average. DWER considered that mining posed effects on reservoir salinity that were within acceptable limits (Dixon et al 2019). DWER noted that LUCICAT appeared to overestimate flows subsequent to strong drought years and recommended that the model be investigated in more detail to improve understanding of groundwater dynamics in strong drought years (Dixon et al 2019).

4.4.4 Potential impacts

The Proposal may cause potential impacts to inland waters as a result of:

- Increases in stream salinity as a result of mining-induced saline groundwater discharge.
- Increased water supply for alumina refining.
- Increase sediment from erosion of post-mining landforms.
- Contamination from spills and/or leaks from storage and handling of hazardous materials and waste.

4.4.5 Proposed studies for impact assessment

Alcoa proposes to investigate water supply options to the refinery. Alcoa does not propose to increase surface water or groundwater abstraction under existing water licences.

Alcoa proposes to undertake a hydrological and water quality assessment of mining in the mining areas to assess the potential impacts to the Serpentine Reservoir and water dependent ecosystems due to changing groundwater levels, stream flow and water quality. The hydrological and water quality assessment will incorporate the findings of previous studies for the mine and groundwater and surface water monitoring in previous mining areas.

4.5 Air Quality

4.5.1 EPA objective

To maintain air quality and minimise emissions so that environmental values are protected.

For the purposes of EIA, the EPA (2020a) define air quality as the chemical, physical, biological and aesthetic characteristics of air. 'Air' refers to all the air above the ground up to and including the stratosphere.

4.5.2 Receiving environment

The refinery is the largest industrial source of atmospheric emissions in the area. The contribution of emissions to the atmosphere from other sources include emissions associated with motor vehicles, trains, agricultural activities, wildfires or hazard reduction burning, and the use of domestic wood heaters. These sources are also considerable contributors of particulates, oxides of nitrogen, ozone and volatile organic compounds.

Winds in the Pinjarra region result from both large-scale (synoptic) winds associated with low and high pressure systems, local-scale winds induced by thermal influences (e.g. sea breeze) and the terrain features of the Darling Scarp. Topographical features of the Darling Scarp have been found to influence the local meteorology of the Pinjarra refinery area (Environ 2003).

Existing refinery emissions

The primary emissions released from the refinery are nitrous oxide (NO_x), carbon monoxide (CO), particulates, volatile organic carbons (VOCs), and trace levels of metals. Emissions of NO_x and CO arise primarily from the combustion of natural gas and are released to the atmosphere from the Powerhouse boilers, Calciners and Oxalate kilns. The Alinta Cogeneration project also contributes to the greenhouse gas emissions released from the refinery.

Emissions of particulates (or dust) are released from the Calciners (in the form of alumina dust), and to a lesser extent the Oxalate kiln. In addition, particulates are also released as a result of mining activities, windblown dust emissions from the bauxite stockpile area and the RSA, and bulk materials handling and transport activities.

VOC emissions from alumina refineries are caused by breakdown of organic material contained in the bauxite, additives to the liquor stream and in by-products of fuel combustion processes. During alumina refining, these organics are degraded and produce an extensive range of substances, some of which are volatile enough to be emitted to air. These VOC emissions are the cause of the characteristic odour associated with alumina refineries.

Metals such as mercury, arsenic and nickel are introduced into the Bayer process primarily through the trace amounts present in bauxite, and the current knowledge indicates that the majority of metals are recirculated within the caustic liquor stream or deposited with the residue. Notwithstanding this, trace amounts of various metals have been found to be present in emissions from various sources at the Pinjarra refinery.

Odorous emissions are caused by the breakdown of organic material contained in the bauxite, additives to the liquor stream and in by-products of fuel combustion processes. Some of these volatile substances are odorous and even the trace levels emitted can contribute to ambient odour (Environ 2003).

4.5.3 Existing studies and management

Pinjarra Alumina Refinery air quality assessment

The refinery has been subject to air quality modelling and health risk assessment in 2003, 2008 and 2014.

The most recent air quality modelling was by Air Assessments (2014), involving prediction of ground level concentrations of air pollutants due to increased production at the refinery to 5.0 Mtpa. The air quality modelling was undertaken in support of a s45C application to amend MS 646 for the proposed increase in production.

The air quality modelling was subject to peer review by Pacific Environment (2015) who concluded that the modelling approach and emissions estimation techniques were acceptable and the contaminants assessed were extensive. The peer review noted that some potential pollutants were not assessed; however Alcoa advised that these pollutants were not considered significant at the time (Pacific Environment 2015).

The air quality modelling outputs were used by Environ (2014) to undertake a health risk screening assessment of the increased production to 5.0 Mtpa. The health risk screening assessment indicated that, at 5.0 Mtpa production, the refinery had a low potential to contribute to the incidence of cancer in the exposed population or cause acute or chronic non-carcinogenic health effects (Environ 2014). Further, an expert peer review concluded that the health risk screening assessment provided a sound breadth and depth of data and analysis upon which solid conclusions could be based and that an increase in production at the Pinjarra refinery to 5.0 Mtpa would not pose any public health risk to local residents (Weinstein 2015).

Pinjarra Alumina Refinery air quality management

The refinery is subject to an AQMP, in accordance with Condition 6 of MS 646. The AQMP includes the following components:

- Oxalate kiln stack monitoring
- Digestion Regenerative Thermal Oxidiser (RTO) stack monitoring
- Calciner stack monitoring
- Boiler stack monitoring
- Failure response and contingencies for stack emissions
- RSA and bauxite stockpile dust management
- Ambient dust monitoring.

The AQMP specifies monthly stack monitoring, which exceeds the requirement for quarterly stack monitoring under Environmental Licence L5271/1984/14.

The refinery has in place a RSA Dust Management Plan that includes annual review of operational controls.

4.5.4 Potential impacts

The Proposal may result in increased air emissions from the refinery and the mine, causing a reduction in ambient air quality impacting human health and amenity.

4.5.5 Propose studies for impact assessment

Alcoa proposes to undertake air quality modelling of the refinery to account for the increased production as well as dust emissions from RSAs. The air quality modelling will provide input to a screening health risk assessment of the refinery, to assess health risks associated with cancer, and non-cancer acute and chronic hazards.

Alcoa proposes to undertake air quality modelling of mining to predict the dust emissions and impact to ambient air quality.

4.6 Greenhouse Gas Emissions

4.6.1 EPA objective

The environmental factor guidance for greenhouse gas (GHG) emissions sets the following objective (EPA 2020b):

To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change.

4.6.2 Existing GHG emissions

Both the refinery and the mine have been reporting under the *National Greenhouse and Energy Act 2007* (NGER) since 2009. The refinery is classified as a large facility under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Safeguard Rule) that requires Alcoa to surrender Australian Carbon Credit Units if baseline emissions are exceeded. The baseline and annual Scope 1 emissions are published on the Clean Energy Regulator's website. The mine's emissions have been below the designated large facility threshold to date.

The Scope 1 GHG emissions from the refinery are predominantly from stationary sources of natural gas combustion (i.e. Powerhouse boilers, Calciners, Oxalate kiln). Other smaller sources include petrol/diesel/liquefied petroleum gas (LPG) combustion (i.e. on and off-road vehicles), use of petroleum-based oils and greases, combustion of process chemicals for non-energy purposes, combustion of acetylene for welding and the use of sulfur hexafluoride in electrical equipment. Scope 2 GHG emissions are from the consumption of supplementary electricity from the South West Interconnected Scheme (SWIS) and steam produced at the Pinjarra Alinta Cogeneration Facility.

Bauxite mining operations account for a relatively minor proportion of GHG emissions associated with alumina production. The main sources of mining-related emissions are in the consumption of diesel fuel in heavy mobile equipment, electricity use and in the clearing of vegetation for mining. Other smaller sources are the same as the smaller sources at the refinery and the use of explosives. Carbon stores on mined land are restored by mine rehabilitation, being sequestered over time as the post-mining ecosystem develops. Burning of cleared vegetation releases nitrous oxide (N₂O) and methane (CH₄) (not reported under

NGER in accordance the National Greenhouse and Energy Reporting (measurement) Determination 2008) and results in net GHG emissions to that sequestered in rehabilitation.

GHG emission estimates

MS 646 Attachment 2 authorises GHG emissions (Scope 1 and 2) from the refinery and the Alinta Cogeneration facility to 2.58 megatonnes of carbon dioxide equivalent (Mt CO₂-e) for 5.0 Mtpa alumina production, at an intensity of 564 kg CO₂-e/t alumina. At this rate, the proposed 0.25 Mtpa production increase would result in an additional 141,000 t CO₂-e/y of which, approximately 65% would be from Scope 1 sources at the refinery. The default Scope 1 emission rate in the Safeguard Rule for alumina production is 545 kg CO₂-e/t and is based on an Australian average for alumina production. This demonstrates the refinery's efficiency compared to other Australian alumina refineries given the MS 646 limit for the refinery includes Scope 1 and 2 emissions and additional electricity generation and is only 19 kg CO₂-e/t alumina above the Australian average for Scope 1 emissions for alumina production. The global weighted average for Scope 1 and 2 emissions from alumina refining in 2018 was 1,345 kg CO₂-e/t alumina (CRU 2019). More than double the intensity at the refinery and cogeneration facility.

The GHG emissions (Scope 1 and 2) for the mine are estimated at approximately 6 kg CO₂-e/t bauxite or approximately 20 kg CO₂-e/t alumina (Alcoa 2018). Burning of cleared vegetative waste from mining areas is estimated to emit approximately 1 kg CO₂-e/t bauxite or approximately 3.5 kg CO₂-e/t alumina. Mining and burning of vegetation are thus estimated to emit < 5% of the GHG emissions from alumina refining. Emissions from proposed diesel electricity generation is estimated at 0.634 t CO₂-e/MWh; below the 2019-20 emission factor for the SWIS (0.69 t CO₂-e/MWh as published in the National Greenhouse and Energy Reporting (measurement) Determination 2008). The total emissions from this electricity generation is estimated to be approximately 32,000 CO₂-e/year and will offset some of the current Scope 2 emissions. Other GHG emissions are not expected to change from current operations.

4.6.3 Potential impacts

The Proposal may result in increased net GHG emissions from the refinery and the mine; however, these facilities have some of the lowest GHG intensities of their type.

4.6.4 Proposed studies for impact assessment

To support the update or removal of the existing GHG limits in MS 646 Alcoa proposes to undertake a GHG assessment for the Proposal in accordance with the updated guidance (EPA 2020b).

4.7 Social Surroundings

4.7.1 EPA objective

To protect social surroundings from significant harm.

For the purposes of EIA, the EPA (2016g) defines social surroundings as it is presented in the EP Act: the social surroundings of man are his aesthetic, cultural, economic and social

surroundings to the extent that those surroundings directly affect or are affected by his physical or biological surroundings.

4.7.2 Receiving environment

Native Title and Aboriginal and European heritage

The Proposal lies within the registered Native Title Claim, Gnaala Karla Booja (WC 1998/058), which falls under the representative body of the South West Aboriginal Land and Sea Council.

The Peel Region has a rich history of Nyoongar Aboriginal cultural heritage, as well as European heritage. In the vicinity of the refinery there are seven European heritage sites listed on the State Register of Heritage Places and a total of 50 sites of heritage importance, including 18 relating to Aboriginal heritage (Environ 2003). Based on a broad review of recorded heritage sites within the Huntly Mine, both Aboriginal heritage sites (i.e. Registered and 'Other Heritage Places') and European heritage sites (i.e. State Register and Municipal Inventory) are present.

Alcoa conducts ethnographic and archaeological surveys using consultants and Aboriginal custodians. Sites that are identified during the Aboriginal Heritage Surveys are registered with the Department of Aboriginal Affairs and protected from mining impacts. Alcoa and Aboriginal heritage consultants have developed a draft model to predict areas most likely to contain heritage values, based on soil types, aspect, slope and vicinity to streams. This allows intensive surveys in areas more likely to have heritage values. Surveys of mining areas have been undertaken using this model. Sites that have been identified are recorded and protected from mining impacts.

Social and economic receptors

The Proposal is located in the Peel Region, which has an economy based mainly on mining and mineral processing, largely associated with Alcoa's operations. In addition to mining, manufacturing, retail trade, agriculture and construction are the main areas of employment for residents.

The land surrounding the refinery is mainly rural and utilised for agriculture with the major agricultural activities in the region being beef cattle and sheep grazing. The closest residential receptors to the refinery are located off North Spur Road, approximately 3.5 km north-northeast of the refinery and on Napier Road, 4 km to the south of the refinery (Environ 2003).

The mine is present within State Forest, which is multiple-use and managed for water catchment protection, timber production, recreation and conservation. Recreational uses of the Jarrah forest include bushwalking and cycling, as well as outdoor activities associated with the various rivers, wetlands and dams present throughout the region.

4.7.3 Existing studies and management

Pinjarra Alumina Refinery noise assessment

The refinery was subject to a noise assessment by Wood (2019), involving ambient noise monitoring and noise modelling to predict the impact of refinery noise emissions on sensitive receptors. An outcome of the assessment was to further consider controls for noise emissions as part of a broader Pinjarra refinery noise management program which includes the continued assessment of feasibility and practicability of implementing acoustic controls on a range of refinery equipment, with the aim of reducing overall noise levels at relevant receptors.

Huntly Mine noise management

The mine is subject to a two-stage operational noise management process. Stage 1 comprises noise modelling of planned mining and forecast weather to predict potential impacts on noise sensitive premises. The modelling informs adjustment to mine planning to ensure compliance with the Environmental Protection (Noise) Regulations 1997.

Stage 2 comprises noise modelling of actual mine operations and live weather to predict potential impacts on noise sensitive premises. The operations noise model is used to monitor the risk of active operations causing an exceedance of the Noise Regulations, and informs adjustment to at risk operations to reduce the potential noise impacts.

During 2018, Alcoa received four noise complaints from two complainants regarding the mine. In 2019, seven complaints were received from five complainants. All complaints were investigated and compliance with the Environmental Protection (Noise) Regulations 1997 confirmed.

4.7.4 Potential impacts

The Proposal may cause potential impacts to Social Surroundings as a result of:

- Disturbance to Aboriginal heritage sites.
- Disturbance to European heritage sites.
- Impacts to amenity through construction and operational noise.
- Impact to visual amenity from mining operations and infrastructure.
- Impact on recreational use of areas, including potential realignment of walking tracks.

4.7.5 Proposed studies for impact assessment

Alcoa has completed an archaeological survey for the northern and southern mining areas (Figure 1-1) and propose to also undertake ethnographic surveys in these areas.

Alcoa proposes to update the noise model for the refinery to account for the increase in production from 5.0 Mtpa to 5.25 Mtpa and undertake a noise impact assessment of mining. The noise impact assessment for mining will comprise ambient monitoring and predictive modelling of mining noise emissions and noise levels at sensitive receptors.

Alcoa proposes to undertake a landscape and visual impact assessment of mining to determine the landscape and visual values of the area, the potential viewsheds and key

viewpoints, and the significance of visual impacts from mine operations and infrastructure to those viewpoints and landscape / visual values.

Alcoa proposes to develop a management plan for the relocation of the Munda-Biddi trail to enable the development of mining. The management plan will be developed to the requirements of DBCA.

5 Matters of National Environmental Significance (MNES)

Table 5-1 presents a summary of the relevant MNES for the Proposal, with detail provided under the environmental factors presented in Section 4. As presented, the Proposal has the potential to support the following MNES:

- Listed threatened species (flora and fauna).
- Listed migratory species.

Table 5-1 Summary of MNES relevance to the Proposal

MNES	Relevance to the Proposal
Listed threatened species and ecological communities	<p>Relevant.</p> <p>There are no TECs known or likely to occur within the Proposal development envelope.</p> <p>Seven threatened flora species have the potential to be present within the development envelope. See Section 4.2.2.</p> <p>Fourteen threatened terrestrial fauna have the potential to be present within the development envelope. See Section 4.3.2.</p> <p>One species of aquatic fauna has the potential to be present in waterbodies in the development envelope. See Section 4.4.2.</p>
Listed migratory species	<p>Relevant.</p> <p>Eight migratory species have the potential to be present within the development envelope. See Section 4.3.2.</p>
Wetlands of international importance	<p>Not relevant.</p> <p>Proposal lies approximately 20 to 30 km to the east of the closest Ramsar wetland, the Peel-Yalgorup System.</p> <p>The southern portion of the Huntly Mine development envelope lies within the hydrological catchment of the Ramsar wetland. However the Proposal is not expected to cause significant impacts to the wetland.</p>
Commonwealth marine areas	<p>Not relevant.</p> <p>Proposal is not located offshore.</p>
World Heritage properties	<p>Not relevant.</p> <p>No World Heritage properties in vicinity of Proposal.</p>
National Heritage places	<p>Not relevant.</p> <p>No National Heritage places in vicinity of Proposal.</p>
Nuclear actions	<p>Not relevant.</p> <p>Proposal is not a nuclear action.</p>
Great Barrier Reef Marine Park	<p>Not relevant.</p> <p>Proposal is on the west coast of Australia.</p>

MNES	Relevance to the Proposal
Protection of water resources from coal seam gas development and large coal mining development	Not relevant. Proposal does not involve coal seam gas or coal mine development.

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