

**Alcoa of Australia
Limited**

***Empodisma* Peatlands TEC
Action Plan**

Willowdale Mine

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April 2025

| Version | Description | Prepared by | Reviewed By | Approved By | Date |
|---------|----------------------------|-------------|--|-------------|------------|
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| 0 | Issued for Approval | F. Hart | K. Bankin | L.Mailey | 22/04/2025 |

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Abbreviations

| Abbreviation | Definition |
|--------------|---|
| AEP | Annual Exceedance Probability |
| Alcoa | Alcoa of Australia Limited |
| BAM Act | <i>Biosecurity and Agricultural Management Act 2007 (WA)</i> |
| BC Act | <i>Biodiversity Conservation Act 2016 (WA)</i> |
| DCCEEW | Department of Climate Change, Energy, the Environment and Water |
| DCMP | Drainage Control Management Plan |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| EP Act | <i>Environmental Protection Act 1986 (WA)</i> |
| EPA | Environmental Protection Authority |
| EPBC Act | <i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i> |
| GDE | Groundwater Dependent Ecosystem |
| GDP | Ground Disturbance Permit |
| GIS | Geographic Information System |
| HCWM | Hydrogeological Conceptual Water Model |
| IBRA | Interim Biogeographic Regionalisation of Australia |
| PMST | Protected Matters Search Tool |
| TEC | Threatened Ecological Community |
| TECAP | Threatened Ecological Community Action Plan (this document) |
| TSSC | Threatened Species Scientific Committee |
| WA | Western Australia |
| WBM | Water Balance Model |
| WoNS | Weeds of National Significance |

Definitions

| Term | Definition |
|---------------------------------------|--|
| Activities | Refers to mining activities, and infrastructure development and sustainment. |
| Annual Exceedance Probability (AEP) | AEP is the probability of an event occurring in any given year. If a flood of a particular size has an AEP of 1%, there is a one in 100 chance that it will exceed this size in any given year (DEW, 2025). |
| Construction | Project phase that includes harvesting and clearing activities, and the construction of haul roads and infrastructure. |
| Declared Pest | Under the BAM Act, the Minister may declare harmful organisms that are present within an area of the State to be a Declared Pest. |
| Environmental Impact Assessment (EIA) | An orderly and systematic process to evaluate a proposal and its effects on the environment, as well as to consider the mitigation and management of those effects (EPA, 2023). |
| Ground Disturbance Permit (GDP) | The GDP is Alcoa's internal process which was created to avoid, minimise and manage potential environmental and heritage risks. The process reviews potential exploration, construction and operational activities in-line with Project constraints and environmental commitments and provides a due diligence check of potential environmental sensitivities prior to the activity commencing. Activities are assessed and signed-off by the appropriate level of the business based on the type of activity. |
| Groundwater Dependent Ecosystem (GDE) | GDE includes ecosystems that use groundwater as all or only as part of their water supply to meet all or some of their water requirements. |
| Infrastructure | Includes any structures that enable or support mining activities including (but not limited to): stockpiles; haul roads; conveyors; crushers; structures for water storage; and water monitoring and infrastructure. |
| Key weed species | Weed species listed as either a Declared Pest, Weed of National Significance (WoNS) or weed species ranked as having high invasiveness and low feasibility of control (DBCA, 2014). |
| Management Actions | The identified actions implemented to meet the environmental objective (EPA, 2024). |
| Management Targets | A type of indicator that is defined to demonstrate that the objective is being met (EPA, 2024). |
| Mining activities | Refers to the integrated process of extracting bauxite from mineral reserves below the surface by coordinating the use of people and equipment. This refers specifically to removing topsoil and overburden, breaking caprock (blasting or ripping) to expose the viable bauxite, removal of viable bauxite, crushing and conveying bauxite to the refineries. Excludes infrastructure or rehabilitation activities. |
| Mining Avoidance Zone (MAZ) | Spatial area which prohibits mine pits and infrastructure, with the exception of monitoring and rehabilitation activities which have minimal impacts |
| Monitoring | The regular observation and recording of activities taking place in a program. Monitoring assesses management |

| Term | Definition |
|---------------------------------------|--|
| | outcomes, the condition of the environment to help determine if desired outcomes are being achieved (CPC, 2023). |
| Operational | Active and established activities occurring across the Project, including mine pits, infrastructure, crusher, conveyor, and haul roads. |
| Rehabilitation | In relation to an area that has been disturbed, includes: (a) stabilisation of the area; and (b) restoration of the landforms of the area to a state that is as close as practicable to their original undisturbed state; and (c) the return of the native vegetation of the area to a state that is as close as practicable to its original undisturbed state. |
| Significant flora and vegetation | As per EPA (2016). Flora and vegetation may be considered significant for a range of reasons, including, but not limited to, the following: Flora <ul style="list-style-type: none"> • being identified as threatened or priority species; • locally endemic or associated with a restricted habitat type (e.g. surface water or GDEs); • new species or anomalous features that indicate a potential new species; • representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); • unusual species, including restricted subspecies, varieties, or naturally-occurring hybrids; or • relictual status, being representative of taxonomic groups that no longer occupy widely in the broader landscape. Vegetation <ul style="list-style-type: none"> • being identified as Threatened Ecological Communities or Priority Ecological Communities; • restricted distribution; • degree of historical impact from threatening process; • a role as a refuge; or • providing an important function required to maintain ecological integrity of a significant ecosystem. |
| Threatened Ecological Community (TEC) | A naturally occurring assemblage of plants and animals listed under relevant legislation and endorsed by the Minister for Environment as being threatened with extinction by human activity, or in danger of being destroyed or significantly modified by development or other pressures (EPA, 2016). |
| Vegetation complex | A classification system for vegetation types within the south-west of Western Australia defined by Havel (1975). The system delineates forest vegetation using a combination of plant species co-occurrence patterns, landforms, soils and rainfall. |
| Weed species | Weed species are plants that can grow in locations where they are not desired and can have adverse effects on the environment and economy. |
| Weeds of National Significance (WoNS) | A list of plant species selected based on their invasiveness and impact characteristics, their potential and current area of spread and their primary industry, environmental and socioeconomic impacts, and agreed upon by Australian |

| Term | Definition |
|------|---|
| | governments based on an assessment framework (Invasive Plants and Animals Committee, 2016). |

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1 Executive Summary

This *Empodisma* Peatlands Threatened Ecological Community (TEC) Action Plan (TECAP) has been prepared by Alcoa of Australia Limited (Alcoa) for the confirmed occurrence of the *Empodisma* peatlands of southwestern Australia TEC (refer to Appendix B for Commonwealth conservation categories and definitions), located within the Willowdale mine, specifically within the Flinders resource region situated within the Larego mine region.

This is the first version of the TECAP which outlines **interim** management provisions due to the high levels of uncertainties and lack of current knowledge regarding the *Empodisma* peatland TEC within Willowdale.

Additionally, hydrological assessments are being undertaken concurrently with the development of this TECAP, therefore not all information was available during the development of this document. The purpose of this TECAP is to provide the **interim** mitigation, management and monitoring framework for the confirmed occurrence of the *Empodisma* peatlands TEC (see Figure 2-1) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The *Empodisma* peatlands TEC may potentially be impacted by construction and operational activities, therefore this TECAP addresses the risks and potential impacts that may arise from Alcoa's bauxite mining activities undertaken in proximity to the confirmed occurrence of the TEC.

Potential impacts have been identified to the *Empodisma* peatlands TEC, including (but may not be limited to):

Direct impacts from:

- clearing of vegetation.

Indirect impacts from:

- changes to hydrogeological and hydrological regimes (e.g. groundwater mounding, altered surface water flows);
- drainage failures and sedimentation runoff into the TEC;
- movement of machinery and equipment introducing and / or spreading *Phytophthora* dieback and / or weed species;
- dust deposition and smothering of vegetation;
- altered fire regimes, unintentional fire and prescribed burns;
- changes to ecosystem resilience as a result of climate change; and
- disturbance and alteration of the ecosystem from invasive species (e.g. feral pigs).

This draft TECAP specifically addresses the following significant vegetation community, listed under Commonwealth environmental legislation, currently known to occur within the Willowdale mine, as presented in Table 1-1.

Table 1-1: Summary of the *Empodisma* Peatlands TEC¹

| Vegetation Community | Description | Listing | |
|---|---|----------------|-------------------------|
| | | State (BC Act) | Commonwealth (EPBC Act) |
| Threatened Ecological Community: <i>Empodisma</i> peatlands of southwestern Australia. | The assemblage of plants, animals and other organisms associated with a type of freshwater, peat-based wetland that is found in the High Rainfall Province of the south-west of Western Australia. It is typically a sedgeland to shrubland of vegetation complex on peaty substrates that almost always includes the perennial grass-like twig rush <i>Empodisma gracillimum</i> . <i>Empodisma</i> peatlands provide habitat for a diverse range of hydrophilic species, including threatened, regionally endemic, and relictual flora and fauna species (DCCEEW, 2023a). | N/A | Endangered |

¹ Listing and information current at time of TECAP preparation.

It is anticipated that all proposed interim mitigation, management and monitoring provisions outlined within this TECAP and undertaken *in situ* will result in the maintenance of the confirmed occurrence of the *Empodisma* peatlands TEC within the Willowdale mine.

However, there are high levels of uncertainty and lack of appropriate knowledge in relation to this occurrence of the *Empodisma* peatlands TEC within the Northern Jarrah Forest and in relation to mining activities and other potential indirect impacts.

This TECAP will be updated as further data and knowledge is gained through ongoing studies and research, and continued monitoring is undertaken to verify the efficacy of management controls and to further refine these as required.

This adaptive management approach is recognised by the Western Australian (WA) Environmental Protection Authority (EPA) as a systematic approach to improving environmental results and management practices during Project implementation through the application of learning from monitoring outcomes and management actions (EPA, 2024). Additionally, adaptive management is recognised by the Commonwealth Department of the Environment as an Assurance Framework (Commonwealth of Australia, 2016).

The Key Environmental Factors relevant to this TECAP are (see Section 2.1):

- Flora and Vegetation; and
- Inland Waters.

2 Context, Scope and Rationale

This TECAP has been prepared by Alcoa of Australia Limited (Alcoa) for the confirmed occurrence of the *Empodisma* peatlands of southwestern Australia TEC, located within the Flinders region of the Willowdale mine (Figure 2-1 below). This TECAP has been developed in accordance with relevant State and Commonwealth guidelines and guidance to address the environmental management of the confirmed *Empodisma* peatlands TEC and describes the interim mitigation, management and monitoring framework in relation to the identified risks and potential impacts that may arise from Alcoa's bauxite mining activities undertaken in proximity to the confirmed *Empodisma* peatlands TEC. This TECAP does not address the exploration, rehabilitation and closure phases or closure management activities.

This TECAP specifically describes the draft management targets and actions and monitoring that will be undertaken to ensure that potential direct and indirect impacts on the confirmed *Empodisma* peatlands TEC have been avoided, minimised and mitigated in accordance with mitigation hierarchy principles. Alcoa's Biodiversity Policy (Alcoa, 2021) requires that the mitigation hierarchy (avoid, minimise, and mitigate through rehabilitation) is implemented to manage potential impacts to biodiversity values.

Objective-based provisions have been applied to address the management of the confirmed *Empodisma* peatlands TEC occurring within the Willowdale mine, due to the lack of appropriate knowledge and high levels of uncertainty regarding this TEC.

The following are key objectives of this TECAP:

- describe the significant vegetation community which may be at risk of potential impacts, both direct and indirect, from bauxite mining activities occurring in proximity;
- describe and apply the mitigation hierarchy to avoid, minimise and mitigate (through rehabilitation) any potential impacts to the significant vegetation community;
- describe how potential impacts resulting from the bauxite mining activities will be identified, mitigated and adequately managed and monitored through the setting of both outcomes and objectives along with response actions; and
- demonstrate Alcoa's adaptive management approach strategies relevant to significant vegetation communities to meet best practice principles and there is increased understanding of significant vegetation community values.

Management of other significant flora, vegetation, and fauna values are outside the scope of this TECAP and are addressed in the following relevant environmental management plans:

- Fauna Management Plan;
- Flora and Vegetation Management Plan;
- Rehabilitation Management Plan; and
- Water Resources Management Plan.

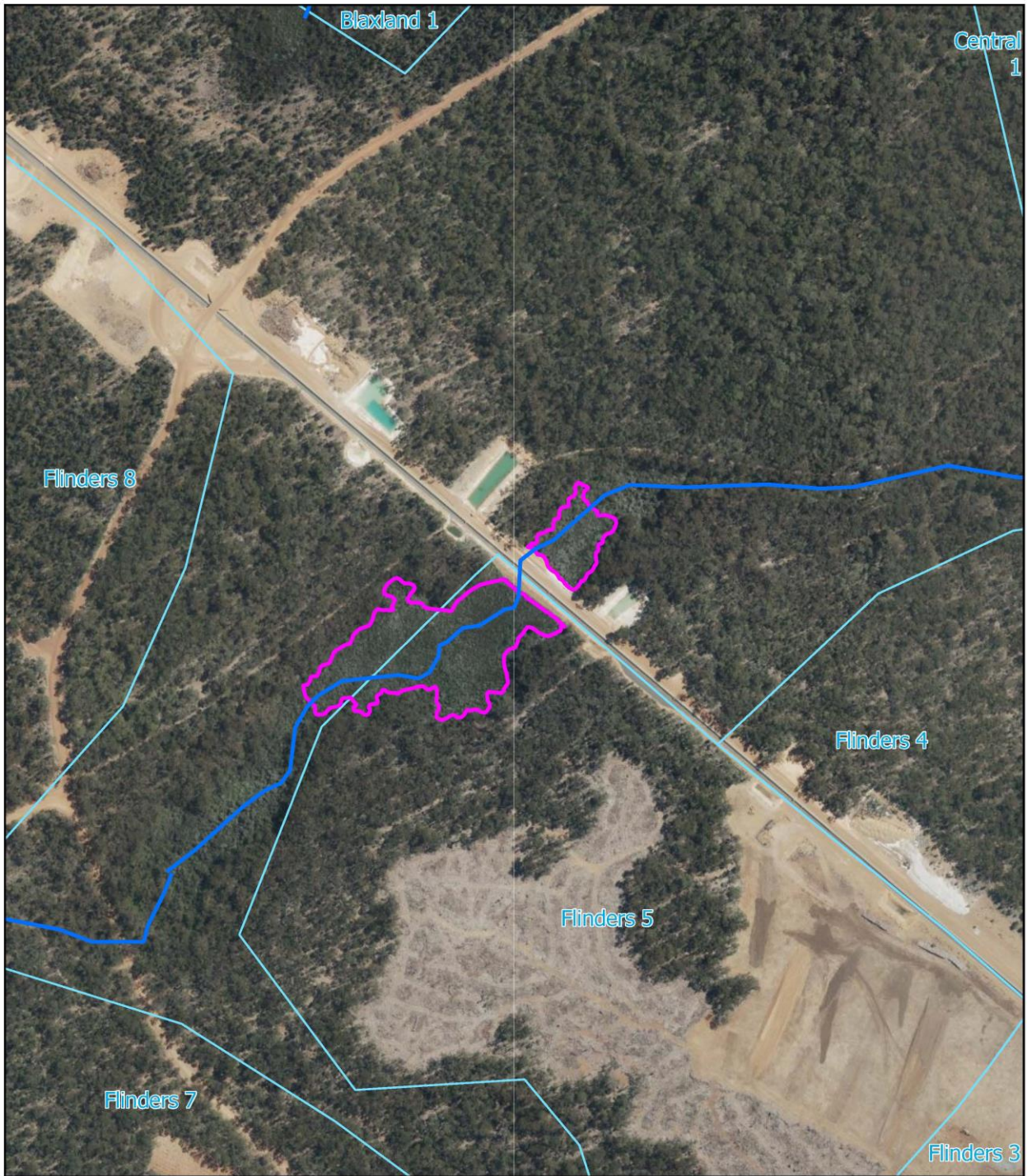
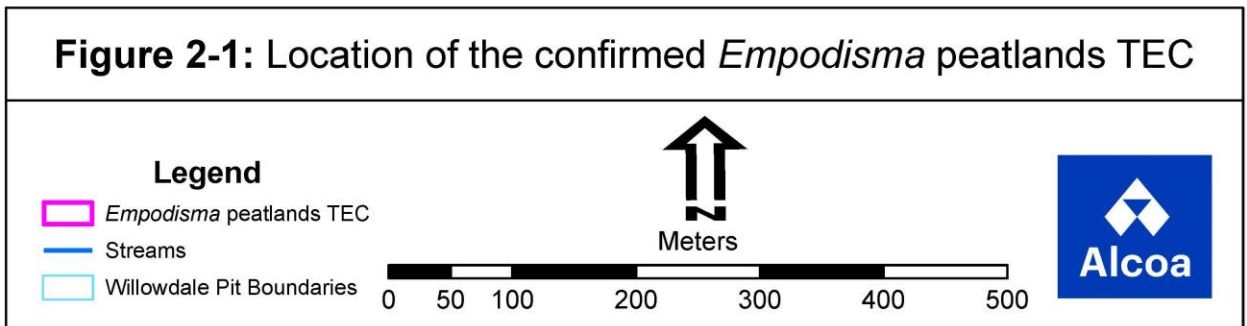


Figure 2-1: Location of the confirmed *Empodisma* peatlands TEC



*Figure 2-1: Location of the confirmed *Empodisma* peatlands TEC (image current as at March 2025)*

2.1 Key Environmental Factors

Environmental factors (defined in the EPA's Administrative Procedures, [EPA, 2021b]) are factors that the EPA uses as an organising principle for Environmental Impact Assessment (EIA), comprising a number of environmental values. They provide a systematic approach to organising environmental information for the purpose of EIA. Further, the EPA has identified an environmental objective for each environmental factor, and these objectives are aimed towards ensuring the objects and principles of the State *Environmental Protection Act 1986* (EP Act) are achieved (EPA, 2023). Alcoa recognises that there are inherent links between the Flora and Vegetation key environmental factor and other environmental factors, such as the Inland Waters environmental factor. Therefore, these two key environmental factors have been considered in conjunction with one another for the purposes of this TECAP.

Flora and Vegetation

The EPA (2016a) defines flora as native vascular plants and vegetation as groupings of different flora patterned across the landscape that occur in response to environmental conditions.

The EPA's environmental objective for this factor is *"To protect flora and vegetation so that biological diversity and ecological integrity are maintained"*. In the context of this objective, ecological integrity is the composition, structure, function and processes of ecosystems, and the natural range of variation of these elements (EPA, 2016a).

Inland Waters

The EPA (2018) defines this factor is *"The occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality)."*

Inland waters include groundwater (e.g. superficial and confined aquifers), and surface water (e.g. waterways, wetlands, and estuaries).

The EPA's environmental objective for this factor is *"To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected."*

The Inland Waters factor is here recognised in conjunction with the Flora and Vegetation in the context of this TECAP as potential changes to the quality and quantity of inland waters that may affect the *Empodisma* peatlands TEC.

2.2 Relevant Environmental Legislation

The Commonwealth EPBC Act, administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW), is Australia's primary national environmental legislation and is a legal mechanism affording the protection and management of nationally and internationally important plants, animals, habitats and places. The values requiring protection under the EPBC Act are considered 'matters of national environmental significance' (MNES). There are nine identified protected matters, one of which is listed Threatened Ecological Communities.

The DCCEEW (2025) describes an ecological community, and TECs as:

"An ecological community is a group of native plants, animals and other organisms that naturally occur together and interact in a unique habitat. Its structure, composition and distribution are determined by environmental factors such as soil type, position within the landscape... climate, and water availability, chemistry and movement...An ecological community becomes threatened when it is at risk of extinction..."

Under the EPBC Act, three categories exist for listing TECs (see Appendix B for further detail):

- Critically Endangered;
- Endangered; and
- Vulnerable.

An ecological community can be nominated as a TEC under the EPBC Act after a rigorous and transparent scientific assessment, including a consultation period with experts and the public and assessment by the Commonwealth Threatened Species Scientific Committee (TSSC). Subsequently an ecological community can be listed under the EPBC Act, following the assessment period. Once an ecological community is listed, its recovery is promoted using conservation advice and recovery plans.

The *Empodisma* peatlands ecological community underwent a formal nomination, assessment (prioritised in 2019) and listing process under the EPBC Act, and the *Empodisma* peatlands of southwestern Australia TEC was subsequently formally listed in the Endangered category under the EPBC Act, effective 7 September 2023. The TSSC assessed the community to be eligible for listing as Endangered, due to the very restricted nature of its distribution and ongoing reduction in community integrity coupled with a range of major threats, such as drying climate, damaging fire regimes and interactions

with invasive animals. At the time of listing, the Minister determined that a Recovery Plan was not required, however a conservation advice document was developed by the TSSC based on the best available information regarding the conservation status and threats to an ecological community; the *Approved Conservation Advice for the Empodisma Peatlands of Southwestern Australia* (DCCEEW, 2023a, herein referred to as The Advice) was prepared for this TEC. This Advice is considered the key guiding document for the conservation and recovery of the TEC and outlines the main factors that cause it to be eligible for listing and provides information on appropriate measures and actions that may be undertaken to stop its decline and / or support its recovery.

2.3 Current Knowledge

2.3.1 Contemporary Flora and Vegetation Surveys

A wide range of flora and vegetation surveys, studies and research programmes have been undertaken across the Huntly and Willowdale mine regions over many years and include various flora and vegetation assessment and survey methodologies, such as targeted and detailed surveys, and including traverses, transects and quadrats. As part of Alcoa's commitments to undertake pre-mining baseline flora and vegetation surveys, through the process of undertaking these surveys, typically a desktop review of various databases for environmental values within a survey area (plus an additional buffer beyond the survey area) is undertaken. This ensures an understanding of the environmental values that exist or are likely to occur within a survey area and in the surrounding areas can be determined. The results of which inform the process of following the mitigation hierarchy and allows for an understanding of potential impacts to environmental values pre- and post-mining activities.

Recent flora and vegetation surveys undertaken in 2023 and 2024 commissioned by Alcoa identified through Protected Matters Search Tool (PMST) reviews as part of desktop reviews, that the *Empodisma* peatlands of southwestern Australia TEC may occur within scattered locations throughout the Northern Jarrah Forest, and within the Willowdale mine, based on indicative distribution mapping by DCCEEW (2023b).

In response to the recognition of the potential presence of the TEC within Alcoa's mine regions, Alcoa commissioned Western Environmental in 2024 (Western Environmental, 2025) to undertake a targeted vegetation survey to confirm the presence or absence of the *Empodisma* peatlands TEC at a location within the Willowdale mine. The survey area was determined based on historical records of the key indicator species *Empodisma gracillimum* occurring within the Flinders area and in conjunction with indicative distribution mapping undertaken by DCCEEW (2023b). The area surveyed was subsequently confirmed as an occurrence of the *Empodisma* peatlands TEC after being assessed as meeting the key diagnostic characteristics for the TEC as per The Advice (DCCEEW, 2023a). The confirmed occurrence of the TEC is 2.29 ha in size and was rated as being in Very Good condition as per the condition classes, categories and thresholds within The Advice (DCCEEW, 2023a – see Appendix C).

2.3.2 *Empodisma* Peatlands TEC

The following summarises information from The Advice (DCCEEW, 2023a). The *Empodisma* peatlands TEC is described as the assemblage of plants, animals and other organisms associated with a type of freshwater, peat-based wetland (including within damplands, troughs, paluslopes, palusplains and palusmonts floodplains) that is found in the High Rainfall Province of the southwest of Western Australia. It is typically a sedge/land to shrubland vegetation complex on peaty substrates that almost always includes the perennial grass-like twig rush *Empodisma gracillimum*. *Empodisma* peatlands provide habitat for a diverse range of hydrophilic species, including threatened, regionally endemic, and relictual flora and fauna species.

The *Empodisma* peatlands typically form in localised areas of the landscape where water collects and predominantly (almost exclusively) occurs in the Warren IBRA subregion and the Southern Jarrah Forest IBRA subregion of the Jarrah Forest IBRA bioregion. However, some occurrences, such as the confirmed occurrence within the Willowdale mine, occur where climatic, stratigraphic and topographic conditions are suitable for *Empodisma* peatlands to form. Occurrence within the Northern Jarrah Forest is considered likely to be isolated occurrences and typically linked to seasonal or permanent waterlogging. In areas where rainfall exceeds evapotranspiration and there are suitable geomorphological characteristics, the winter saturated, summer moist habitats that maintain peatlands in southwest Western Australia can form. In these areas, organic-rich but low nutrient acidic soils (organosols) can accumulate over time forming peatlands, with ages of up to 8,000 years having been recorded, but similar peatlands in other regions date back to the late Pleistocene / early Holocene.

Peatlands are intricately linked to water, where equilibrium peat accumulation and water table depth (saturated zone) depend on the net water input to the peatland. The permanence or intermittency of the period of water availability in a peatland can be directly related to precipitation and evapotranspiration, mechanisms of recharge and discharge,

permeability of underlying sediments and shape of the wetland. The depth, duration and frequency of inundation of *Empodisma* peatlands can be highly variable, reflecting the catchment, the physical properties of the site and the prevailing weather conditions. However, in 'typical' years, as determined by long-term climatic trends, the peatlands are saturated for up to a few consecutive months, with many occurrences drying during summer.

The confirmed occurrence of the *Empodisma* peatlands TEC within the Willowdale mine shows a distinct boundary between the surrounding woodland vegetation, which contains the streamzone tree species *Eucalyptus megacarpa* (Bullich, amongst other streamzone species), and the peatland itself. This boundary/delineation between the *Empodisma* peatland and woodland vegetation is clearly visible on aerial imagery and distinguishable on ground, however not all boundaries between *Empodisma* peatlands and surrounding wetland vegetation are apparent due to intergrading between peatland and other vegetation.

The confirmed *Empodisma* peatlands TEC is considered to constitute an aquatic (wetland) surface expression GDE (WSP, 2025).

In order to be a protected matter of national environmental significance, occurrences of the ecological community must meet both (see Appendix C):

- the key diagnostic characteristics; AND
- at least the minimum condition thresholds.

Empodisma peatlands have a unique composition of flora which are characteristic of wetter sites. *Empodisma gracillimum* is almost always present, and considered a key indicator and structural species of this TEC. This flora species was recorded by Western Environmental (2025) within the confirmed occurrence of the TEC.

The *Empodisma* peatlands may also provide habitat and refuge for significant fauna such as quokka, rakali and other species.

2.3.2.1 Key Threats to the *Empodisma* Peatlands TEC

The Advice (DCCEEW, 2023a) outlines key threats facing the ecology community (see Table 2-1 below), which represent the main factors that cause it to be eligible for listing under the EPBC Act. DCCEEW considers that the identified threats interact, rather than act independently. The *Empodisma* peatlands TEC has been impacted by a drying climate from anthropogenic climate change interacting with fire regimes that cause biodiversity decline. Other threats include invasive feral animals, hydrological changes, and land clearance (DCCEEW, 2023a).

Table 2-1: Summary of Key Threats to the Empodisma Peatlands TEC and relevance to Willowdale Operations²

| Key Threat | Threat Status | | Description | Relevance |
|--|---------------|---------------------|---|-----------|
| | Timing | Severity | | |
| Clearing | Ongoing | Potentially major | Aside from direct loss and fragmentation of native vegetation, land clearing can also lead to a variety of impacts on soils, including erosion, pH and nutrient changes. Land clearing in the region of the TEC is now primarily for infrastructure projects, urban development or grazing and horticulture. Clearing can also impact hydrological regimes such as surface water flows. | Yes |
| Climate Change | | Potentially extreme | Anthropogenic climate change is influencing the frequency and severity of fire conditions in southwestern Australia, including through influencing temperature, environmental moisture, weather patterns and fuel conditions. The likely impacts to the TEC from climate change are via seasonal shifts in temperature, evaporation and rainfall. Increased temperature combined with lower rainfall decreases water available for ecosystem processes and increases fuel dryness increasing the risk of fire. Water deficits may lead to mortality of individuals. | Yes |
| Diseases and pathogens | | Potentially major | Transmission of pathogens occurs through various vectors such as humans and animals, and through contaminated vehicles and machinery. Effective hygiene practices can help manage transmission. <i>Phytophthora cinnamomi</i> is considered a major threat to vegetation communities in the southwest, including to species that are part of the floristic component of the TEC. Feral pigs act as vectors of infested soil. | Yes |
| Fire regimes that cause biodiversity decline | | Extreme | Fire regimes that cause biodiversity declined are listed as a Key Threatening Process. Long-term and short-term disruption or alteration can also impact habitat and species diversity. When peat soils are not saturated, the organic substrate can ignite consuming peat, and in the southwest, the drying climate exacerbates the threat of peat fires. Peat fires may smoulder for weeks or months after ignition. The consumption of peat by fire typically alters soil hydrology and chemistry and reduces soil water retention. | Yes |
| Grazing and trampling from livestock | | Potentially major | Livestock such as cattle, deer and horses damage wetland vegetation through grazing and trampling which destabilises wetland substrates and increases bare ground. Other impacts include weed invasion and degradation or loss of habitat. | No |
| Invasive species – animals (feral / unmanaged) | | Major | Invasive fauna species subject the ecological community and the broader landscape to individual and compounding impacts such as potentially major habitat disturbance, predation of native animals, competition for resources, weed spread and direct transmission of disease and parasites. Wallowing, digging and rooting by feral pigs can destroy vegetation and fauna habitat, cause erosion and encourage weed invasion. | Yes |
| Invasive species – plants (weeds) | | Minor | Weeds impact wetland ecology by directly competing with and restricting regeneration of established native plants, reducing habitat for fauna and increasing the risk of fire due to increased fuel loads. These impacts reduce the overall ecosystem resilience of the TEC. | Yes |
| Hydrological changes (anthropogenic) | | Potentially major | A reduction in water availability across the landscape, and in catchment areas and seepage zones of paluslopes can potentially create a significant impact for the water input / evaporation balance within nearby occurrences of the TEC. Human induced changes to surface hydrology and land use can influence the fuel characteristics, influencing fire behaviour and resulting in peat loss. The cumulative impacts from inappropriate water management / usage, including localised groundwater abstraction further reduces soil saturation, dries vegetation, limits hydrophilic species regrowth and can increase fuel loads. | Yes |

² As per The Advice (DCCEEW, 2023a).

2.3.3 Hydrological Assessment

Alcoa commissioned a consultant (WSP) in 2025 to undertake hydrological assessments in a two-phased approach to understand any changes to surface water and groundwater conditions to the confirmed occurrence of the *Empodisma* peatlands TEC. Additionally, the assessment will provide an understanding about the conceptualisation of the TEC with regard to inland waters, and understand the potential impacts of mining within the catchment of the TEC.

This approach will define baseline conditions in addition to future mine scenarios. The future objective from this assessment is to quantify the changes in response to future scenarios of the inland water system and potential change in flow regimes will be quantitatively estimated using a simplified Water Balance Model (WBM). The WBM proposes a number of elements including TEC water storage volume; surface water catchment runoff; direct rainfall onto the TEC; evaporation from the TEC ponded water surface; overflow from the TEC; groundwater seepage from the TEC; and groundwater inflow into the TEC. The groundwater assessment will include the development of a Hydrogeological Conceptual Water Model. The assessment by WSP covers two phases, the first being an assessment and conceptualisation based on existing mining conditions, and the second being a technical modelling phase based on future mining scenarios.

The objectives of the interim high level Phase A initial hydrological assessment (WSP 2025) was to:

- Confirm the hydraulically connectivity of the *Empodisma* peatlands to groundwater.
- Estimate groundwater elevations, water through-flow rates and provide an understanding of potential mine related ecological impacts to the *Empodisma* peatlands
- Present a preliminary understanding and expectations of potential impacts due to mining operational activities on the *Empodisma* peatland (TEC).

The outcomes of the interim high level Phase A presented that:

- the confirmed *Empodisma* peatlands TEC is considered to constitute an aquatic (wetland) surface expression GDE;
- land use changes in the *Empodisma* peatlands TEC sub-catchment are minimal (scenario 1, 2, and 3), resulting in only minor differences in groundwater model outcomes, namely:
 - groundwater elevations; and
 - TEC throughflow water discharges.
 - these changes in groundwater elevations and throughflow water discharges pose minimal risk to the TEC;
- changes of modelled climate had a greater influence on water balances than changes of land use;
- during the wet season, the groundwater table is expected to interact ('connect with') surface water in the TEC, invoking direct hydraulic connection with the TEC. This suggests the TEC is a surface expression GDE, with levels of flowthrough discharge reflective of variance in rainfall in-turn affecting groundwater recharge amounts;
- during the dry season, the elevation of the groundwater table falls, invoking hydraulic disconnection between surface water and groundwater beneath the TEC. The modelling however suggests the groundwater table remains 'in connection' with the TEC root zone, and it is expected to contribute to maintaining the ongoing health and condition of the TEC;
- mining activities are likely to marginally increase the elevation of the groundwater table due to increased groundwater recharge in response to reduced vegetation cover and reduced transpiration rates across the catchment;
- due to the flow through capacity of the TEC wetland, any increased groundwater table levels will be surface expressed and flowthrough the TEC (natural process of the wetland GDE). As such, changes associated with the proposed haul road within the Flinders region is unlikely to result in any:
 - permanent inundation of TEC vegetation, whereby plants would die from waterlogging / saturation and / or;
 - change to the TEC's overall health and condition.

Phase two of the assessment is underway and due to be completed end of April 2025. Once the phase two assessment is received and reviewed, the TECAP will be updated and refined to reflect results from the assessment and will assist in informing trigger criteria and thresholds for management, and monitoring requirements.

2.3.4 *Phytophthora* Dieback

The pathogen *Phytophthora cinnamomi*, known as *Phytophthora* dieback, is a destructive disease that has had a large impact on both Western Australian and Australian native plants. Of the many root pathogens that cause disease within Australia, *Phytophthora cinnamomi* has caused the most significant impact to date and poses the biggest threat (Commonwealth Department of Environment 2014).

Phytophthora species are considered parasitic and behave mainly as a necrotrophic pathogen causing damage to the host plant's root tissues because of infection and invasion. *Phytophthora* dieback can cause permanent damage to ecosystems because once an area is infested with the pathogen, eradication is usually impossible. The disease presents a significant threat to biodiversity as it places important plant species at risk of death, local extirpation or extinction (Glevan 2021).

The Northern Jarrah Forest has widespread *Phytophthora* dieback infestation, resulting from the extensive activities of the timber industry and environmental conditions favourable to the disease. The disease affects more than 20% of native plant species in the southwest region, the most susceptible families being Proteaceae, Ericaceae and Xanthorrhoeaceae (Glevan 2021). Within these families, the genera *Adenanthos*, *Andersonia*, *Astroloma*, *Banksia*, *Isopogon*, *Leucopogon*, *Persoonia*, *Petrophile*, *Xanthorrhoea*, and *Xylomelum* all demonstrate high susceptibility (Glevan 2021). The affected species are key components of the Jarrah forest floristic diversity (Bradshaw 2015).

Phytophthora dieback has been identified by DCCEEW as a Key Threatening Process. The confirmed occurrence of the *Empodisma* peatlands TEC falls within an area that has been mapped as *Phytophthora* dieback infested, however the condition of the TEC at the time of the Western Environmental (2025) survey was Very Good and there was no evidence of impact from *Phytophthora* dieback within the peatland.

2.4 Activities and Potential Impacts

Activities

The confirmed *Empodisma* peatlands TEC is located within the Larego mine region in the Flinders resource region and is situated near Flinders 5. Surrounding the TEC are areas previously cleared for pits, access roads, sumps and a conveyor which intersects the northeastern portion of the TEC, which was constructed prior to the formal listing in 2023 of the *Empodisma* peatlands of southwestern Australia TEC.

Potential Impacts

Due to the nature of Alcoa's bauxite mining, there can be extensive areas cleared for operations, in conjunction with the requirement for infrastructure, such as haul roads, access roads, drainage sumps amongst other construction and operational requirements. The main potential impacts of existing operations within the Flinders assessment area on the confirmed *Empodisma* peatlands TEC are described in Table 2-2 below. In addition to listing the potential impacts, the potential for occurrence (i.e. has occurred, potential to occur / potential to occur) of each impact from the current operations within the Flinders assessment area based on current understanding has been described briefly below.

Table 2-2: Summary of Potential Impacts to the confirmed *Empodisma* peatlands TEC

^ Actual = has occurred / Potential = to occur or potentially has occurred

| Potential Impact | Potential for Occurrence [^] | |
|---|---------------------------------------|---|
| Vegetation clearing – within TEC | A | A small linear portion of the confirmed <i>Empodisma</i> peatlands TEC has been historically cleared in May 2019 for a raised conveyor. This vegetation clearing and conveyor construction was undertaken over four years prior to the formal listing of the TEC. The TEC lies within the 100m stream zone Limited Disturbance Area (LDA). |
| Vegetation clearing – outside TEC | P | A small number of pits were previously cleared in November 2024 approximately 100 m to the southeast of the TEC boundary. This clearing was undertaken prior to Alcoa’s identification of a potential occurrence of the TEC within the Flinders resource region and therefore prior to the subsequent confirmation of the occurrence of the TEC. |
| Alteration and / or impediment of surface water flows | P | Intersection of the TEC by the raised conveyor may have intersected surface water flows. A number of culverts were installed under the raised conveyor alignment. Impediment/s to the culverts or insufficient capacity of the culverts may be a high risk to the TEC. Assessment is currently being undertaken to understand the hydraulic capacity of the existing design for one storm AEP event of the Flinders crossing road culverts. |
| Drainage failure and sediment runoff | P | There are a number of sumps installed along the northeastern edge of the raised conveyor alignment. Drainage failure or overflow of these sumps may be a high risk to the TEC. Cleared areas are at higher risk of erosion and sediment runoff causing turbid surface waters to potentially discharge into the TEC. Rehabilitation of the open areas (i.e. cleared pits) is of high priority as water infiltration is higher in cleared areas, resulting in groundwater mounding. |
| Alteration (fluctuation) of groundwater (i.e. interception of groundwater for pits and / or groundwater mounding) | P | Areas have been cleared for pits approximately 100 m from the TEC boundary. As a result of this clearing, groundwater mounding may occur adjacent to or within the TEC due to increased water infiltration. This may impact on the hydrology of the peatland (e.g. increased water ponding within the peatland or if peatland becomes unsaturated, the peat can self-ignite). WSP (2025) noted from their initial TEC impact assessment (Phase A memo) that land use changes in the TEC sub-catchment are minimal, and mining activities are likely to marginally increase the elevation of the groundwater table due to increased groundwater recharge in response to reduced vegetation cover and reduced transpiration rates across the catchment. However, any increased groundwater table levels will be surface expressed and flowthrough the TEC as a natural process of the wetland GDE and is unlikely to result in any permanent inundation of the TEC or change to the TEC’s overall health and condition. Further groundwater assessment/s will include the development of a Hydrogeological Conceptual Water Model to understand groundwater aspects and subsequent interaction with surface water. |
| Contamination from chemicals and / or hydrocarbon spills and leaks | P | The movement of machinery and vehicles may result in contamination from chemicals and / or hydrocarbons spills and leaks. |
| Introduction and / or spread of <i>Phytophthora</i> dieback. | A | The confirmed <i>Empodisma</i> peatlands TEC is situated within an area that has been mapped as <i>Phytophthora</i> dieback infested. However the TEC condition during field assessment undertaken in January 2025 was rated as Very Good (Western Environmental, 2025), with no evidence of impacts from <i>Phytophthora</i> dieback. |
| Introduction and / or spread of weeds | P | The movement of machinery, vehicles, personnel and feral pigs has the potential to introduce and / or spread weeds into the TEC and areas surrounding the TEC. Field assessment undertaken in January 2025 of the confirmed TEC did not report the presence of any weeds (Western |

| Potential Impact | Potential for Occurrence^ | |
|---|---------------------------|--|
| | | Environmental, 2025). Any weed treatment and control that occurs (if required) within and adjacent to the TEC should ensure the correct herbicides are utilised and there is no off-target impacts. |
| Feral pig disturbance | A | Evidence of feral pig disturbance at the edges of the confirmed <i>Empodisma</i> peatlands TEC were reported during field assessment in January 2025 (Western Environmental 2025) Feral pigs can alter the habitat and introduce weeds and disease, and alter the surfacewater flows. |
| Altered fire regimes | P | Clearing for construction and operations adjacent to the TEC may alter the fuel load and fire regime of the local area. Uncontrolled fire starting from Alcoa operations, which may burn the peatland. DBCA controlled burns may burn the TEC. |
| Vegetation smothering from dust emissions | P | The intersection of the TEC by a raised conveyor in conjunction with the existing cleared areas may result in dust emissions and smothering of vegetation within the TEC. However the TEC condition during field assessment undertaken in January 2025 was rated as Very Good (Western Environmental, 2025). |

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2.4.1 Key Assumptions and Uncertainties

Key Assumptions

Given the unique occurrence of this TEC within the Northern Jarrah Forest, currently there are no identifiable key assumptions that can be made based on the limited information around this TEC.

Key Uncertainties

The *Empodisma* peatlands TEC was previously only considered to be restricted to the south coast of Western Australia. Therefore, The Advice (DCCEEW, 2023a) provides information primarily on the basis of information pertaining to the TEC on the south coast. There is no other known record or available information on the TEC occurring in the Northern Jarrah Forest, and therefore the occurrence of the TEC within the Willowdale mine is a highly unique occurrence. In the absence of publicly available information relevant to the TEC in the Northern Jarrah Forest, in addition to occurring within proximity to mining operations, there are a large number of uncertainties. Additionally, due to the lack of baseline hydrological and hydrogeological studies in the area, there is minimal understanding on the impacts of hydrology and hydrogeology on this TEC in the context on mining operations. The hydrological assessment that is being undertaken will provide information and data, however until completion of assessment there is a high level of uncertainty and lacking knowledge in this space.

There is limited data on the sensitivity of wetland and peatland flora species response to potential groundwater mounding as a result of vegetation clearing in proximity to the TEC. There is also limited understanding and knowledge around future flora and vegetation community responses to cumulative impacts resulting from anthropogenic disturbances.

The Advice (DCCEEW, 2023a) does not list dust as a key threat to the *Empodisma* peatlands TEC. Therefore, it may be assumed that dust is not a major threat to the TEC. The confirmed *Empodisma* peatlands TEC within Willowdale is bordered by woodland (excluding where the conveyor intersects) which may act as a barrier to potential dust smothering within the actual TEC. However given the conveyor is elevated above the TEC and intersects the TEC, there may be some dust entering the TEC, although this may be presumed to be at low levels due to the design of the conveyor. It is uncertain to what extent dust may impact the TEC, as The Advice (DCCEEW, 2023a) does not identify dust as a key threat to this TEC. However, it should be noted that The Advice (2023a) pertains primarily to the south coast TEC, and does not specifically consider mining operations and dust generation in the context of the TEC.

There is limited knowledge of the potential impacts of climate change on the *Empodisma* peatlands TEC. The CPC (2023) considers that the cumulative effects of climate change are likely to have significant impacts on some vegetation communities occurring across the Northern Jarrah Forest. In particular, The Advice (DCCEEW, 2023a) has described that climate change is a key threat facing the ecological community. However, there are high levels of uncertainty about the magnitude of the effect of climate change on forest ecosystems.

Interim provisions have been included for avoidance buffers, however the risk profile from Phase B of hydrological / hydrogeological assessment will inform a site-specific management strategy such as a rule of thumb which could include guidelines like designated buffers or percentages of cleared areas within the catchment, and help to determine the proximity at which mining activities can occur relative to the TEC.

3 Management Provisions

This TECAP has applied objective-based provisions due the level of uncertainty and lack of appropriate knowledge in relation to the *Empodisma* peatlands TEC. The absence of appropriate data and knowledge prevents setting achievable and effective outcomes and measurable trigger and threshold criteria. Therefore, in this case, initial management targets and actions have been established (see Table 3-1 below)

A draft environmental risk assessment for Flinders 5 and 6 pits was prepared by Alcoa personnel and reviewed in the process of developing this TECAP.

Table 3-1: Interim Management Targets, Actions, Monitoring and Reporting

| EPA Objectives | | | |
|--|--|--|--|
| Flora and Vegetation: To protect flora and vegetation so that biological diversity and ecological integrity are maintained. | | | |
| Inland Waters: To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected. | | | |
| Management Target | Management Actions | Monitoring: Frequency and Location | Reporting |
| <p>Target 1 No clearing of vegetation within the confirmed <i>Empodisma</i> peatlands TEC (refer Figure 2-1).</p> | <ul style="list-style-type: none"> Establish and maintain a Mining Avoidance Zone (MAZ) with an appropriate buffer (buffer size to be determined based on risk assessment outcomes, interim buffer proposed to be 100 m to the specific TEC as outlined in Figure 2-1³). Review of mapped TEC boundary in GIS prior to any new disturbance in proximity to the TEC. Pre-start meetings with harvesting and clearing personnel to review GDP and sensitivities, and subsequent review of clearing boundaries in-field. If required, review of Ground Disturbance Permits (GDP) that are in proximity to the TEC to ensure there is no overlap. Clearing boundaries marked in clearing machinery / equipment. TEC boundary to be marked on any relevant construction plan/s as a MAZ. In-field demarcation (e.g. flagging) of clearing boundary where practicable. Clearing will be confined to an approved boundary outside of the TEC. Where feasible, installation of fencing and or signage for the TEC. Ensure appropriate training and inductions for all personnel. | <ul style="list-style-type: none"> Monthly reconciliation assessment of clearing in proximity to the confirmed TEC (e.g. aerial imagery reviews and in-field verification). | <p>Monthly internal reporting of all management and monitoring actions.</p> <p>Auditing of operational requirements.</p> |
| <p>Target 2 No clearing⁴ of vegetation within the (interim provisional) 100 m mapped or derived streamzone vegetation where the confirmed TEC occurs until further advice on control mechanisms (appropriate buffers).</p> | <ul style="list-style-type: none"> Maintain mapped or derived streamzone MAZ with an appropriate buffer Establish and maintain a Mining Avoidance Zone (MAZ) with an appropriate buffer (buffer size to be determined based on risk assessment outcomes, interim buffer proposed to be 100 m to the specific TEC as outlined in Figure 2-1³). Review of mapped TEC boundary in GIS prior to any new disturbance in proximity to the TEC. Review of mapped and derived streamzone vegetation in GIS. If required, review of GDPs that are in proximity to the TEC to ensure there is no overlap. Clearing boundaries marked in clearing machinery / equipment. In-field demarcation (e.g. flagging) of clearing boundary where practicable. Clearing will be confined to an approved boundary outside of the confirmed MAZ. Any required clearing outside of the streamzone vegetation which is in proximity to the TEC will be undertaken during summer or autumn months where practicable to reduce potential for erosion and sediment runoff. Ensure appropriate training and inductions for all personnel. | <ul style="list-style-type: none"> Monthly reconciliation assessment of clearing in proximity to the confirmed TEC and the surrounding mapped or derived streamzone vegetation (e.g. aerial imagery reviews and in-field verification). | |
| <p>Target 3 Surface water flows will not be impeded to ensure continuity of surface water hydrological regimes.</p> | <ul style="list-style-type: none"> Review of mapped TEC boundary in GIS prior to any new disturbance in proximity to the TEC. Establish and maintain a MAZ with an appropriate buffer³ Construct appropriate culverts to withstand at minimum 1% Annual Exceedance Probability (AEP) event at appropriate locations as determined by hydrological assessment. Clearing for streamzone crossings⁵ (where required) will be undertaken during summer or autumn months where practicable to reduce potential for erosion and sediment runoff. Streamzone crossings⁵ (where required) to be constructed perpendicular to stream flow to reduce habitat impact. Review of and adherence to Drainage Control Management Plan/s (DCMP). | <ul style="list-style-type: none"> Review of available hydraulic conductivity assessments for culverts. Periodic and / or opportunistic review of culverts to check for hydraulic conductivity. Refer to draft monitoring provisions in Appendix A. | |

³ Buffers may change based on the outcome of the risk assessment including justification and rationale for the buffer, taking into account the specific TEC attributes and further knowledge around potential impacts.

⁴ Excludes any requirement for: operational monitoring, maintenance and rehabilitation activities such as removal of regrowth vegetation on sumps for integrity or trimming of trees along conveyor alignment within the interim provisional 100 m MAZ for mapped or derived streamzone vegetation; potential installation of monitoring bores within the 100 m MAZ for mapped or derived streamzone vegetation, as determined by hydrological assessment/s (expected end April 2025). If (pending technical advice) monitoring bores are to be installed within the interim provisional MAZ, specific bore location/s and a review of potential impacts will be undertaken. Monitoring bores will be installed with minimal ground and vegetation disturbance.

⁵ Phase A Memo (WSP 2025) outcomes providing interim rational, and actions may be revised based on Phase B technical advice (expected end April 2025).

EPA Objectives

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

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

| Management Target | Management Actions | Monitoring: Frequency and Location | Reporting |
|--|--|---|---|
| <p>Target 4 Avoid or otherwise minimise impact to the TEC and streamzone vegetation within the Flinders area resulting from any discharge of environmentally hazardous material (e.g. hydrocarbon leaks or spills) which may contaminate groundwater.</p> | <ul style="list-style-type: none"> Chemicals and hydrocarbons not to be stored within the TEC and/ or interim provisional 100 m mapped or derived streamzone vegetation buffer and must be banded / within enclosed containment systems. Ensure vehicles and / or machinery carry appropriate spill clean-up kits which are regularly maintained and replaced as required. Ensure adequate maintenance of vehicles and machinery and undertake pre-mobilisation inspections. In the event of a spill, implement a spill response procedure which may include additional groundwater or surface water monitoring or soil testing as required. Any contaminated soils to be collected, transported, and disposed to an appropriately licensed facility. Induction training for construction personnel includes safe handling procedures and spill management (including prevention, minimisation, escalation and clean up, and reporting). Adherence to Environmentally Hazardous Materials Management Plan (EHMMP). | <ul style="list-style-type: none"> Opportunistic review of construction and operational disturbance to check for cleanliness and any spills or leaks. Opportunistic review of any chemicals and hydrocarbons that may be stored near the TEC and streamzone vegetation associated with the TEC. Review of mapped and derived streamzones as required. Post-clearing inspections. Refer to interim monitoring provisions in Appendix A. | <p>Monthly reporting of all management and monitoring actions.</p> <p>Auditing of operational requirements.</p> |
| <p>Target 5 Sediment runoff will be appropriately contained in the event of a drainage failure to prevent sediment discharge into the confirmed <i>Empodisma</i> peatlands TEC.</p> | <ul style="list-style-type: none"> Install additional drainage protection slots (DPS) and / or sumps and / or erosion protection measures are installed if required (e.g. determined by hydrological assessment). Sumps and DPS to be constructed to withstand at minimum 1% AEP event. If required, drill and blast Flinders 5 and 6 pits to maximise water infiltration and reduce sediment runoff prior to mining activities accessing bauxite. Review of mapped TEC boundary in GIS prior to any new disturbance in proximity to the TEC. Establish and maintain an appropriate buffer (interim provisional buffer of 100 m). In-field inspections of operational DPS and / or sumps as per relevant DCMP/s to ensure no overflow. Clearing for streamzone crossings (where required⁵) will be undertaken during summer or autumn months where practicable to reduce potential for erosion and sediment runoff. Streamzone crossings (where required, and outside of the MAZ) to be constructed perpendicular to stream flow to reduce habitat impact. Adherence to relevant DCMP/s. | <ul style="list-style-type: none"> Review of relevant DCMP/s. If required, monitoring of pits that have been drilled and blasted to ensure pits can handle significant storm events without drainage failures. Refer to interim monitoring provisions in Appendix A. | |
| <p>Target 6 Avoid or otherwise minimise alteration of hydrogeological regimes (i.e. groundwater) within the Flinders area.</p> | <ul style="list-style-type: none"> Accelerated rehabilitation of cleared pits in proximity to the confirmed TEC as soon as reasonably practicable to reduce water infiltration and potential groundwater mounding. Review of mapped TEC boundary in GIS prior to any new disturbance in proximity to the TEC. Establish and maintain an appropriate buffer (interim provisional buffer of 100 m to be implemented). Groundwater bore modelling and hydrological assessment to determine accurate depth to groundwater within proximity of the TEC. Where available, review of the Hydrogeological Conceptual Water Model prior to conducting any new disturbance within the Flinders area (outside of MAZs). No mining activities to occur below groundwater as far as reasonably practicable. No groundwater abstraction within or in proximity to the TEC. Groundwater bores to be installed and decommissioned in accordance with relevant Australian standards. | <ul style="list-style-type: none"> Refer to interim monitoring provisions in Appendix A. | |

EPA Objectives

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

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

| Management Target | Management Actions | Monitoring: Frequency and Location | Reporting |
|---|---|---|---|
| <p>Target 7 Avoid or otherwise minimise indirect impacts through the potential introduction and / or establishment of <i>Phytophthora</i> dieback.</p> | <ul style="list-style-type: none"> Boundaries of <i>Phytophthora</i> dieback mapped areas are marked in-field (e.g. flagging) and available on Alcoa's spatial database (i.e. infested, uninfested, uninterpretable) along access tracks, and appropriate portable washdown equipment is established. Ensure <i>Phytophthora</i> dieback management procedures are implemented during activities. Where <i>Phytophthora</i> dieback mapping has not been carried out before clearing, activities will only occur during dry soil conditions. Update Alcoa's internal spatial database to reflect new relevant records. Ensure controls are in place including signage, portable wash down bays (as needed) and clean-down points. Inspect construction and operational vehicles and equipment for soil and vegetative material before entering undisturbed areas. Regular checks of tyres and undersides of vehicles to ensure cleanliness and free of soil material. Construction and operational vehicle and equipment movements are limited to designated roads, access tracks and approved cleared areas. Induction training for personnel includes minimising environmental disturbance from <i>Phytophthora</i> dieback. | <ul style="list-style-type: none"> Opportunistic visual observations during activities. Desktop reconciliation of <i>Phytophthora</i> dieback mapping (i.e. infested, uninfested, uninterpretable). Opportunistic auditing of training records. <i>Phytophthora</i> dieback hygiene mapping is undertaken to provide initial interpretation to provide historical reference. Once mapping is completed, it is valid for 12 months. Subsequently, dieback lines are periodically reassessed where future activities are planned. Active dieback edges are assessed for changes in addition to an assessment of dieback-free forest areas to determine any new spot infections. | <p>Monthly reporting of all management and monitoring actions.</p> <p>Auditing of operational requirements.</p> |
| <p>Target 8 Avoid or otherwise minimise indirect impacts through the potential introduction and / or establishment of key weed species⁶.</p> | <ul style="list-style-type: none"> Undertake appropriate soil handling and movement planning. Update Alcoa's internal spatial database to reflect new relevant records. Ensure controls are in place including signage, wash down bays and clean-down points. Inspect construction and operational vehicles and equipment for soil and vegetative material before entering undisturbed areas. Regular checks of tyres and undersides of vehicles to ensure cleanliness and free of soil material. Construction and operational vehicle and equipment movements are limited to designated roads, access tracks and approved cleared areas. Induction training for personnel includes minimising environmental disturbance from weeds. All key weed species⁴ are treated according to the weed control management outlined by Weeds Australia (Invasive Plants and Animals Committee, 2016). | <ul style="list-style-type: none"> Opportunistic visual observations during activities. Periodic review of internal records. Weeds recorded during TEC vegetation monitoring (see Appendix A). | |
| <p>Target 9 Dust suppression activities will be undertaken to minimise generation and spread of dust to the confirmed <i>Empodisma</i> peatlands TEC.</p> | <ul style="list-style-type: none"> Vegetation clearing and exposed areas will be kept to a minimum wherever reasonably practicable. Reduced speed limits for machinery and vehicles in climatic conditions that may increase dust generation. Appropriate maintenance of raised conveyor to minimise dust emissions. Adherence to the Dust Management Plan (in draft). | <ul style="list-style-type: none"> During TEC vegetation monitoring (see Appendix A), record any evidence of dust deposition within the confirmed TEC. Regular review of dust management procedures. | |
| <p>Target 10 Appropriate fire response strategies are in place in the event of a fire (i.e. controlled burn or unintentional fire) within the Flinders assessment area to minimise fire impacts to the confirmed <i>Empodisma</i> peatlands TEC.</p> | <ul style="list-style-type: none"> Communicate location of the confirmed TEC and in the event of a fire to DBCA's fire branch. Maintain and implement as required the Emergency Response Plan. Induction training for personnel. Maintenance of vehicles and machinery to ensure operating optimally and reduce potential for sparks and / or ignition of fire. | <ul style="list-style-type: none"> Regular review of the DBCA prescribed burn schedule in proximity to the TEC. Opportunistic visual observations during activities. | |
| <p>Target 11 Minimise introduction and / or spread of feral pigs within the confirmed <i>Empodisma</i> peatlands TEC.</p> | <ul style="list-style-type: none"> Sightings of feral animals within the Flinders area to be recorded as soon as practicable for improved feral animal movement, location and understanding to inform additional feral animal monitoring and control. Avoid or otherwise minimise creation of new tracks / roads within the Flinders area to minimise open areas that may be used as movement pathways for feral pigs. | <ul style="list-style-type: none"> During TEC vegetation monitoring (see Appendix A), record any evidence of feral pig disturbance within the confirmed TEC. Regular review of the fauna sighting register. | |

⁶ Key weed species refers to: Declared Pests; Weeds of National Significance (WoNS); or weed species ranked as having high invasiveness and low feasibility of control (DBCA, 2014).

EPA Objectives

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

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

| Management Target | Management Actions | Monitoring: Frequency and Location | Reporting |
|-------------------|---|--|-----------|
| | <ul style="list-style-type: none">• Fauna will not be fed or interacted with (excluding feral fauna control).• Any food brought to the Flinders area will be stored in containers with secure lids and food wastes will be bagged and appropriately disposed.• Consult with DBCA regarding appropriate management of feral pigs.• No food wastes or litter to be left. | <ul style="list-style-type: none">• During vegetation health monitoring (see Appendix A), record any evidence of feral pig disturbance within the confirmed TEC. | |

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4 Adaptive Management and Review of the TECAP

This is the first version of the TECAP which outlines interim management and monitoring provisions due to the high levels of uncertainties and lack of appropriate knowledge regarding the TEC within Willowdale. Additionally, hydrological assessments are being undertaken concurrently with the development of this TECAP, therefore not all information was available during the development of this document.

The EPA defines adaptive management as a systematic approach to improving environmental results and management practices during Project implementation through the application of learning from monitoring of outcomes and management actions (Figure 4-1, EPA [2024]).

Alcoa is committed to undertaking this adaptive management approach which includes:

- identifying and defining significant flora and vegetation values and appropriate outcomes and objectives that are risk-based, specific, measurable, adequate and realistic;
- the ongoing collection and analysis of baseline and monitoring data and undertaking comparisons to baseline, historic, reference, local and regional data regularly to determine potential impacts;
- evaluating the effectiveness and relevance of management actions against the outcomes and objectives and undertaking reviews on an annual basis to determine if any changes to actions, targets or monitoring are required;
- evaluating existing methodologies and adopting new or additional monitoring methodologies where suitable;
- reviewing and amending applicable protection and / or buffer zones with regard to data collection and analyses;
- undertaking a range of research programmes relating to significant flora and vegetation across the Project and applying knowledge gained to address any knowledge gaps; and
- undertaking a regular review of and respond to legislative requirements.

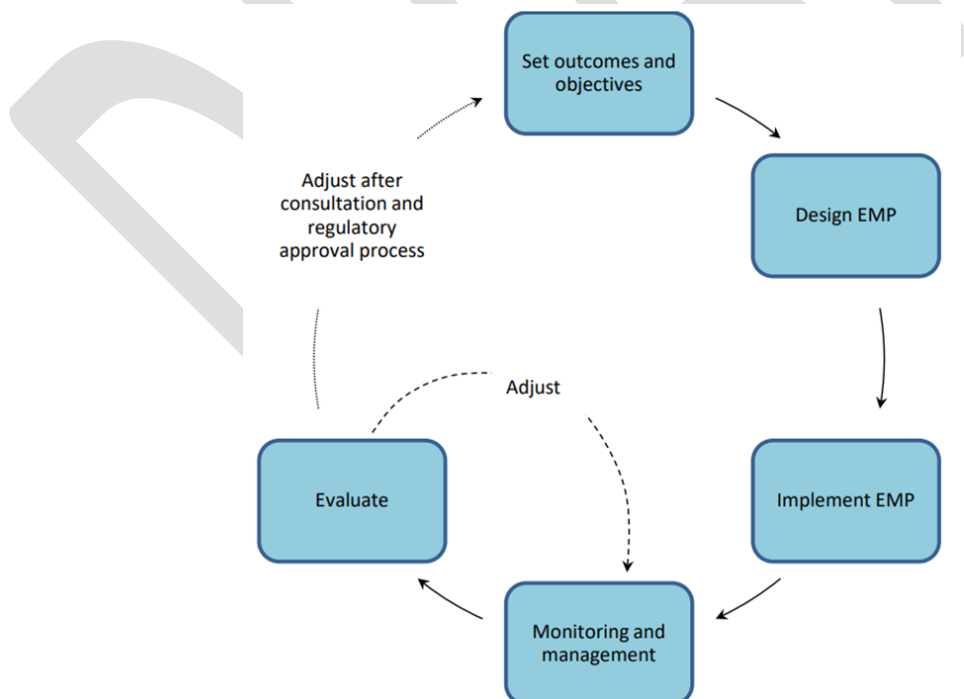


Figure 4-1: Adaptive Management Approach (EPA, 2024)

Changes to the TECAP

Alcoa will periodically review this TECAP throughout construction and operation and will update the Plan as required to include new data and information obtained through additional surveys, hydrological assessments and monitoring activities.

Updates to the Plan will be made in accordance with the adaptive management approach described above and documented in Table 4-1 below. If required, any substantial changes made to this Plan, Alcoa will ensure to consult with all relevant stakeholders regarding the changes as part of the adaptive management approach.

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Table 4-1: Summary of Changes Between TECAP Versions⁷

| Complexity of Changes: | | | | |
|---|--------------------|--------------------|-----------------------------|-----------------------------|
| Number of Key Environmental Factors: Two | | | | |
| Item No. | Section No. | Page No(s). | Summary of Change(s) | Reason(s) for Change |
| N/A | | | | |

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⁷ This is the first version of the TECAP. Summary of changes between TECAP versions will be detailed here.

5 References

- Alcoa of Australia Limited (2023a). Flora and Vegetation Management Plan Huntly and Willowdale Mines (v1).
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- Conservation and Parks Commission (2023). *Forest Management Plan 2024 – 2033*. Conservation and Parks Commission. Perth, Western Australia. <https://www.dbca.wa.gov.au/media/3373/download>
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6 APPENDICES

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APPENDIX A: Interim Monitoring Provisions

Table A-1: Interim Monitoring and Methodology Provisions for the Confirmed Empodisma Peatlands TEC⁸

| Monitoring Action | Alcoa Responsible Team / Department | Aspect | Location | Timing | Methodology | Additional Information |
|--|-------------------------------------|--|---|--|---|---|
| Surface water flows | Operations / Mining Studies | Flow rates and elevations. | Both upstream and downstream of the confirmed TEC. | Opportunistic grab samples (more in higher flows). | Continuous surface water monitoring loggers should be installed both upstream and downstream, within closer proximity to the confirmed TEC, and within one of the three culverts under the raised conveyor to record surface water flow rates and water elevations. | There are eleven turbidity monitors already existing downstream of the confirmed TEC, the closest being ~ 2 km downstream of the confirmed TEC. |
| Surface water quality | Operations / Mining Studies | Turbidity, dissolved oxygen (DO), electrical conductivity (EC), pH, total dissolved solids (TDS), and temperature. | Both upstream and downstream of the confirmed TEC. | Opportunistic samples (more in higher flows). | Continuous water quality monitoring loggers should be installed both upstream and downstream of the confirmed TEC to monitor a variety of analytes. Until a continuous logger/s is installed, WSP (2025) recommend undertaking grab samples when there is streamflow. Weekly grab samples are recommended at a minimum, more should be taken when there are higher flows. | |
| Groundwater levels and quality | Operations / Mining Studies | Water levels, DO, EC, pH, temperature, TDS, major anions (chloride, sulphate, carbonate and bicarbonate) and major cations (sodium, potassium, calcium and magnesium). | Both upstream and downstream of the confirmed TEC. | Frequency of manual groundwater level monitoring should be increased to at least weekly in those groundwater bores within 500 m of the confirmed TEC and which do not contain groundwater level loggers. Groundwater level monitoring should be more frequent during and immediately following (i.e. 1 – 2 days) after rainfall events in those bores without water level loggers. | Additional groundwater bores can be evaluated before potential installation around the confirmed TEC and included into the groundwater monitoring program. These may be screened in the regolith or saprock / bedrock and should be equipped with groundwater level data loggers. Existing bores should have groundwater level data loggers installed where possible. Groundwater samples should be collected from each of the newly installed bores and additional bores and record a variety of analytes. | There are twenty-one groundwater monitoring bores already existing upstream of the confirmed TEC, and seven located downstream. Four of these bores are located within 300 m of the confirmed TEC. Existing bores should have groundwater level data loggers install for monitoring of elevations as soon as possible. |
| Vegetation health (surrounding woodland / vegetation) ⁹ | Operations / Mining Studies | Vegetation monitoring for vegetation structure, condition, floristic diversity, evidence of sedimentation and dieback, and feral fauna disturbance (e.g. feral pigs). | Monitoring transects at selected locations in woodland / vegetation that immediately surrounds / borders the TEC. | During appropriate seasons in accordance with EPA (2016c) survey timing, commence Q3 2025. | Transects (e.g. 50 m long) with 2 x 2 m quadrats at intervals for understorey and 10 x 10 m quadrats at intervals for overstorey. Photo monitoring at the start and end of each transect for visual records. | To determine any changes in condition and floristics of the woodland vegetation surrounding the confirmed TEC. Drones, spectral imagery may be utilized to support in-field monitoring, due to the density of the confirmed TEC, it is highly difficult to physically traverse the TEC. |
| Vegetation health (TEC) | Operations / Mining Studies | Visual ¹⁰ monitoring for vegetation structure, condition evidence of sedimentation and dieback, and feral fauna disturbance (e.g. feral pigs). | Photo point monitoring from selected locations. Where physical access is feasible, monitoring plots may be established within the confirmed TEC boundary. | During appropriate seasons in accordance with EPA (2016c) survey timing, commence Q3 2025. | Visual monitoring via photo point monitoring from selected locations. In addition, at the same time or within 1 – 3 days of vegetation monitoring, groundwater monitoring of selected bores may be conducted to determine levels and any changes, and, where possible, conduct <i>in situ</i> surface water monitoring at points upstream and downstream to analyse DO, EC, salinity, pH, temperature and salinity. | Drones, spectral imagery may be utilized to support in-field monitoring, due to the density of the confirmed TEC, it is highly difficult to physically traverse the TEC. Possible visual monitoring, however, also potentially floristic diversity is assessed. This is challenging due to density of TEC vegetation and access issues. |
| Threatened fauna | Operations / Mining Studies | Ground-dwelling fauna (e.g. quokka). | Within and adjacent to the confirmed TEC. | TBC | Suitably qualified / experienced personnel to undertake monitoring via camera traps. | To determine potential population/s of ground-dwelling threatened fauna that may be utilizing the TEC, and to monitor for any potential change/s in populations. |

⁸ Monitoring recommendations based on WSP (2025a, b) have been summarised above, however due to the levels of uncertainty and high number of knowledge gaps at the time of this TECAP preparation, the provisions here are considered draft and to be refined as further information is obtained, and to be based on hydrological assessments, risk assessment, and other pertinent information.

⁹ Due to difficulty in physically accessing the TEC due to vegetation density and to minimise the potential for trampling and disturbance of TEC vegetation to conduct vegetation monitoring, surrounding vegetation health can be monitored as an indicator of TEC health and condition, in addition to supporting monitoring such as from drones and aerial imagery.

¹⁰ Due to vegetation density of the TEC, visual monitoring of the mapped TEC may be the primary method (e.g. photo point monitoring from selected locations), with supporting monitoring of surrounding vegetation. However, where possible, drones may be utilised to determine whether physical access is possible into the mapped TEC to undertake in-field monitoring, and remote sensing imagery may be conducted to support field assessment and allow comparison to baseline historical data, taking into account natural variation in difficult to access areas.

APPENDIX B: Commonwealth Ecological Communities Conservation Categories

Table B-1: Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) Conservation Categories and Definitions (DCCEEW, 2024c)

| Category | Definition |
|------------------------------------|---|
| CE <i>Critically Endangered</i> | Extremely high risk of extinction in the immediate future*. *Immediate future: Indicative timeframe being the next 10 years, or three generations of any long-lived or key species believed to play a major role in sustaining the community (whichever is the longer), up to a maximum of 60 years. |
| EN <i>Endangered</i> | Extremely high risk of extinction in the near future^. ^Near future: Indicative timeframe being the next 20 years, or five generations of any long-lived or key species believed to play a major role in sustaining the community (whichever is the longer), up to a maximum of 100 years. |
| VU <i>Vulnerable</i> | Extremely high risk of extinction in the medium-term future#. #Medium-term future: Indicative timeframe being the next 50 years, or 10 generations of any long-lived or key species believed to play a major role in sustaining the community (whichever is the longer), up to a maximum of 100 years. |

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APPENDIX C: Key Diagnostic Characteristics of the *Empodisma* Peatlands TEC

The key diagnostic characteristics are designed to inform the identification of the ecological community. Assemblages of native species that do not meet the key diagnostics are not part of the nationally listed ecological community. The ecological community is defined as the assemblage of native species inhabiting a particular area in nature, that meet the following key diagnostic characteristics:

- Occurs in southwest Australia, mainly within the Warren IBRA bioregion and Southern Jarrah Forest subregion of the Jarrah Forest IBRA bioregion. Discrete occurrences may also be present in the Perth, Northern Jarrah Forest and Fitzgerald IBRA subregions.
- Occurs on an organosols that is typically saturated for at least one month during the year.
- Ground layer almost always contains evidence of *Empodisma gracillimum* unless recently disturbed, for example by fire with 12 – 24 months. Other sedge species from the families Cyperaceae and Restionaceae also are typically present.
- Other indicator species include one or more of the following: *Acacia hastulata*, *Callistemon glaucus*, *Gymnoschoenus aenops*, *Leptocarpus tenax* and *Schoenus multiglumis*.

Condition classes, categorise and thresholds. An *Empodisma* peatland occurrence is in the top three condition classes (DCCEEW, 2023).

| CONDITION CLASSES | INDICATIVE CONDITION MEASURES/THRESHOLDS |
|--|--|
| <p>PRISTINE TO EXCELLENT CONDITION No obvious sign of disturbance OR Vegetation structure intact; Disturbance only affecting individual species.</p> | <p>Vegetative cover¹ (native) is 90% or more across the occurrence AND Perennial vegetation is dominated by characteristic reed/sedge and shrub species (see section 1.2.2.2 & Appendix A) AND Peat² layer is intact (including no fire-pedestal² formation)</p> |
| <p>VERY GOOD CONDITION Vegetation structure altered; Obvious signs of disturbance. For example, from repeated fires, dieback, grazing.</p> | <p>Vegetative cover¹ (native) is 70% or more across the occurrence AND Perennial vegetation is dominated by characteristic reed/sedge and shrub species (see section 1.2.2.2 & Appendix A) AND Peat² layer is intact or near original level with only minor fire-pedestal³ formation</p> |
| <p>GOOD CONDITION Vegetation structure altered but retains basic vegetation structure or ability to regenerate it; Obvious signs of disturbance, e.g., from frequent fires, partial clearing, dieback, grazing.</p> | <p>Vegetative cover¹ (native) is 30% or more across the occurrence AND Characteristic reed/sedge species may not be dominant but characteristic shrubs are present and may be dominant (see section 1.2.2.2 & Appendix A). AND Loss of some peat² layer or fire-pedestal³ formation evident, possibly significant, and peat² depth is at least 0.1 m across the majority of the occurrence</p> |
| <p>DEGRADED TO COMPLETELY DEGRADED CONDITION Basic vegetation structure severely impacted by disturbance; Disturbance evident such as very frequent fires, partial clearing, dieback, and grazing. Not part of the protected ecological community</p> | <p>Vegetative cover (native) is less than 30% AND Characteristic shrubs, reeds/sedge species absent, including absence of <i>Empodisma gracillimum</i> AND Loss of most or all peat material with sand/clay base exposed</p> |
| <p>Notes:</p> <p>¹ Vegetative cover is living biomass. See 2.2.3 for recommendations on accessing time since fire.</p> <p>² Peat – Peat layers are typically evident below the vegetation litter layer. In practice a rigid probe or stick pushed into the peat with replication will give an estimate of depth. As peat is consumed by fire, the woody lignotubers of some species remain. The position of the “crown” of the plant gives an indication of the height at which the stems had emerged from the peat substrate prior to damage by fire.</p> <p>³ Pedestal - The formation of pedestals within the peat layer is typically a function of fire severity and reduced moisture within the peat profile. Pedestal formation is typically associated with loss of structure to peat. In extreme circumstances substrate is powdery/ crumbly when dry and muddy when wet where monosulfidic black ooze discharge or pooling may be evident. Pedestal formation may also result from preferential waterflows and from the growth of vegetation, often tussocks, into a dense often cylindrical mass of stems, roots and leaf bases. These vegetative growth pedestals would be excluded from this measure as they are not formed by fire damage.</p> | |

APPENDIX D: Resources Utilised in TECAP Development

Table D-1: Resources Utilised in TECAP Development

| STATE AND COMMONWEALTH DEPARTMENT / AUTHOR | DOCUMENT TITLE |
|---|--|
| State and Commonwealth Guidelines, Guidance and Instructions | |
| Environmental Protection Authority (EPA) 2016a | <i>Environmental Factor Guideline: Flora and Vegetation</i> , EPA, Western Australia. |
| Environmental Protection Authority (EPA) 2016b | <i>Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment</i> , EPA, Western Australia. |
| Environmental Protection Authority (EPA) 2018 | <i>Environmental Factor Guideline: Inland Waters</i> , EPA, Western Australia. |
| Environmental Protection Authority (EPA) 2021a | <i>Templates – Environmental Management Plans</i> . |
| Environmental Protection Authority (EPA) 2021b | <i>Interim Guidance – Environmental outcomes and outcomes-based conditions</i> , EPA, Western Australia. |
| Environmental Protection Authority (EPA) 2023 | <i>Statement of Environmental Principles, Factors, Objectives and Aims of EIA</i> , EPA, Western Australia. |
| Department of Climate Change, Energy, the Environment, and Water (DCCEEW) 2023a | <i>Approved Conservation Advice for the Empodisma peatlands of southwestern Australia</i> . |
| Department of Climate Change, Energy, the Environment, and Water (DCCEEW) 2023b | <i>Empodisma peatlands of southwestern Australia (Indicative Distribution Mapping)</i> . |
| Department of Climate Change, Energy, the Environment, and Water (DCCEEW) 2024 | <i>Environmental Management Plan Guidelines</i> , DCCEEW, Canberra, March. CC BY 4.0. |
| Environmental Protection Authority (EPA) 2024 | <i>Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans</i> , EPA, Western Australia. |
| State Forest Management Plan | |
| Conservation and Parks Commission (CPC) 2023 | <i>Forest Management Plan 2024-2033</i> . Conservation and Parks Commission. Perth, Western Australia. |