Appendix 4 – Current Approach to Rehabilitation, Monitoring and Area Certification

Alcoa's Current Approach to Rehabilitation, Monitoring and Area Certification

Current Rehabilitation Objective and Approach

The transient nature of Alcoa's bauxite mining operations requires the integration of land rehabilitation activities during the mine operations, mine closure and the post-closure phases, as described in Figure 1 below.

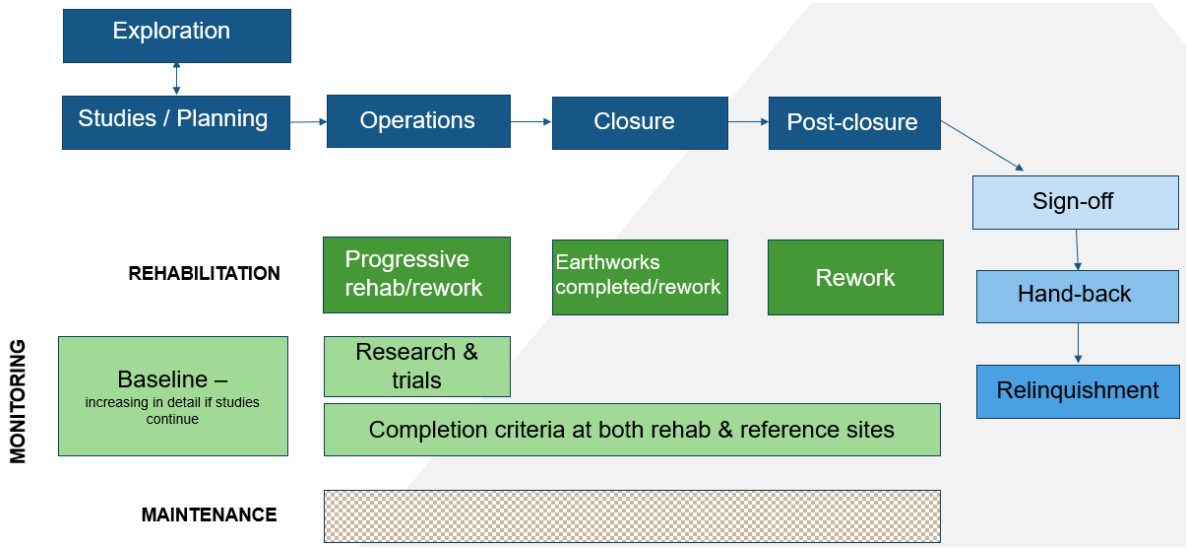

Figure 1: Schematic of the Alcoa's rehabilitation & handback process flow incorporating progressive rehabilitation earthworks, rework where required and continuous improvement via research and trials

This integrated approach results in mining areas being progressively returned to functioning ecosystems suitable for handback to the landholder, within a compressed timeframe. This contrasts with other mineral extraction operations with static footprints that typically commence rehabilitation after mine closure.

Figure 2: Rehabilitation example

Alcoa's bauxite mining is typically confined to discrete mine pits within the surrounding Northern Jarrah Forest that supports and enhances ongoing recruitment of plant species and fauna recolonisation, with low risk of weed infestation.

Alcoa's rehabilitation objective is to establish, and return to the State, a self-sustaining Jarrah Forest ecosystem, that meets the agreed forest values that will support similar management practices as that employed in the surrounding Northern Jarrah Forest. These forest values are described in Table 1.

Table 1: Rehabilitation Goals

Aspect	Goal
Water	To ensure that mined areas do not impact water quality and quantity.
Timber	Establish a forest that has the potential for sawlog production.
Recreation	To maintain existing recreational values where possible and to provide increased opportunities for forest based recreational activities in accordance with DBCA district and regional recreation plans.
Land Management	To conserve the residual soil, to control dieback spread and to ensure the rehabilitation areas are resilient to fire hazards.
Landscape	To create a rehabilitated landscape visually compatible with the adjoining Jarrah forest.
Conservation	To encourage the return of flora and fauna assemblages similar to those within the unmined Jarrah forest
Long-term resilience	Management: to establish and ecosystem that is self-sustaining without ongoing applications of management resources greater than those needed within the unmined forest.

Common to all rehabilitation goals is the replacement of biological elements, ecosystem function, and the re-establishment of ecological processes that puts the mined areas on a restoration trajectory towards unmined forest.

Alcoa is applying the following standards and guidelines to its rehabilitation practises:

- Commander, L E, ed., 2021 Florabank Guidelines - Best Practice Guidelines for Native Seed Collection and Use. 2nd ed. Australia: FloraBank Consortium.
- Commander, L.E. , D.J. Coates, L. Broadhurst, C.A. Offord, R.O. Makinson, and M. Matthes, eds. 2018 Guidelines for the Translocation of Threatened Plants in Australia. 3rd ed. Canberra: Australian Network for Plant Conservation.
- Gann, George D., et al . 2019 "International Principles and Standards for the Practice of Ecological Restoration. Second Edition." Restoration Ecology 27, no. S1: S1-S47.
- Young, R.E., Manero, A., Miller, B.P., Kragt, M.E., Standish,R.J., Jasper, D.A., & Boggs, G.S. (2019). A framework for developing mine-site completion criteria in Western Australia. The Western Australian Biodiversity Science Institute, Perth, Western Australia.

Once published, Alcoa will apply the following guidelines:

- Broadhurst L, Prober SM, Boggs G, Bush D, Breed MF, Dickson F, Harrison PA, Jellinek S, Lynch AJJ, Rymer PD,Young RE, Commander LE (eds) 2023, Guidelines for embedded experiments in ecological restoration and management in Australia (CSIRO).
- Alcoa currently has two active research projects with CRC TiME:
- Natural capital accounting in the mining sector, with Murdoch and Curtin University. This project is looking at the long-term rehabilitation monitoring results and testing the application of a natural capital accounting framework. https://crctime.com.au/research/projects/project-2-7/
- Australian Seed Scaling Initiative: this project builds upon new seeding mechanisms to improve rehabilitation. https://crctime.com.au/research/projects/project-3-13/

Three PhD research programs are currently underway:

- Savuti Henningson regarding germination of Hibbertia species to improve return to rehabilitation
- Eve McCallum regarding the causes of erosion in rehabilitation.
- Johan Wasserman regarding species diversity in the Jarrah forest and in the rehabilitation.

Research findings will be integrated into management plans and other internal documents. Alcoa has a research bibliography with research articles co-authored by staff members, and thesis of students supervised by staff members undertaken onsite. This research is regularly considered and incorporated into management practices.

Alcoa's rehabilitation is measured against completion criteria developed with and approved by DBCA to meet the agreed objective of a self-sustaining jarrah forest ecosystem that meets multiple forest uses. The completion criteria have evolved over time, being informed by interactions in research and practice. Since 1988 and the introduction of a fully native species overstorey, Alcoa has undertaken rehabilitation with respect to three successions of completion criteria:

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

Each completion criterion has an associated standard, including quantitative targets, against which Alcoa monitors and reports the rehabilitation performance. Alcoa's current rehabilitation completion criteria (2016 to present) are published on our website[1].

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

[1] https://www.alcoa.com/australia/en/pdf/mining-operations-rehabilitation-program-completion-criteria.pdf

Alcoa's current rehabilitation approach is a careful balance of reintroducing vegetation with the intent of approximating the surrounding forest richness, and ensuring sufficient functional groups are present as the ecosystems progress along a restoration trajectory towards unmined forest.

An overview of Alcoa's mine rehabilitation, monitoring and handback approach is provided below.

Rehabilitation Planning

Alcoa's mine planning process works hand in glove with the planning of rehabilitation. Mine pits are rehabilitated as soon as possible after ore extraction occurs. The rehabilitation planning process starts at the 10-year Life of Mine (LOM) Plan, which identifies future mining regions and the timing of migration of operations between regions. Conceptual mass balances are prepared for topsoil and overburden materials to ensure there are suitable quantities of rehabilitation materials for the closure of active mine areas and long-term infrastructure.

The 36-month mine plan provides more granularity on ore body boundaries, approved clearing areas and the mining and rehabilitation sequence. Detailed rehabilitation landform designs (where required) are also commenced to define rehabilitation material movement plans.

The 12-month rehabilitation plan is prepared ahead of each rehabilitation season that nominally runs from May to April. This planning involves scheduling of the rehabilitation areas to reduce environmental risk (for example mining areas close to drinking water reservoirs), optimising operational resources (machinery & people), checking overburden and topsoil stockpiles and identifying fresh topsoil donor sites. The rehabilitation areas are also inspected by rehabilitation operators before the draft rehabilitation designs are finalised.

Rehabilitation Risk Management

Alcoa has developed a source pathway receptor model to understand the potential environmental risks associated with rehabilitation operations, particularly during the first 2-3 years following earthworks. During this period the reconstructed soil profile is loose and friable, initially devoid of stabilising plant roots and subject to the erosive processes of rainfall and wind. Juvenile vegetation also transpires soil water to the atmosphere at a lower rate than the surrounding unmined forest, resulting in enhanced groundwater recharge.

The consequences of these potential environmental risks may include:

- erosion of soil materials and sedimentation within adjacent forest areas,
- turbid runoff discharging into nearby streams and drinking water reservoirs,
- groundwater seepage, ponding and discharge,
- fugitive dust, and
- visual amenity degradation.

To mitigate these risks, Alcoa has developed a risk prioritisation matrix to assess the likelihood and consequence of the risks specific to each rehabilitation area and to prioritise the rehabilitation schedule accordingly.

Additionally, Alcoa has developed a "rehabilitation water storage model" and has conducted modelling of a range of scenarios (inputs including various rainfall, soil infiltration, runoff coefficient and reconstructed landscape geometry factors) to inform detailed rehabilitation designs and minimise the risk of soil erosion and turbid water runoff.

Timber harvesting and clearing

In line with commitments made in MS 095, Alcoa works closely with the Western Australian Governments Forest Products Commission (FPC) to ensure mine clearing involves sustainable timber

harvesting and maximises wood residue re-use practices. The FPC is certified to the Australian Standard for Sustainable Forest Management (AS4708:2013) that ensures they manage forestry operations to the highest possible standards Alcoa's sustainability certification was achieved through an intensive audit process, completed in May 2020, which concluded that clearing ahead of mining did not constitute forest 'conversion' on the basis that a sustainable forest ecosystem was re-established after mining. This is a positive third-party endorsement of Alcoa's mined land rehabilitation efforts.

Alcoa's interaction with the FPC is facilitated using the Forest Products Commission 'Harvesting inspection and Action Sheet (Mine Site)'[2]. This document facilitates the handover of operational harvesting areas to Alcoa and provides a coordinated approach to the management of mining operations and timber harvesting operations within and adjacent to Alcoa's bauxite mining regions.

Following timber harvesting and understorey plant clearing activities, Alcoa works with other authorised third parties to further utilise the remaining wood residues. Simcoa Operations Pty Ltd (Simcoa), have access to the wood residues to meet their requirements under the *Silicon (Kemerton) Agreement Act 1987.* Alcoa's non-commercial agreement with Simcoa substantially reduces the quantity of wood residue that is burnt by Alcoa.

Alcoa is also actively investigating other methods to further reduce wood residue burning, including composting, biofuel, and charcoal manufacturing. All proposals are reviewed in consultation with the FPC. Following third-party use, Alcoa completes forest residue removal through burning.

Soil stripping

Following timber harvesting and woody residue removal, the underlying soils above the mineral resource are stripped in two discrete layers, known as fresh topsoil and overburden.

Fresh topsoil (nominally from 1 to 100mm below natural ground level) is mechanically stripped, optimally in late spring and early summer. This material contains native seed, nutrients and beneficial organisms that support successful revegetation. Once stripped it may be stockpiled for up to 3 months before use on rehabilitation areas. Fresh topsoil harvested outside the optimal seasons is known to degrade in quality, primarily due to water ingress and composting. 'Expired' fresh topsoil becomes referred to as 'fallow' topsoil.

Overburden soil (nominally 200 to 300mm below natural ground level) is mechanically stripped and stored in stockpiles separate from fresh topsoil for use in reconstruction of the rehabilitation soil profile.

Both overburden and topsoil materials are classified according to their dieback infection status and stockpiled separately.

Landscaping and soil return

The objective of landscaping is to establish a stable landform that integrates with the surrounding unmined forest (Figure 6). Key elements of landscaping are:

- Deep ripping (as shown in Figure 3 of compacted pit floors with a winged tine to at least 1.2 m to promote infiltration and facilitate tree growth by alleviating compaction and creating structure in the soil profile.

2 Forest Products Commission, 2014. Harvesting Inspection and Action Sheet (Mine Site). FPC Document No. FPC27, Forest Products Commission, Perth.

Figure 3: Deep ripping

- Vertical faces at pit edges are re-shaped to achieve acceptable slope angles that blend in with the surrounding natural forest landscape.
- Long term forest access tracks are reinstated as agreed with DBCA and located as low in the profile as possible with surface water runoff directed into the rehabilitated area.
- Pits are landscaped (as shown in Figure 4) to maximise infiltration and minimise surface water runoff that may cause erosion within the pit and sedimentation in the surrounding forest.

Figure 4: Landscaping

- Overburden and topsoil return (as shown in Figure 5) provides a soil medium for vegetation establishment and sustainable growth. Overburden is to always be returned first followed by topsoil. Soils are returned from stockpiles to an area of the same Dieback classification.

Figure 5: Overburden placement

- Target 300 mm combined depth of overburden and topsoil, spread to all areas to be rehabilitated. Reduced depths of return are permissible on the basis that it is demonstrated that shallower soils were naturally present. The application for approval to use a reduced thickness is usually made on a sub-region basis.
- Topsoil handling is scheduled during dry periods to avoid damage to topsoil structure and negative impact on seed viability during the process.

Figure 6: Landscaping completion

Fauna habitat return

Fauna habitats are strategically placed within the rehabilitated areas to encourage fauna into the rehabilitated areas, as shown in Figure 7. Key elements of fauna habitat establishment are:

- Constructed fauna habitats established at a target rate of one per hectare (minimum one per two hectares).
- Habitats constructed with large logs and rocks.
- Habitats may exacerbate erosion risk and are placed low in the landscape.

Figure 7: Fauna habitat

Contour ripping

Contour ripping of the rehabilitated area occurs post fauna habitat installation to remove compaction caused by the soil return operations and produce on contour furrows, that promote surface water infiltration and reduce the risk of surface erosion until the vegetation is established. Key elements of contour ripping are:

- Ripping carried out on contour with a multi-tine.
- Pit edges, batters and banks are scarified or shallow ripped to avoid bringing rocks to the rehabilitation area surface.

Seeding and planting

Seeds within the topsoil seed bank are the main source of plant species diversity in the rehabilitation. Some species do not store their seed in the soil seed bank, rather, they store it in the canopy. Some species do not set seed, and generally propagate vegetatively. Hence, there are three methods of plant return to the rehabilitation – seeds within the topsoil seed bank, seeds applied with an airseeder or by hand, plants that are planted by hand.

Seeding is undertaken either at the same time as (air seeding), or as soon as possible after (target maximum 7 days – hand seeding) contour ripping. Some species within the seed mix is pre-treated to alleviate seed dormancy.

Plant species that do not return from the topsoil seed bank or from applied seed are called ‘‘recalcitrant’’ and are grown from seed (for species where seeds are scarce), cuttings or by tissue culture (Koch 2007).

Key elements of seeding and planting are:

- Seed collection from approved Huntly and Willowdale Mine provenance zone and informed by genetic analysis.
- Apply seed mix including understorey and overstorey species.
- Standard prescription for majority of mine pits is to establish 70 per cent *E. marginata* and 30 per cent *C. calophylla*.

- For stream crossings or low areas within pits, *E. patens, E. megacarpa and E. rudis* used in proportions relating to density in surrounding areas, calculated from permanent monitoring plots in stream zones.
- Mixed understorey seed sown at the rate of 1-2 kg/ha. Seeding as soon as possible after contour ripping operations (preferably within 7 days).
- Seed applied mechanically at time of contour ripping or by hand.
- Planting recalcitrant seedlings, following significant autumn/winter rains in the second year after completion of soil return etc.
- Use of Dieback free nursery stock.
- Rushes and sedges that are subject to browsing by kangaroos are protected by small mesh guards to enhance plant establishment and survival.
- If required, legume reseeding, Eucalypt planting and recalcitrant planting is done in rehabilitated areas where the cover does not meet the required completion criteria.

Figure 8: Seeding and planting

Fertilising

Fertiliser is applied to newly rehabilitated areas in late winter or early spring each year. This is a once-off fertiliser application, applied in the second year.

Figure 9: Fertilisation application

Rehabilitation Quality Monitoring

Alcoa's rehabilitation quality monitoring program evaluates rehabilitated areas against the Alcoa WA Mining Rehabilitation Completion Criteria that were developed in consultation with the post mining landuse manager, the DBCA and other key stakeholders and endorsed by the MMPLG in 2016.

The 2016 completion criteria are based on the previous four iterations of completion criteria that were first implemented in 1996 and applied to current era rehabilitation practices from 1988. The 2016 criteria reflect the current Alcoa WA Mining mine closure objective, as stated in the section above and are grouped according to eight rehabilitation quality requirements, these being:

- Landuse & Management Priority
- Existing Environment
- Integrated Landscape
- Sustainable Growth & Development
- Catchment Protection
- Vegetation Establishment
- Resilience of Vegetation, and
- Landuse (including timber production)

Of the eight rehabilitation quality requirements, the first two relate to pre-mining requirements and are not relevant to this discussion. The last six relate specifically to mine rehabilitation requirements and are detailed within Table 2.

Table 2: Relevant completion criteria excerpted from the 2016 Alcoa completion criteria

Rehabilitation Quality Requirement	Objective of Requirement	Reference	Completion Criteria	Monitoring Method
2.1 INTEGRATED LANDSCAPE	The mine pit areas are landscaped to be stable and to blend in with the surrounding forest. Landscaping must be completed to ensure effective surface water management. Landscape design will not cause an impediment to access for Parks and Wildlife's operations or be an ongoing financial or management liability.	2.1.1 Landscape design	Slopes must always be less than 18 degrees. No landscaped pit is to have a slope greater than 15 degrees for more than 20 metres unless it is on contour of the surrounding forest floor.	Self-certification by Alcoa annually and / or inspection by Parks and Wildlife confirm landscape design is acceptable.
2.2 SUSTAINABLE GROWTH AND DEVELOPMENT	Waste islands will be effectively Rehabilitated. Waste islands will have caprock shattered and topsoil spread and scarified to prevent impeding vehicular or rubber tyred machine for fire access.	2.2.1 a Rehabilitation establishment a Waste Islands	No area greater than 0.1 of a hectare has unbroken caprock. Trafficability to agreed Alcoa/Parks and Wildlife Working Arrangements.	Self-certification by Alcoa annually and / or inspection by Parks and Wildlife confirm landscape design is acceptable.
2.2 SUSTAINABLE GROWTH AND DEVELOPMENT	There is an adequate cover of topsoil across the rehabilitated area. Topsoil return and coverage is uniform within each individual rehabilitated pit.	2.2.2 b Topsoil	Direct return (or agreed surrogates) topsoil is spread over the rehabilitated area. No area >0.1 ha has no topsoil coverage. The cumulative area without topsoil does not exceed 10% of the rehabilitated pit.	Self-certification by Alcoa annually and / or inspection by Parks and Wildlife confirm landscape design is acceptable.
2.2 SUSTAINABLE GROWTH AND DEVELOPMENT	The rehabilitated area has adequate ground fauna habitat.	2.2.3 c Fauna habitat	Rehabilitation will include one constructed habitat per 2 hectares.	Self-certification by Alcoa annually and / or inspection by Parks and Wildlife confirm landscape design is acceptable.
2.2 SUSTAINABLE GROWTH AND DEVELOPMENT	The area has been contour ripped. Ripping does not prevent access for fire line construction by front end loader. No uncontrolled water runoff or unacceptable soil erosion in or adjoining the pit.	2.2.4 d Contour ripping	Unacceptable erosion is that which: restricts access through the area by 4-wheel drive vehicles is unstable and degrading, or will compromise landuse objectives. Gully erosion will not exceed: 30cm depth and 30cm width, and 100m in length Areas of unintended deposition >0.1 ha	Self-certification by Alcoa annually and / or inspection by Parks and Wildlife confirm landscape design is acceptable.
2.2 SUSTAINABLE GROWTH AND DEVELOPMENT	The pit floor has been ripped.	2.2.5 e Pit floor ripping	Rip compacted pit floor to at least 1.2 m, excluding batters and waste islands. Ripping must be undertaken as per criteria established in Alcoa/Parks and Wildlife Working arrangements.	Self-certification by Alcoa annually and inspection by Parks and Wildlife (where applicable) confirms pit floor ripping is acceptable.

Rehabilitation Quality Requirement	Objective of Requirement	Reference	Completion Criteria	Monitoring Method
2.3 CATCHMENT PROTECTION	Rehabilitated areas conform to water catchment management guidelines.	2.3.1 Catchment Protection	Areas will be stable with no evidence of recent erosion which would compromise stream water quality. There are no areas greater than 0.1 hectare with less than 0.5 native plants per square metre as identified from aerial photography or ground truthing on a 5-yearly basis.	Alcoa 9- and 15-month monitoring. Alcoa aerial photography, at ~5yrs of age.
3.1 VEGETATION ESTABLISHMENT – First 5 years	The overstorey stocking of both jarrah and marri to meet standards.	3.1.1 Establishment of overstorey	The average number of stems/ha within a pit (9 month monitoring data): · Minimum: 600 eucalypt stems/ha · Maximum: 1400 eucalypt stems/ha · Target: 1000 eucalypt stems/ha (except haul roads and pits < 2 ha). · Minimum: 200 marri stems/ha · Minimum: 150 jarrah stems/ha. No rehabilitated sites (>2ha in size) have areas >0.5ha (as identified from either 9mth monitoring or subsequent review of aerial imagery at~5yrs of age) with <100 stems/ha.	Alcoa 9- and 15-month monitoring. Alcoa aerial monitoring at~5yrs of age
3.1 VEGETATION ESTABLISHMENT – First 5 years	There is an adequate legume density early in regeneration.	3.1.2 a Establishment of understorey - legume density	Minimum legumes 0.5 per square metre averaged over a pit assessed at 9-months.	Alcoa 9-month monitoring
3.1 VEGETATION ESTABLISHMENT – First 5 years	There is adequate plant species richness.	3.1.2 b Establishment of understorey - plant species richness	The species richness in monitoring plots in rehabilitated areas to be ≥60% of the average species richness in monitoring plots established in unmined forest.	Alcoa 15-month monitoring
3.1 VEGETATION ESTABLISHMENT – First 5 years	There is an adequate density of resprouter species, as defined by Bell (2001).	3.1.2 c Establishment of understorey - Resprouters	Minimum number of surviving resprouter species will be 200 plants/ha.	Alcoa 9- and 15-month monitoring
3.2 RESILIENCE OF VEGETATION – first 5 years		3.2.1 Weeds	No evidence that significant introductions of new weed species (environmental and declared) are persisting or that weed competition is restraining sustainable development of native species.	Alcoa 15-month monitoring
4.1 RESILIENCE OF VEGETATION 12 years and older	The rehabilitation is capable of persisting at the required standard following bushfire	4.1.1 Resilience of fire affected rehabilitation	A minimum of 300 stems/ha including; A minimum of 150 stems/ha Jarrah; and a minimum of 45 stems/ha Marri.	Alcoa plant survivorship survey. Timing dependent on wildfire and prescribed burn history of the area
4.1 RESILIENCE OF VEGETATION 12 years and older	Tree species not susceptible to dieback are present at an adequate stocking rate.	4.1.2 Dieback	Minimum 200 marri stems/ha at 9 months monitoring.	Alcoa 9-month monitoring

Rehabilitation Quality Requirement	Objective of Requirement	Reference	Completion Criteria	Monitoring Method
4.1 RESILIENCE OF VEGETATION 12 years and older	Rehabilitation is not preferentially attacked by non-dieback forest diseases.	4.1.3 Other Forest diseases	The disease expression in rehabilitation is no greater than in the un-mined forest.	Alcoa assessment.
4.1 RESILIENCE OF VEGETATION 12 years and older	Rehabilitation is not preferentially attacked by insects	4.1.4 Insects	The infestation of rehabilitation by insects is no greater than in the un-mined forest.	Alcoa assessment.
4.1 RESILIENCE OF VEGETATION 12 years and older	Mining rehabilitation areas are not showing evidence of being preferentially affected by drought.	Drought	There is no obvious variation or differential to unmined forest.	Alcoa assessment.
4.2 LANDUSE (INCLUDING TIMBER PRODUCTION) Proposals to carry out thinning on rehabilitated mine sites	There is an adequate density of both jarrah and marri to meet timber production requirements.	4.2.1 Timber production Areas capable of producing sawlogs	The average number of stems/ha: · Minimum: 500 eucalypt stems/ha · Maximum: 1300 eucalypt stems/ha · Target: 900 eucalypt stems/ha (except haul roads and pits <2 ha). · Minimum: 200 marri stems/ha · Minimum: 150 jarrah stems/ha. Based on review of aerial imagery, no rehabilitated sites (>2ha in size) have areas >0.5ha with <100 stems/ha At time of hand back the subject region has a minimum of 250 stems/ha combined total of Jarrah/Marri with the potential to produce a straight bole with a minimum of 3 m of potential future sawlog (excludes stump height). Evidence provided from plot monitoring, research studies, random sampling and aerial photography will be used to estimate density and potential bole length. The timber production landuse criteria only apply to the percentage of rehabilitated area that had a timber production landuse prior to mining, i.e. if 15% of the area mined had no timber production potential, then only 85% of the rehabilitated area needs to meet the timber production landuse criteria.	Alcoa 9- and 15-month monitoring
4.2 LANDUSE (INCLUDING TIMBER PRODUCTION) Proposals to carry out thinning on rehabilitated mine sites	Heavily stocked stands may, be thinned by an agreed proponent to encourage sawlog production or achieve other management objectives	4.2.2 Thinning	N/a	N/a
4.2 LANDUSE (INCLUDING TIMBER PRODUCTION)	There is an adequate understory layer in the regenerated pit.	4.2.3 Management of understorey	Understorey vegetation meets the expected species richness, density and cover.	Alcoa 9- and 15-month monitoring

Rehabilitation Quality Requirement	Objective of Requirement	Reference	Completion Criteria	Monitoring Method
4.2 LANDUSE (INCLUDING TIMBER PRODUCTION)	The rehabilitation has been prescribed burnt (at least once) or a wildfire has burnt the area, or the area is on an approved Parks and Wildlife burning plan.	4.2.4 Management of Fire Risk	100% of the rehabilitated areas have received a prescribed fire or a wildfire or the area is on an approved Parks and Wildlife burning plan.	Alcoa assessment.

The types of rehabilitation monitoring are described in the sections below.

9-month Flora Monitoring

The 9-month flora monitoring, carried out in 9 months from the onset of the wet season, comprises of transects to monitor Eucalypts and quadrats to monitor legumes. Eucalypt transects are 2 metres wide and 50 meters long, in which emergent *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) seedlings are counted separately. At the end of each transect, four 2x2 meter legume quadrats are established, in which all living native legumes are counted as a single total (Figure 10).

Due to the diverse range of pit shapes, transects are not straight lines, but rather meandering paths through the rehabilitation. Establishing transects this way provides the flexibility to evenly cover the entire rehabilitation area and avoids undesired features such as habitat piles and re-established forest tracks.

The survey intensity is set as a percentage of each rehabilitation pit to ensure sufficient coverage. Specifically, the total area monitored for Eucalypt transects is at least 5% of the pit area and the total legume quadrat coverage is at least 0.8% of the pit area. This results in approximately five transect lengths (each with four quadrats) for every hectare of rehabilitation.

During 9-month monitoring, any weed species identified (even if it is outside a transect or quadrat) are recorded opportunistically.

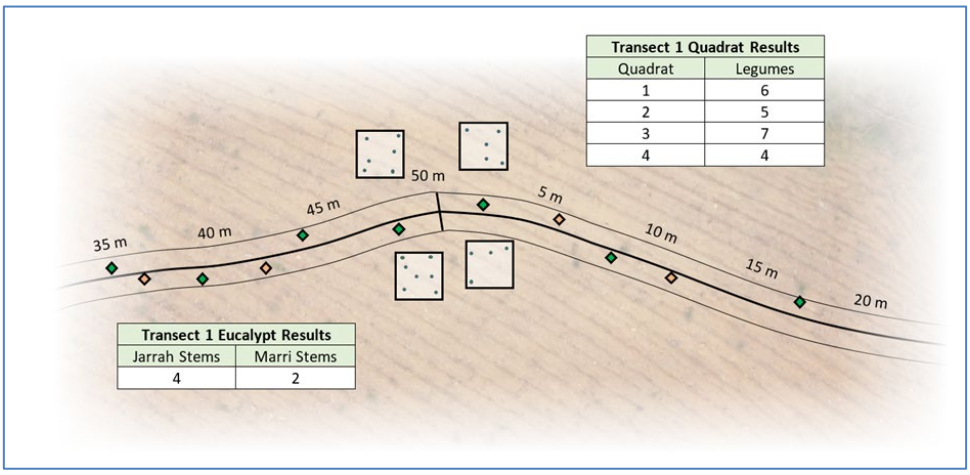

Figure 10: 9-month botanical monitoring, demonstrating the end of one Eucalypt transect, and the beginning of another, with associated legume quadrats

The 15-month flora monitoring carried out 15 months from the onset of the wet season spring, assesses native species richness. Species richness plots comprise five 4 m x 4 m quadrats inside a 20 m x 20 m plot (Figure 12) demarcated with bamboo canes on the corner of each quadrat. These are termed 'temporary plots'. Presence / absence of all living vascular plant species is recorded within in each quadrat. For rehabilitation pits where legume remediation has taken place, the total count of legumes in each quadrat is also recorded. The survey intensity is set at rate equal to one plot every five hectares rounded up (i.e., pits less than 5 hectares are allocated at least one plot, pits between 5 and 10 hectares get two plots etc).

Approximately one in every ten plots is established as a permanent plot. Quadrats in permanent plots are further split into four 2 m x 2 m quadrats, resulting in 20 total quadrats per permanent plot (Figure 5B). In each permanent plot quadrat, density and cover are also recorded for each living vascular plant species. In addition to being used for 15-month richness, permanent plots form the basis of Alcoa's long term rehabilitation monitoring program, whereby these plots are established to track long-term rehabilitation trajectory.

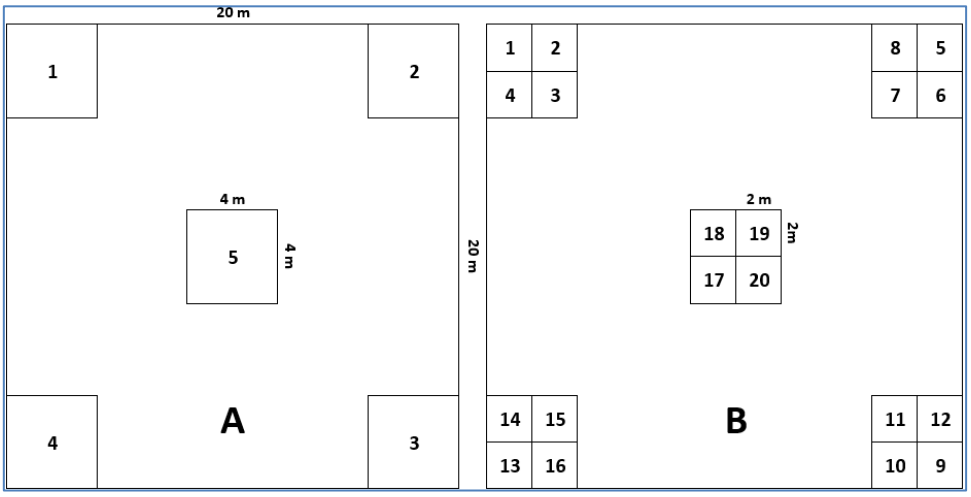

Figure 11: Plot design for Temporary plots (A) and Permanent plots (B)

Figure 12: 15-month Flora Monitoring and typical vegetation establishment after 15 months

Fauna Monitoring

Vertebrate fauna are only a part of the forest rehabilitation process and their progress from pioneering species toward a climax community is interrelated with the vegetation, fungi, microbial and invertebrate community development.

Alcoa has established 12 long-term monitoring sites for vertebrate fauna. These sites are in unmined habitat and areas rehabilitated 5, 10 and 15 years ago. Vertebrate fauna at these sites are periodically monitored to ensure rehabilitated areas are progressing on a restoration trajectory towards unmined

forest. Outcomes from these monitoring surveys inform planning for future rehabilitation programs and undertaking remediation in existing rehabilitated areas.

During the very early stages, very few species will colonise the area due to a lack of suitable habitat and higher levels of predation because of a lack of cover and retreat sites. Once the vegetation, invertebrates and microbial activity, etc invades or develops, additional niches open up and more species can colonise the area. In some cases, the abundance of early colonisers (i.e. pioneers) is reduced due to competition and changing habitat conditions. Rehabilitated areas will cycle through many iterations of this process and along the way, species abundance typically increases, and the various species reach population levels suitable for the habitat and resources available, until such time it becomes a climax community.

Within broad boundaries, the restoration trajectory in rehabilitated areas will be apparent in vertebrate fauna monitoring data.

Rehabilitation Remediation

Alcoa has integrated adaptive management practices within its rehabilitation monitoring program to ensure that the rehabilitation quality is on an appropriate trajectory towards achieving the completion criteria. In some cases, remediation works are required following monitoring surveys to address the following quality issues:

- Plant species richness (species range & spatial distribution)
- Timber production (target species stem density)
- Landform stability (subsidence, erosion & sedimentation)
- Aesthetics (landscape integration, slope, access & drainage)
- Pest & Diseases (Weeds, feral animals, insect infestation & forest disease)

Alcoa implements the practice of returning plant species to the rehabilitation areas at various stages via tube stock planting and legumes seeding. If completion criteria are not met then remediation actions take place. Figure 13 describes the timing of rehabilitation, monitoring and remediation interventions that may be applied over the six-year period after mining is completed. If, at 9 month monitoring, legume and eucalypt densities are below completion criteria targets in certain pits, then legumes are seeded into those pits that autumn, and eucalypts are planted the following winter. If the 15 month monitoring identifies pits below the species richness target in the completion criteria, additional species are planted.

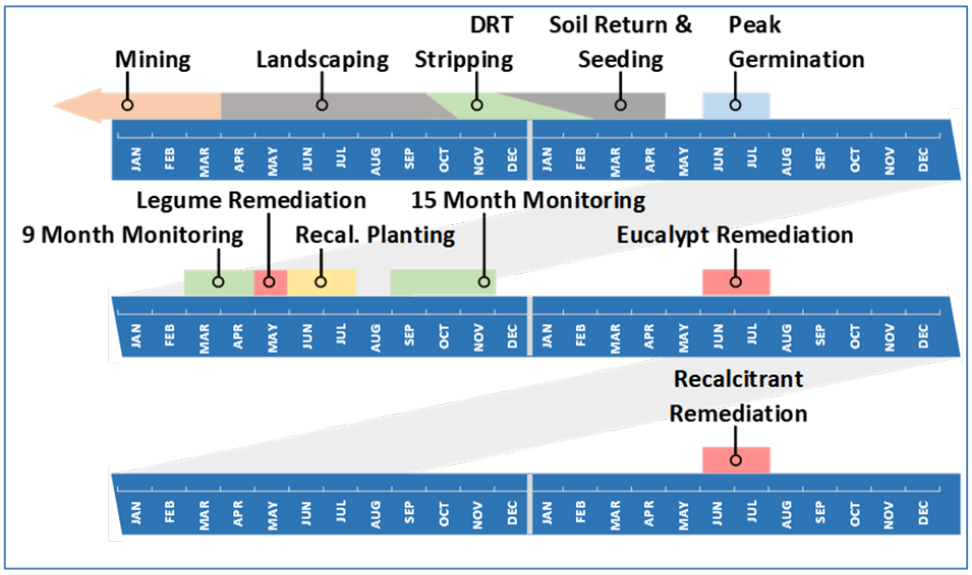

Figure 13: Rehabilitation monitoring and remediation timing

If monitoring indicates remediation is required due to erosion, re-work is completed using the smallest earthmoving machinery possible to minimise disturbance to surrounding establishing rehabilitation. During remediation, the soil profile is re-established, contour ripped, re-seeded and re-planted (if required).

Rehabilitation Area Certification Process (Handback)

Alcoa follows an MMPLG agreed approach to rehabilitation area certification and relinquishment of management responsibility. Alcoa refers to these steps as "sign-off" and "handback", respectively.

Since rehabilitation practices and procedures have evolved over time and Completion Criteria are subject to periodic review, Alcoa's rehabilitation areas are assessed for handback against differing criteria and expectations depending on the year of establishment (refer Table 3).

Rehabilitated areas established up to 1987 reflect the agreed practice at that time of establishing a non-jarrah forest ecosystem with restricted objectives and values and are collectively termed Early Era rehabilitation.

From 1988, with the objective of restoring a self-sustaining jarrah forest ecosystem, criteria were increasingly influenced by ecological considerations.

Table 3: Periods of rehabilitation establishment and associated Completion Criteria that are applicable for each period

Rehabilitation establishment year	Applicable Completion Criteria	Reference
1966-1987	Early Era (pre-1988) Rehabilitation. Formally accepted by the MMPLG 5 June 2002.	DoIR (2002, 2007)
1988-2004	Current Era (post-1988) Rehabilitation Formally accepted by MMPLG, 14 October 1998.	DoIR (2002)
2005-2015	Completion Criteria for 2005 onwards - Current Era Rehabilitation. Review completed and approved by MMPLG 15 March 2007.	DoIR (2007)
2016 onwards	This document	

The assessment of rehabilitation against the Completion Criteria is applied throughout the various stages of the rehabilitation operations and during the early years of ecosystem development. This ensures that corrective actions can be carried out while operations are still nearby.

An Environment/Rehabilitation checklist has been developed to record the status of rehabilitation in the field. Historic rehabilitation records and aerial photographs are also used to assist with the assessment.

Assessment results and photographs taken at each site are stored in Alcoa's Geographical Information System to ultimately assist DBCA with future management of the rehabilitation. The assessments indicate whether the site is exhibiting sustained growth and development. If a site is recorded as not meeting one of the criteria, it is recorded within Alcoa's corrective action management system to inform rework planning.

Areas that do not meet the standards due to the presence of significant infrastructure, such as pit faces, are automatically reviewed with DBCA regardless of growth on the site. Some additional works like the installation of access tracks and waterholes for fire management are carried out to facilitate the integration of management of the rehabilitated areas with the surrounding forest. The sites are reviewed in a local and regional context.

Applications for certificates of acceptance (referred to within Alcoa as "sign-off"), which signal successful completion of requirements, will be made by Alcoa on a mining region or sub-region basis, rather than at the individual pit scale. Therefore, it is likely that more than one set of criteria applicable to rehabilitation of different ages will be applicable and applied accordingly in the assessment of overall rehabilitation success.

There is an ongoing process prior to proposed handback of rehabilitated areas for Alcoa to internally monitor and confirm achievement of completion criteria prior to submission of applications for certificates of acceptance. This takes place at the various stages of completion, supported by monitoring data and self-audit checklists. DBCA reviews Alcoa's rehabilitation checklists, and monitoring data are provided to DBCA annually to allow field audits of the rehabilitation and timely feedback to Alcoa where appropriate.

The formal acceptance of rehabilitated areas by the State is achieved through the issue of a Certificate of Acceptance to Alcoa by the DBCA on behalf of the State. The indicative steps required to receive a Certificate of Acceptance are outlined below. Note that timeframes provided are intended to be the maximum required, and endeavours will be made to limit the time taken to the minimum necessary at each phase.

The process, responsibilities and timeline for rehabilitation area sign-off and handback is summarised in Table 4.

Table 4: Timeline for signoff and handback of completed rehabilitation

STEP	TIMING
1. Alcoa initiates discussion with the MMPLG[2] signalling intent to submit an application for a Certificate of Acceptance (Final Submission Report - Section 3.5), including confirmation of the scope and content of the Final Submission Report (based on Appendix B) for the area involved.	Alcoa to initiate.
2. Alcoa provides a draft Final Submission Report to the MMPLG for review and confirmation of content.	Alcoa to initiate.
3. MMPLG reviews the draft Final Submission Report and provides feedback on report content and presentation within 6 weeks.	6 weeks
4. Within 6 weeks Alcoa applies for a Certificate of Acceptance, including a Final Submission Report (Letter and report addressed to DSD attention MMPLG) which is distributed to MMPLG members.	6 weeks or TBA
5. Within 10 weeks of receiving the Final Submission Report, the MMPLG provides an Assessment Report to Alcoa,	8 weeks
6. Within 12 weeks of receiving the MMPLG Assessment Report, Alcoa submits a draft Action Plan to address any issues identified within the Assessment Report.	12 weeks or TBA
7. Within 4 weeks of receiving the draft Action Plan, MMPLG provides feedback to Alcoa identifying any further actions to be included in the Action Plan.	4 weeks
8. Within 12 weeks or as otherwise advised, Alcoa completes activities within the final Action Plan or identifies areas and proposed arrangements to address any 'further requirements' and submits evidence in the form of a Completion Report to the MMPLG.	12 weeks or TBA
9. Within 4 weeks of receipt, MMPLG completes review of the Completion Report and provides advice to Alcoa on the outcome. Then within 2 weeks, the Department of State Development (DSD) places an advertisement in the West Australian and on its website indicating that the MMPLG report on this application and associated documentation is publically available, with any comments accepted during a 4 week period (comments are to be acknowledged by DSD and forwarded to MMPLG members as they are received).	6 weeks
10. Within 6 weeks of the closing date for public comments, DSD and DPaW develop a response to public submissions in consultation with MMPLG members and Alcoa and provides a recommendation to MMPLG regarding the issue of a certificate of acceptance.	6 weeks
11. Within 2 weeks of a recommendation MMPLG meets and confirms a decision on whether to advise DPaW to issue a Certificate of Acceptance.	2 weeks
12. DPaW issues Alcoa with a Certificate of Acceptance within 8 weeks of supporting advice from MMPLG.	8 weeks
Maximum indicative timeframe from submission of draft Final Submission Report to issuing of Certificate of Acceptance	**70 weeks**
	Government
	Alcoa