Government of **Western Australia**
Department of **Water and Environmental Regulation**

GREEN ENERGY

Proponent Guideline

Contents

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Foreword

The Environmental Protection Authority (EPA) recognises that climate change is a leading threat to Western Australia's unique environment. To this end, the EPA considers decarbonisation projects are vital to meet the state's 2050 target for reduced greenhouse gas emissions and to minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as possible.

In addition, as an independent statutory body with responsibility to use its best endeavours to protect the environment, the EPA is responsible for advising government on how the environmental benefits of these industries need to be realised in a way that is consistent with the EPA objectives. This means any likely significant environmental impacts of decarbonisation projects will need to be assessed and mitigated appropriately, as they are for other major projects in WA.

This guideline has been developed in consideration of key concepts and issues the EPA will consider when applications are referred to it under the *Environmental Protection Act 1986*. These include application of the mitigation hierarchy, identifying the environmental outcomes of the proposal, environmental monitoring, how the EPA considers other approvals, and key issues across a range of green energy proposal types.

We therefore encourage all proponents to ensure that projects fully consider and are aligned with the principles in this document, and the EPA's environmental factor objectives, to facilitate a smooth and efficient assessment process. This ensures that decarbonisation projects will have fewer technical environmental assessment and management challenges, will have more public acceptance and trust, and can demonstrate key legislation, and policy objectives are met.

The EPA was consulted during the preparation of this guideline, and its publication is consistent with the *EPA Strategic Plan 2023–2026*.

Darren Walsh
Chair, Environmental Protection Authority

Why provide a guideline for green energy proponents?

The State Government is committed to initiatives that decarbonise the economy to mitigate the impacts of climate change, and ensure that the state can realise the benefits of the global clean energy transition.

To meet this ambition, the State Government has committed to the Green Energy Approvals Initiative. This guideline outlines key information required to enable streamlined assessment for green energy projects. While expediting the approval and implementation of green energy projects is important, protecting our unique environment must be a priority.

Purpose of this guideline

This guideline has been prepared to assist proponents in undertaking assessments under Part IV of the *Environmental Protection Act 1986 (EP Act)* and to identify key issues considered by the Environmental Protection Authority (EPA) when assessing green energy projects. This document provides a guideline on the following key green energy industries:

- solar power generation
- onshore wind power generation
- offshore wind power generation
- renewable hydrogen manufacturing
- critical mineral[1] mining and processing.

[1] Australia's Critical Minerals list is subject to change. At the time of writing, the following are considered critical minerals: high purity alumina, antimony, beryllium, chromium, cobalt, gallium, germanium, graphite, indium, lithium, manganese, nickel, niobium, platinum group elements, rare earth elements, scandium, silicon, tantalum, tungsten and vanadium. The most recent list can be found on the Department of Industry, Science and Resources website.

Environmental impact assessment in Western Australia

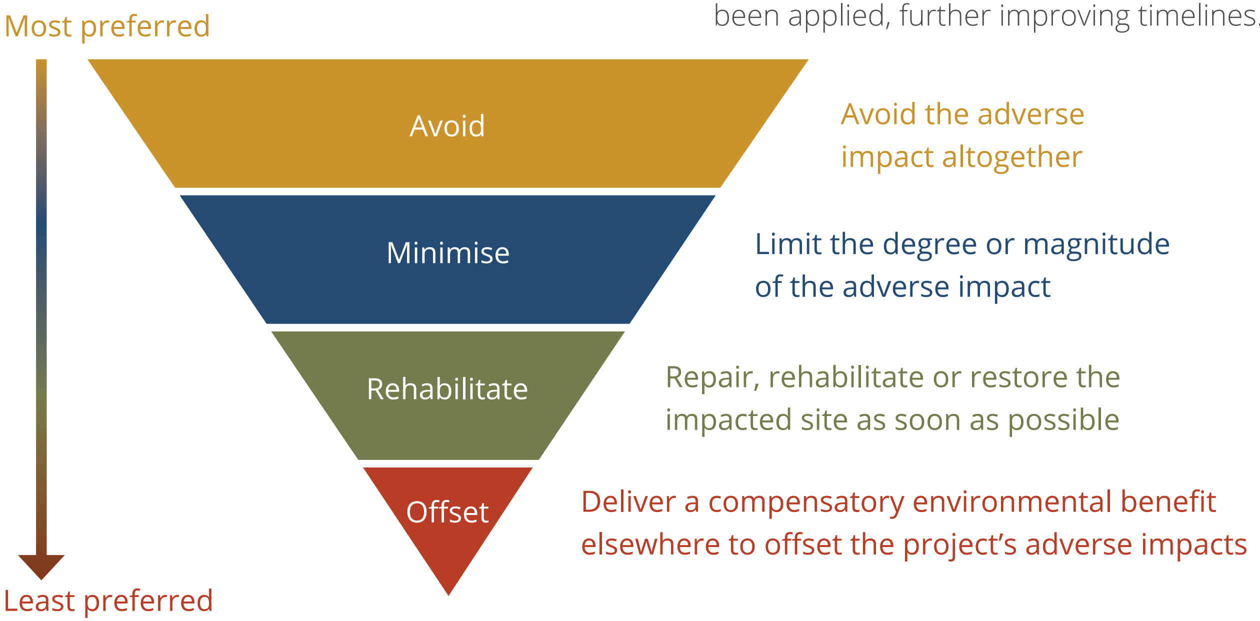
Projects with the potential to significantly impact the environment must be referred to the EPA. The EPA may then consider whether it will conduct an environmental impact assessment (EIA) or if another statutory decision-making process can mitigate the potential environmental impacts.

Under Part IV of the WA *EP Act*, the EPA has substantial discretion to determine an appropriate level of assessment for a project. In deciding the level of assessment, the EPA may have regard for the number and complexity of relevant key environmental factors; the level of public interest in a proposal; the values, sensitivity, and quality of the environment that could be affected; the level of confidence in the prediction of impacts; and the success of proposed mitigation. Alternatively, the EPA may determine that other statutory decision-making processes (such as clearing permits and works approvals, and licences under Part V of the EP Act) could mitigate the potential impacts of the proposal, thereby resulting in the EPA determining not to assess the proposal.

The minimum timeframe for EIAs is about 40 to 58 weeks; however, it is usually much longer. A key factor that leads to extended assessment times is the provision of insufficient information related to an application, in particular how proponents plan to mitigate the environmental impacts of their projects.

The mitigation hierarchy

The mitigation hierarchy provides a guideline on reducing the potential impacts of a proposal. There are four steps in the mitigation hierarchy – Avoid, Minimise, Rehabilitate and Offset. The mitigation hierarchy is a key consideration in EIA and, when applied early in the planning stages of project development, may permit the avoidance of impacts upfront. Once a project is referred to the EPA, proponents will be expected to demonstrate how they have considered and applied this hierarchy to reduce the potential impacts on the environment.



Providing well-reasoned mitigation measures to reduce environmental impacts may enable the EPA to apply a more expedited assessment approach. The application of mitigation measures can provide regulators with greater certainty on the expected outcomes of the proposal, sometimes reducing or eliminating the need for additional information, which can then result in shorter assessment timeframes. The extent and nature of formal feedback from stakeholders during the assessment process can be improved by the proponent demonstrating robust mitigation measures have been applied, further improving timelines.

Each step in the mitigation hierarchy should be applied to the greatest extent practicable before determining the residual impact and consideration of the next step. The process of mitigation is iterative, and the hierarchy should be considered and applied continually throughout all stages of the project.

Planning and early actions to avoid and minimise environmental impacts (over and above rehabilitation and offsets) should be prioritised. Avoidance and minimisation actions, particularly when identified early in the project planning phase, can:

- increase the certainty that environmental impacts can be mitigated
- provide cost-effective mitigation options and flexibility of mitigation methods
- attract greater stakeholder acceptance and support for the project
- reduce the complexity and/or number of environmental approvals required.

While this document focuses on avoidance and minimisation options, it is important to recognise that sourcing and securing appropriate offsets can be challenging, particularly in some regions of WA.

Where it is likely a significant residual impact may remain after all steps in the mitigation hierarchy have been applied, offsets should be considered as early as possible.

Inappropriate or insufficient offset consideration is often a cause of significant delays in the EIA process. Early consideration and stakeholder engagement on offsets, including rehabilitation, is therefore critical for streamlined assessments.

To support nature positive initiatives and to enable offsets to contribute to environmental protection and enhancement outcomes at regional scales, the EPA has released *Public Advice – Considering environmental offsets at a regional scale.*

For further information on how Rehabilitation and Offsets can be applied, refer to other documentation such as:

- SER National standards for the practice of ecological restoration in Australia
- EPBC Act environmental offsets policy (including the EPBC Act Offsets assessment guide or calculator)
- Biodiversity Conservation Trust Restoring Native Vegetation Guidelines
- WA Environmental Offsets Framework (including the State WA Offsets metric or calculator)

The mitigation hierarchy, environmental outcomes and monitoring

For each relevant environmental factor (i.e. terrestrial fauna or flora and vegetation) the EPA expects proponents to propose environmental outcomes for each relevant environmental value (e.g. a specific Priority Ecological Community) impacted by their proposal as part of their EIA. In this context, an environmental outcome is the state or condition of the environmental value during or after implementation. In essence, it is the state of the environment after the mitigation hierarchy has been applied.

Environmental factor	Example environmental values
Flora and vegetation	Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community Claypans of the Swan Coastal Plain Threatened Ecological Community Individuals of *Morelotia australiensis* Individuals of *Grevillea olivacea*
Terrestrial fauna	Suitable black cockatoo foraging habitat Potential black cockatoo breeding hollows Suitable chuditch habitat

EIA documents submitted by proponents tend to be impact or proposal focused, identifying residual impacts of the proposal, such as the loss of a certain number of hectares of native vegetation. Describing the impacts is certainly critical to good EIA; however, the EPA expects the proponent to take this assessment a step further and describe what that impact will mean for the environment. For example, will clearing that area of native vegetation affect dispersal, result in weed encroachment, increase soil degradation, or remove critical habitat for fauna breeding? Identifying the environmental outcome will therefore identify whether further mitigation measures could or should be applied. As with the mitigation hierarchy, determining acceptable environmental outcomes is iterative and should occur in every stage of the EIA process.

While the EPA has objectives for each environmental factor, an environmental outcome should be more specific and relate to each value that will be impacted. In assessing a proposal, the EPA will consider whether the environmental outcomes are consistent with the objective of that environmental factor and the principles of the EP Act, and whether reasonable conditions can be applied. The EPA is unlikely to recommend conditions for all environmental values impacted by a proposal; however, where conditions are recommended, the EPA prefers to set outcome-based conditions. Therefore, in proposing environmental outcomes for a value, proponents should consider how they will achieve, and demonstrate through monitoring, that these outcomes will be met.

When outcome-based conditions are set they are generally not prescriptive to allow opportunities for proponents to be pragmatic and innovative about how to realise the condition. However, in limited cases, the EPA may require a monitoring program to be submitted as part of the EIA. In these cases, an environmental management plan should be submitted during the assessment, which is specific and focused only on how to achieve the described outcome.

The EPA has published an interim guideline on *Environmental Outcomes and Outcome-Based Conditions* and how to prepare environmental management plans required under Part IV of the EP Act.

Steps for mitigating environmental impacts

Step 1: Understand the environmental values

The first stage of planning to mitigate the impacts of a project is to understand the environmental values present on the site. The EPA structures its consideration of environmental values into 14 Environmental Factors within five themes – Sea, Land, Water, Air and People. For each of these Environmental Factors, there is a range of digital data sources that may be used to understand whether values may be present on the site. Environmental values may represent many things, including areas of native vegetation, watercourses, and heritage sites. Proponents are encouraged to initially undertake a detailed desktop assessment to understand the potential for their project to impact these values.

Assessments and surveying

Where desktop analysis indicates that there may be relevant environmental values, undertaking on-ground surveys is typically required as part of the assessment process. By conducting assessments and surveys, key environmental values and constraints can be identified for consideration, improving the efficiency of the assessment process. Suitably qualified specialists should be engaged to investigate prospective development sites. The number and variety of potential assessments and surveys will depend on the project but may include:

- Flora diversity and significant flora
- Fauna diversity, fauna habitat assessment and significant fauna
- Vegetation types and significant ecological communities
- Noise and vibration studies
- Visual impact assessments
- Soil and contamination studies
- Dieback investigations
- Indigenous heritage surveying
- Groundwater studies
- Surface water studies

Additional understanding of the significance of identified impacts can be obtained through studying relevant conservation advice, wildlife conservation plans, management plans, and policy documents.

Step 2: Investigate and apply avoidance options

The mitigation hierarchy starts with avoidance. Avoidance is the most effective measure to reduce impacts and has the highest certainty. Avoidance measures should be based on the understanding of environmental values.

There are two main approaches to avoiding environmental impacts – **project siting** and **project design**. Consideration should begin as early as possible in the planning process when adjustments to project siting and design are still feasible.

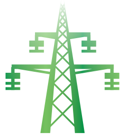
Project siting and project design provide the greatest opportunity to reduce identified environmental impacts. Avoidance costs can be significant but are lower than the costs of minimisation, rehabilitation or offsets.

Commencement of proactive engagement with stakeholders, particularly local communities and Aboriginal people, at this early stage is strongly encouraged as this will lead to a better understanding of the potential issues of concern, opportunities to resolve issues before they escalate, and improve the likelihood of stakeholder support for the project.

Avoidance through project siting

The project location significantly influences its environmental impact. Siting to avoid environmental impacts often requires compiling primary and secondary data on the environmental values of a site, potential alternative sites, and land in proximity. Proponents should seek the support of an accredited environmental consultant with relevant skills and experience to assist in siting decisions.

The principles below should be considered for green energy projects to avoid environmental impacts and reduce assessment requirements:

	**Use disturbed land**	Use already disturbed (brownfield) land such as closed mines, cleared agricultural land, and closed landfills to avoid the need for further clearing or degradation. Locate marine discharges in existing high-energy, well-mixed waters. Locate proposals with air emissions in existing industrial areas to allow for consideration of cumulative airshed impacts and where established buffer areas exist.
	**Co-locate and use shared infrastructure**	Co-locate with complementary land uses and share common user infrastructure (e.g. ports, desalination) to reduce the need for new infrastructure. This can mitigate habitat fragmentation and cumulative impacts and expedite the approval process where some assessment may have already been completed.
	**Locate near existing infrastructure**	Site projects close to existing energy transmission and storage infrastructure and general transport (common use roads and ports) to minimise the need to develop new infrastructure.
	**Avoid environmentally significant areas**	Site projects away from areas of national, state, and local environmental significance or areas that are environmentally sensitive.

Avoid threatened fauna	Site projects away from the habitat and/or migration paths of threatened or endangered fauna that are known to be impacted by the green energy technologies being used.
Avoid threatened flora and vegetation	Where clearing of native vegetation is required, site away from known areas of threatened or endangered flora and ecological communities.
Avoid soil degradation and erosion	Avoid sites with existing soil contamination and sites with the potential to disturb acid sulfate soils. Avoid clearing deep-rooted vegetation. Consider design on a landscape scale to minimise erosion and prevent salinity mobilisation.
Consider water scarcity	If water is a key project input, avoid locations where water scarcity is high. Consider the environmental impacts and financial costs of desalination, and the impacts of drawdown production.
Avoid cultural and heritage-significant sites	Avoid impacting significant Aboriginal cultural heritage value, such as cultural landscapes, artefacts, and culturally important environmental values such as bush tucker, flora and fauna of cultural importance, and water sources.
Keep away from populated areas	Avoid areas with high population density, such as urban areas, to mitigate a range of impacts including visual amenity and noise-sensitive receptors.
Consider site topography	Consider the topography of the site and how it may contribute to the project's environmental impact (e.g. higher gradient land may impact water flows, erosion, sedimentation, noise and visual amenity).
Consider cumulative impacts	Consider past, present, and foreseeable future proposals in proximity (including non-green energy proposals) and whether cumulative impacts will exceed acceptable levels.

Avoidance through project design

Project design provides another avenue for avoiding environmental impacts. This can relate to any aspect of a project, including scheduling, construction, operations, and decommissioning. Decisions about project design to mitigate environmental impacts are best made following site selection. This allows for consideration of site characteristics to inform design during the site decision-making process.

The following project design strategies should be considered to avoid environmental impacts:

Adjust project layout	Adjust the layout, placement, and routing of facilities and operations on the project site. For example, underground transmission lines can reduce impacts on fauna and fragmentation. Layout adjustments can also reduce visual and noise amenity impacts.
Select suitable technologies and materials	Select technologies and/or materials which minimise environmental impacts, where practicable. For example, use high-quality solar panels with longer lifespans, thereby reducing waste generation.
Use sufficient buffers and separation	Use adequate separation or buffer distances to help mitigate localised impacts, including on surrounding flora and fauna, fauna habitat, waters, noise, and visual amenity.
Incorporate vegetation screening	Screen project sites with native plants to help mitigate the landscape and visual impacts of projects.
Consider project scheduling	Schedule the timing of project operations and construction to avoid disturbing flora and fauna at sensitive times (e.g. during migration periods).
Apply circular economy principles	Minimise, reuse, and recycle waste generated from operations, plan for infrastructure recycling at the end of project life, and use reusable and recyclable materials in production processes.

Application of avoidance and minimisation – practical examples

Wind and solar facilities

We are at the early stages of the green energy revolution so there are relatively few case studies where large-scale wind and solar facilities have been developed. However, proponents are already demonstrating practical and considered ways of applying the mitigation hierarchy, for example:

- moving the locations of specific wind turbines and associated infrastructure (such as access tracks) to avoid and minimise impacts to the threatened black-footed rock wallaby. A proponent established a minimum 1 km buffer from all rocky outcrops known to be used by this species to protect critical breeding locations, avoid impacts to foraging habitat adjacent to the rocky outcrops, and provide habitat connectivity where rocky outcrops were close together
- changing the layout of solar panels onsite to avoid and minimise impacts to locally significant vegetation, maintain vegetated corridors to facilitate fauna movement, and undertake additional weed management measures to address higher-risk values such as Priority Ecological Communities
- ensuring the layout of site access tracks minimises impacts to terrestrial fauna by limiting clearing of riparian vegetation to ensure fauna movement and dispersal is maintained, and engaging fauna specialists to undertake pre-clearance surveys and monitoring prior to construction of the solar arrays to identify active burrows, dens or mounds utilised by ground-dwelling fauna. This will assist in minimising impacts to be ensuring areas are avoided until such time the species has independently moved on
- implementing separation distances and turbine spacing to minimise impacts to avifauna using an internationally important wetland, and committing to best-practice bird and bat detection methods to enable real-time curtailment practices to be implemented.

Hydrogen and critical mineral mining processing

Industrial proposals as well as critical mineral mining and processing are well established within WA, and while the focus of this guideline is on green energy proposals, industry best-practice standards from conventional industrial and mining proposals should also be considered and applied. For example:

- To avoid significant impacts to biological values, a renewable fuels processing facility was located within an existing brownfield site within an established industrial area. The proposal was also being expanded to include green hydrogen production. The location provided ready customers and therefore avoided significant pipeline and infrastructure corridors and minimised impacts on populated areas by co-locating within an industrial precinct. The location has also allowed the proposal to use recycled industry water, addressing the challenge of being able to supply the large volumes required to produce hydrogen. Together, these measures have avoided and minimised impacts to most biological values. The proponent was also able to repurpose existing infrastructure.
- To avoid impacts to sites with Aboriginal cultural heritage value, a lithium–tantalum miner conducted early and extensive consultation with Traditional Owners and designed the site layout with their input. Areas of total exclusion and areas of cultural importance were identified, agreed upon and incorporated into the project design. Prior to applications being submitted, a comprehensive native title agreement had been agreed upon and signed, and the Traditional Owners had no objections to the project during consultation for the environmental approvals.
- To minimise impacts to surrounding surface water and underlying groundwater receptors, a lithium miner built a reverse-osmosis plant to remove lithium from the excess process water being stored in on-site dams. They conduct ongoing monitoring of the dams, groundwater and surrounding surface water receptors to ensure impacts are minimised.

Step 3: Investigate and apply minimisation options

After avoiding impacts as much as possible through project siting and design, minimisation actions should be applied to reduce remaining impacts. Minimisation measures reduce the likelihood, duration, severity, significance, and/or extent of impacts that cannot be avoided. Minimisation should be applied throughout a project's lifespan, including design, construction, operations, and decommissioning phases.

Example: Minimising impacts on fauna

Fauna (including marine and subterranean fauna) can be displaced by green energy projects. Many factors contribute to fauna displacement, including the removal and fragmentation of habitat, light pollution, noise emissions, invasive species introduction, and collisions. The following strategies should be considered to minimise potential impacts on fauna:

- Maintain fauna movement corridors.
- Minimise road traffic.
- Implement speed limits.
- Narrow roads and verges to allow wildlife to cross the road quickly.
- Engage a fauna spotter for pre-clearing surveys and during clearing and site disturbance.
- Use high-frequency noise, outside the range of human hearing, to repel animals.
- Manage waste to prevent the attraction of wildlife.
- Implement fencing and barriers to minimise fauna interactions with the project site or infrastructure.
- Provide shading or carefully direct light sources to reduce disruption to nocturnal fauna.
- Manage feral animals.

Example: Minimising impacts on flora and vegetation

Flora and vegetation (including marine) can be displaced by green energy projects. Many factors contribute to flora and vegetation displacement, including vegetation clearing, weed or pest introduction, and impacts on surface water drainage. The following strategies should be considered to minimise potential impacts on flora and vegetation:

- Engage botanists for pre-clearing surveys to identify and protect significant flora.
- Maintain vegetation corridors.
- Erect protective barriers to shield sensitive vegetation.
- Use low-impact machinery and techniques to reduce soil compaction and damage to root systems.
- Implement erosion and sediment control measures to protect vegetation from water runoff.
- Implement site access, monitoring, and management protocols to minimise the risk of weeds and pests being introduced.

Mitigating impacts of green energy proposals

The following sections discuss more specific avoidance and minimisation considerations for different types of green energy projects, with diagrams depicting their most common environmental impacts. The tables following describe the key identified impacts,[2] the environmental factors that would be impacted, and options to avoid and minimise those impacts. Review the avoidance and minimisation examples and assess whether each can be applied. These lists are not exhaustive, and impacts can vary considerably by project. Proponents should engage relevant consultants and consult with stakeholders to ensure all the potential impacts of their specific projects are identified, adequately understood, and mitigated.

[2] The key identified impacts are those considered most common to the relevant green energy project. Examples of avoidance and minimisation options for the other impacts depicted within the diagrams can be found in the 'Avoidance through project siting', 'Avoidance through project design' or 'Further reading' sections.

Mitigating impacts of solar projects

Solar energy projects involve the installation of solar panels or arrays to harness and convert sunlight into electricity for renewable and sustainable power generation. Technologies for producing solar energy come in two main forms – solar photovoltaic and solar thermal. Solar photovoltaic systems directly convert sunlight into electrical energy, while solar thermal systems capture solar heat.

No.	Potential impact
1	Vegetation clearing and disturbance
2	Disruption of ecosystem processes
3	Fauna displacement
4	Fauna mortality and injury
5	Disruption to visual amenity
6	Disturbance of cultural heritage
7	Waste pollution

Factor	Potential impacts	Description	Avoidance options	Minimisation options
Social surroundings	Disruption to visual amenity	The presence of solar panels and supporting transmission and storage infrastructure can change the appearance of landscapes. Solar panels can cause glint and glare impacts.	• Consider panel layout that minimises visibility, such as arranging panels in alignment with existing land features and contours. • Consider limiting above-ground infrastructure and cabling.	• Explore angling solar panels to redirect glint and glare. • Consider applying anti-reflective coatings to solar panels. • Investigate low-profile mounting systems.
Flora and vegetation	Vegetation clearing and disturbance	Vegetation is lost through clearing for the project.	• Explore options for hybrid land use, such as co-locating panels with agricultural land. • Consider floating solar arrays; positioning panels on floating platforms in bodies of water.	• Investigate options to maintain vegetation cover under and between solar panel rows.
Other	Waste pollution	Solar projects will generate waste as panels reach their end of life. Where solar panels cannot be reused or recycled, they must be disposed of in a landfill, which is associated with risks and environmental impacts.	• Explore infrastructure and technologies with a long asset life (to reduce turnover) and/or with potential for future reuse and/or recovery of materials. • Set the solar capacity of the project in consideration of projected energy demand and supply from other sources to avoid overinvestment in panel capacity.	• Implement servicing, cleaning, and maintenance protocols and knowledge to support extended asset life. • Separate waste streams and transport them to the associated recycling or waste facilities.

Managing bushfire risk

Solar farms often consider retaining native vegetation to mitigate potential clearing requirements. However, the practical need to safeguard infrastructure against bushfires may limit the feasibility of vegetation retention, potentially leading to more extensive clearing than initially anticipated.

Despite this challenge, avoidance and minimisation measures remain viable. Proponents should carefully consider project design and collaborate with relevant authorities, such as local governments and accredited bushfire assessment professionals, to address bushfire management requirements effectively.

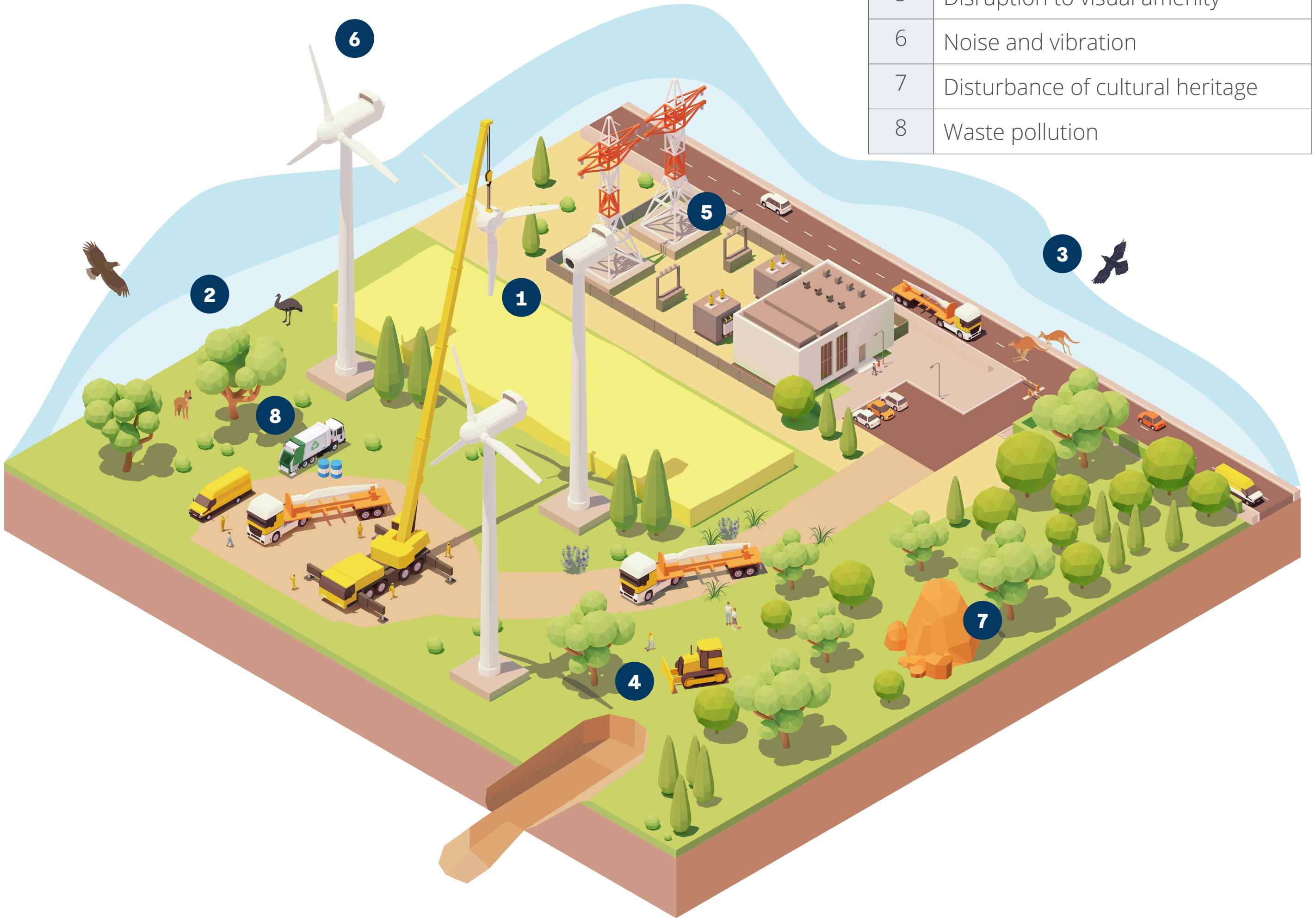
Mitigating impacts of wind proposals

Wind turbines offer an effective route to harness energy contained in wind. Wind energy is one of Australia's main sources of renewable energy. These projects involve erecting wind turbines to capture the kinetic energy of wind and convert it into electricity. As wind flows across the turbine blades, their rotation drives generators, producing electricity.

Onshore wind

An onshore wind farm typically includes multiple wind turbines that are connected to the grid through transmission lines. Each turbine requires road access for construction and ongoing maintenance of equipment. Wind turbines are often situated at elevated locations or on coastlines, to harness stronger and more consistent winds.

No.	Potential impact
1	Vegetation clearing and disturbance
2	Fauna displacement
3	Fauna mortality and injury
4	Disruption of ecosystem processes
5	Disruption to visual amenity
6	Noise and vibration
7	Disturbance of cultural heritage
8	Waste pollution



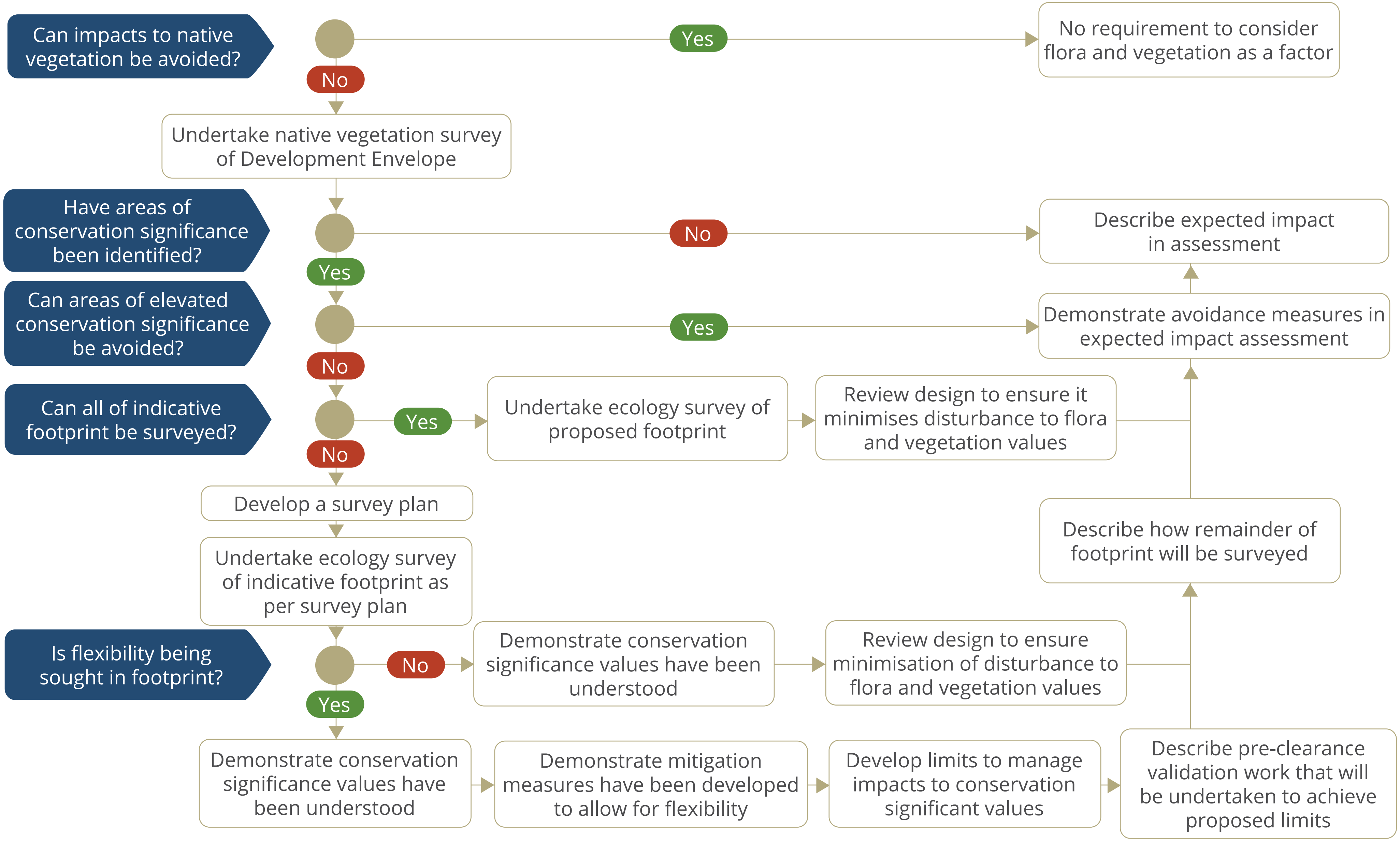
Factor	Potential impacts	Description	Avoidance options	Minimisation options
Terrestrial fauna	Fauna mortality and injury	Bird and bat injury and/ or mortality can occur via collision with wind turbines or with traffic.	• Explore options for below-ground transmission lines to avoid bird or bat collisions. • Consider smart curtailment protocols, such as turning off wind turbines at certain speeds to reduce the chance of collision. Wind turbines could also be shut off when birds are detected in the vicinity.	• Explore tower designs that minimise attraction as perches. • Explore blade design features and patterning known to reduce collision risk. Consider turbine features, blade height, visibility, lighting, configuration, row spacing, and column number.
Social surroundings	Noise and vibration impacts	Mechanical noise is generated from machinery components in wind turbines. Aerodynamic noise is generated from the interaction of the flow of air and the blades.	• Explore options for project siting away from sensitive receptors, with appropriate buffers. • Consider turbine arrangement to minimise noise propagation. • Consider spacing and alignment to reduce cumulative noise impacts.	• Investigate noise-reducing materials or coatings for turbine components. Explore technologies that use counter-vibrations. • Consider adjustment of blade angles. • Investigate options for noise barriers.
	Visual amenity impacts	Presence of wind turbines and supporting infrastructure can change the appearance of landscapes. Impacts on visual amenity are subjective and should be understood via stakeholder consultation.	• Explore options for project siting away from sensitive receptors, with appropriate buffers. • Consider sites with a low elevation and flat topography to minimise viewshed.	• Consider turbine colours and materials that blend harmoniously with the surroundings. • Investigate options for vegetative screening. • Regularly maintain turbines to prevent visual wear and tear.

Factor	Potential impacts	Description	Avoidance options	Minimisation options
Not applicable	Waste pollution	Wind projects will generate waste as turbines reach their end of life. Where turbines cannot be reused or recycled, they must be disposed to landfill, which is associated with environmental impacts.	• Select infrastructure and technologies with long asset life (to reduce turnover) and that allow future reuse and/or recovery of materials. • Set the capacity of the project with consideration of projected energy demand and supply from other sources to avoid overinvestment in turbine capacity.	• Implement sufficient servicing, cleaning, and maintenance protocols and knowledge to support extended asset life. • Separate waste streams and transport them to appropriate recycling or waste facilities.

Vegetation clearing for wind projects

Effectively demonstrating the application of mitigation measures within a vegetated setting often requires an iterative approach to designing the vegetation survey. Depending on the size and complexity of the proposed wind project, it may not be feasible to survey the precise project footprint, especially if the design is not yet finalised during the assessment stages.

The process of demonstrating mitigation begins with understanding the existing values, in this case vegetation values. As depicted in the flow chart below, proponents should tailor mitigation strategies based on this understanding. In some contexts, additional investigations may be necessary to assess conservation values and identify potential avoidance zones.


Can impacts to native vegetation be avoided?
Yes
No requirement to consider flora and vegetation as a factor
No
Undertake native vegetation survey of Development Envelope
Have areas of conservation significance been identified?
No
Describe expected impact in assessment
Yes
Can areas of elevated conservation significance be avoided?
Yes
Demonstrate avoidance measures in expected impact assessment
No
Can all of indicative footprint be surveyed?
Yes
Undertake ecology survey of proposed footprint
Review design to ensure it minimises disturbance to flora and vegetation values
No
Develop a survey plan
Undertake ecology survey of indicative footprint as per survey plan
Describe how remainder of footprint will be surveyed
Is flexibility being sought in footprint?
No
Demonstrate conservation significance values have been understood
Review design to ensure minimisation of disturbance to flora and vegetation values
Yes
Demonstrate conservation significance values have been understood
Demonstrate mitigation measures have been developed to allow for flexibility
Develop limits to manage impacts to conservation significant values
Describe pre-clearance validation work that will be undertaken to achieve proposed limits

Offshore wind

Offshore wind turbines are less obtrusive than those onshore as size and noise are partly mitigated by distance. Offshore wind can generate higher outputs than onshore wind, owing to higher average wind speeds over open water. Installation and maintenance are a greater challenge than for onshore farms. Regular maintenance is required to prevent damage from the harsh conditions – winds, waves, and saltwater. Installing and maintaining undersea cables for power transmission can be complex and costly. Electricity produced by offshore wind turbines travels back to land through a series of cable systems.

In addition to the factors impacted by onshore wind proposals, offshore wind has the potential to impact benthic communities and habitats, coastal processes, marine environmental quality, and marine fauna.

No.	Potential impact
1	Disturbance of benthic communities and habitats
2	Disturbance of coastal landforms
3	Impacts to water and sediment quality
4	Contamination
5	Fauna displacement, injury, and mortality
6	Interference with existing uses
7	Disruption of visual amenity

Factor	Potential impacts	Description	Avoidance options	Minimisation options
Marine environmental quality, Benthic communities and habitats	Impacts to water and sediment quality, disturbance to benthic communities and habitats	Pile driving and cable laying disturb seabed sediments, increasing turbidity and suspended sediment loads. This impacts water quality, light attenuation, and benthic habitats. Wind turbines alter water column properties, affecting nutrient cycling, oxygen availability, and salinity distribution. Corrosion protection measures can cause chemical emissions.	• Explore options to amend project design and configuration to preserve natural wind mixing. • Consider low-toxicity corrosion protection measures.	• Investigate alternative foundation designs with decreased sediment disturbance, e.g. floating foundations. • Consider horizontal tunnelling methods to reduce impacts associated with trenching. • Consider seabed intervention methods for cable installation that minimise turbidity.
Marine fauna	Fauna displacement, injury, and mortality	The presence of infrastructure alters the natural movements and behaviours of marine animals. Vessels pose collision risks. Underwater noise generated can mask communication noise, cause behavioural changes, affect navigation, or cause hearing loss. Electromagnetic fields generated from subsea cables can impact on prey detection and migration navigation. Artificial light can disrupt biological behaviours and cause physiological changes.	• Investigate foundation types that do not require pile driving for installation. Consider vibratory pile driving over impact pile driving techniques. • Consider mooring with minimal potential for entanglement (e.g. catenary moorings).	• Consider barriers, such as bubble curtains or underwater fencing, to minimise fauna interactions with the project site and infrastructure. • Explore options to schedule offshore works concurrently to limit number of vessel movements. • Investigate cable layouts and engineering controls with reduced electromagnetic fields. • Consider lighting design, light emissions, and reflective infrastructure.

Mitigating impacts of renewable hydrogen proposals

Renewable hydrogen projects (often referred to as 'green' hydrogen projects) use renewable energy sources to power the electrolysation of water, producing hydrogen. The hydrogen may be stored and distributed in this form or converted to other products (such as ammonia and methanol) for transportation. A green hydrogen proposal will typically be an industrial site that incorporates a large-scale electrolyser, water supply facilities (which can include desalination), renewable energy infrastructure (such as solar panels, wind turbines and transmission lines), storage assets and distribution infrastructure.

Many of the environmental impacts associated with a green hydrogen project will relate to its renewable energy capacity. Guidance on how to mitigate the impacts of solar and wind power generation is contained above.

No.	Potential impact
1	Disruption to natural sand and wave movements
2	Water contamination
3	Subterranean impacts
4	Air pollution
5	Climate pollution
6	Noise impacts to amenity
7	Disturbance of cultural heritage

Factor	Potential impacts	Description	Avoidance options	Minimisation options
Coastal processes	Disruption to natural sand and wave movements	Coastal infrastructure disrupts the longshore drift process. Sediment may accumulate on one side of the structure, causing beach erosion on the other side. Structures can also modify wave energy and direction.	• Consider using jetties or pylons (over rock break walls) to preserve natural movements.	• Explore options for dune stabilisation.
Marine environmental quality and Inland waters	Water contamination	The construction and operation of port facilities may impact water and sediment quality through dredging and ship movements. Hydrogen production may discharge liquid pollution into the marine environment and/or inland waters, which can impact the physicochemical characteristics of water.	• Investigate options for siting the project where existing port infrastructure exists. • Investigate circular economy principles to recycle and reuse waste effluents to avoid the need to discharge. • Explore options to establish buffer zones around watercourses.	• Site considering topography, to minimise potential for contamination via water flows. • Consider installing silt curtains or turbidity barriers around construction areas or dredging sites. • Consider precision dredging techniques to minimise seabed disturbance. • Explore materials, technologies, and processes that reduce the amount of effluent and pollution created. • Consider treating effluent prior to discharge. Discharge pollution in large open bodies of water with high levels of mixing and water flow.

Factor	Potential impacts	Description	Avoidance options	Minimisation options
Subterranean fauna, Terrestrial environmental quality, Inland waters	Subterranean impacts	Underground storage is a viable option for large-scale storage of hydrogen. Potential impacts are not fully understood but impacts on geological subsurface structures and groundwater are possible.	• Consider using pre-disturbed sites, such as old mines, for below-ground storage. • Site and design below-ground storage appropriately in consideration of environmentally significant and sensitive areas and geological structures. • Explore options to avoid storage in areas of suitable habitat for subterranean fauna.	• Explore the latest research and identified best practices for the storage and management of hydrogen below ground.
Air quality	Air pollution	Hydrogen production may cause air quality impacts from emissions, particularly if grey hydrogen processing is used in the early stages of the project. Where hydrogen is converted to ammonia, there is risk of accidental release into the environment.	• Investigate production technologies and materials that avoid the production of air contaminants. • Consider adjusting project siting and design, including buffers, to avoid high population areas or areas sensitive to emitted pollutants.	• Investigate production technologies and materials that minimise quantities and/or concentration of air contaminants. • Explore options for scheduling of operations to minimise any pollution impacts.

Recognition of other regulator regimes in the management of hydrogen projects

Management of safety risks in hydrogen projects are likely to require several approvals or licences from other regulators. To avoid duplication, the EPA considers the role that other decision-making authorities (DMAs) can take in assessing projects.

Proponents are encouraged to engage in consultation with relevant DMAs to identify opportunities where elements of a project may be assessed through alternative processes, avoiding duplication.

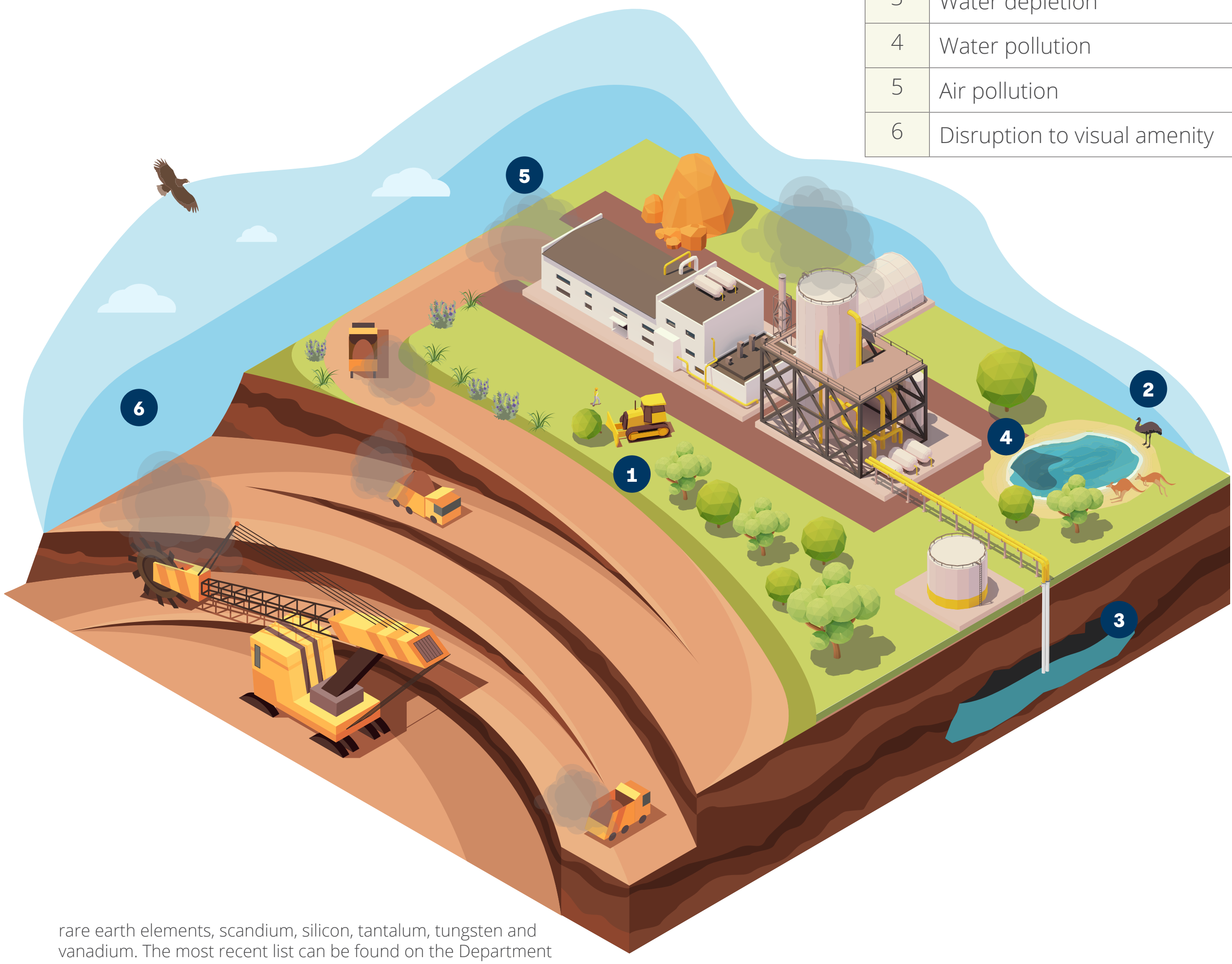
Safety management is commonly considered by an alternative DMA (such as the Department of Energy, Mines, Industry Regulation and Safety). However, it is important that where safety elements are required, these elements are considered during the design and environmental assessment. Examples of safety elements include second access roads, safety fencing, low fuel zones, and the provision of water for fire suppression.

Mitigating impacts of critical mineral proposals

Critical minerals[3] are minerals that are important for modern technologies, economies, or national security, and are vulnerable to supply chain disruption. Australia has a long and successful history of processing critical materials. Critical minerals are used in the manufacture of advanced technologies including mobile phones, computers, fibre-optic cables, semiconductors, banknotes, defence, aerospace, and medical applications. Critical minerals are increasingly being used overseas in green energy technologies such as electric vehicles, wind turbines, solar panels, and rechargeable batteries.

Critical mineral processes encompass both mining and refining processes. Initially, the ore is extracted and transported to a processing plant, where valuable minerals are separated and concentrated. The mine operations often include tailings storage, waste rock dumps, water storage and often dewatering to allow mining below the water table. The refining steps involve comminution (crushing and grinding), sizing, classification, concentration, and chemical mineral processing.

No.	Potential impact
1	Vegetation clearing and disturbance
2	Fauna displacement
3	Water depletion
4	Water pollution
5	Air pollution
6	Disruption to visual amenity



[3] Australia's Critical Minerals list is subject to change. At the time of writing, the following are considered critical minerals: high purity alumina, antimony, beryllium, chromium, cobalt, gallium, germanium, graphite, indium, lithium, manganese, nickel, niobium, platinum group elements, rare earth elements, scandium, silicon, tantalum, tungsten and vanadium. The most recent list can be found on the Department of Industry, Science and Resources website.

Factor	Potential impacts	Description	Avoidance options	Minimisation options
Inland waters	Water pollution	Critical mineral mining and processing may involve the use of toxic chemicals with the potential to contaminate local waters and groundwaters.	• Explore options to treat wastewater prior to excretion to reduce toxicity. • Investigate appropriate waste disposal to prevent leakage into water (e.g. line tailing ponds).	• Monitor water quality and adjust operations as needed to remain at safe levels. • Explore methods to remove contaminants from water if contamination occurs.
Air quality	Air pollution	Dust emissions may result during construction and mining activities, including drilling, material handling and transportation, and tailings management.	• Explore options to site project away from sensitive receivers and use appropriate buffers. • Consider covering exposed surfaces to prevent wind erosion. • Consider scheduling potential dust-emitting activities during periods of weaker winds.	• Investigate dust suppression techniques to reduce spread (e.g. water sprays). • Consider dust control measures such as dust management systems, dust collectors, dust binding, and dust barriers.

Byproduct management for critical mineral projects

For critical mineral projects, effective byproduct management is crucial. As critical mineral mining projects increasingly support downstream refining processes in WA, refining can yield various secondary byproducts. Some of these byproducts may have existing commercial markets, while others could be valuable for resale.

When a critical mineral mining proponent considers developing a refinery (whether on the same site or elsewhere), they should explore options for storing secondary byproducts from the refining process. Maximising the potential for reusing these secondary byproducts simplifies subsequent refinery approvals, potentially enabling a reduced level of assessment. Where no market exists immediately, waste return to the mine site is the preferred option.

Stakeholder support

Effective communication and active stakeholder engagement significantly influence project outcomes. Strong engagement benefits both the proponent and the community. Community support relies on maintaining social licence, which involves establishing and nurturing trust. To achieve this, stakeholders should be identified early in the planning process. By involving them from the outset, solutions can be tailored to local contexts. Regular discussions about project details, objectives, and potential impacts ensure alignment with community needs and values.

Visual amenity, noise, and interference with existing uses are significant considerations for any green energy project, frequently drawing attention from stakeholders. Poor management of these impacts leads to negative public perception, challenging social licence. Social and aesthetic impacts are subjective, requiring thorough stakeholder consultation to understand and mitigate. Decision-making authorities should also be consulted throughout the process. The following strategies should be considered to mitigate potential social and aesthetic impacts.

Factor	Description	Avoidance options	Minimisation options
Visual amenity	Public concern often stems from the blight of wind turbines on the landscape, or glint and glare from solar panels. The presence of infrastructure can dramatically alter the appearance of the landscape.	• Explore options to co-locate, use disturbed land, and/or locate near existing infrastructure. • Consider amending project density. • Investigate spatial buffers and/or vegetation screening. • Explore options to locate on sites with low elevation and flat topography.	• Explore colours and materials that blend harmoniously with the surroundings. • Consider incorporating natural features to soften visual impact. • Consider incorporating educational displays and/or art installations.
Noise	Noise can be produced and emitted from green energy projects, such as during electrolysis in renewable hydrogen projects, or from machinery components in wind turbines.	• Consider adjusting project siting and design (including buffers) to avoid high-population areas or areas sensitive to noise. • Explore options to schedule operations so noise impacts occur at less meaningful times.	• Investigate noise management techniques such as noise barriers. • Consider spacing and alignment to reduce cumulative noise impacts.
Existing uses	Green energy project site boundaries and infrastructure can interfere with or displace existing uses of the area. Activities such as commercial and recreational fishing, tourism, recreational activities, and commercial shipping can be impacted.	• Investigate options to site away from key areas of importance for uses and hot spots of activity. • Explore options to co-locate, use disturbed land, and/or locate near existing infrastructure.	• Consider scheduling major construction and activities to avoid key times of importance for users.

What if significant residual environmental impacts remain?

Full and appropriate application of the mitigation hierarchy may result in the EPA determining that a proposal does not warrant assessment. However, if significant residual environmental impacts remain, the project will be assessed by EPA under Part IV of the *Environmental Protection Act 1986*. The following provide guidance on the assessment process:

- *Statement of environmental principles, factors, objectives and aims of EIA*
- *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2021*
- *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2021*

The EPA determines whether assessment of the proposal is required, and the level of assessment required, based on the likely significance of the project's environmental impact. Proposals that are thoroughly scoped and planned following EPA guidance are less likely to require adjustment during the assessment process and are generally approved in a timelier fashion. Similarly, the fewer significant environmental impacts that a project is expected to have, the more likely it is to be promptly assessed and approved.

Note that guidance in this document is not comprehensive and that further research and expert guidance is recommended to tailor specific projects. Proponents should consider engaging with consultants, stakeholders, and relevant agencies to maximise the mitigation potential for a proposal.

Further reading

Green energy

- Green Energy Approvals Initiative

Mitigation

- A cross-sector guide for implementing the Mitigation Hierarchy
- Offsets mitigation hierarchy

Solar

- Mitigation measures to reduce impact of solar power projects
- NSW Large-Scale Solar Energy Guideline

Renewable hydrogen

- Australia's National Hydrogen Strategy
- Renewable Hydrogen Guidance: Land tenure for large scale renewable hydrogen projects
- Map of Western Australia's Hydrogen Projects

Onshore wind

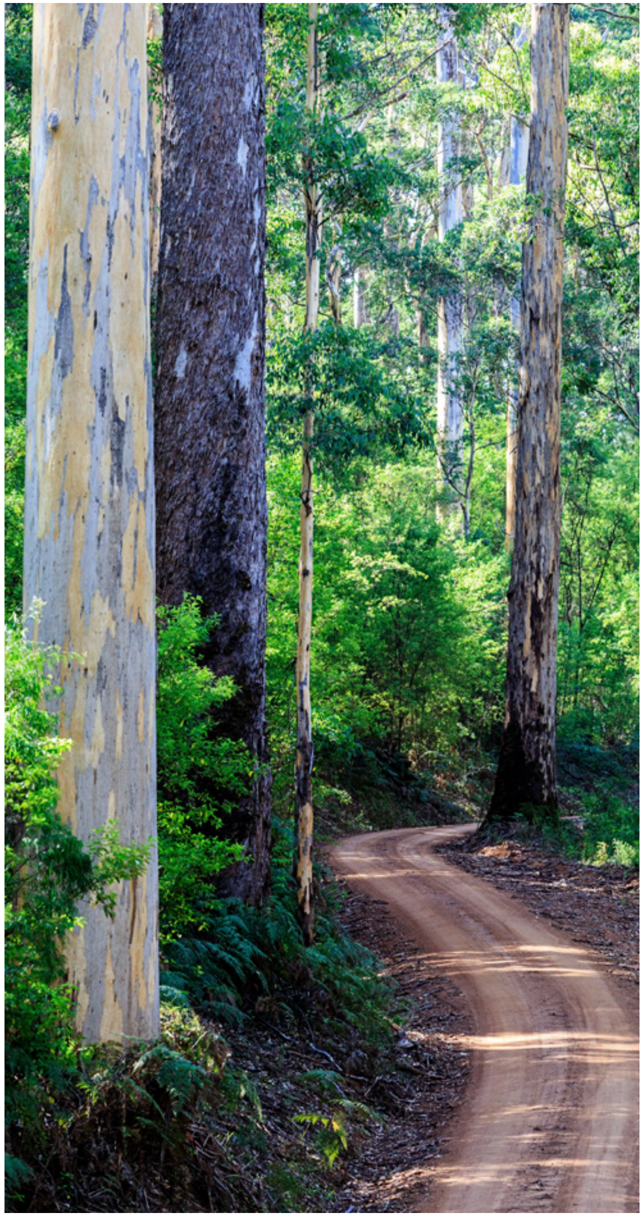
- Onshore Wind Farm Guidance – best practice approaches when seeking approval under Australia's national environmental law (DRAFT)

Offshore wind

- Offshore wind in Australia
- Key environmental factors for offshore windfarm environmental impact assessment under the Environmental Protection and Biodiversity Conservation Act 1999

Critical minerals

- Australia's Critical Minerals List and Strategic Materials List
- Mining Proposal Guidance



Appendix: Example[4] environmental impact mitigation checklist

Impact identification	Yes	No	Comment
The potential environmental impacts of the project have been identified and are understood, including completion of surveys	☐	☐	
Impact avoidance – project siting	**Yes**	**No**	**Comment**
Can the project use already disturbed (brownfield) land?	☐	☐	
Can the project be co-located to share common infrastructure?	☐	☐	
Can the project be sited near existing infrastructure?	☐	☐	
Can the project be sited away from areas of national, state, and local environmental significance or areas that are environmentally sensitive?	☐	☐	
Can the project be sited away from habitat and/or migration paths of threatened or endangered fauna?	☐	☐	
Can the project be sited away from known areas of threatened or endangered flora and ecological communities?	☐	☐	
Can the project be sited to avoid soil degradation and erosion?	☐	☐	
If water is a key input, can the project be sited away from locations where water scarcity is high?	☐	☐	

4 This checklist is intended as a guideline only and is not comprehensive. Further research and consultation should be undertaken to ensure all mitigation avenues are considered.

Impact avoidance – project design	Yes	No	Comment
Can the project be sited away from sites that have significant cultural and heritage value?	☐	☐	
Can the project be sited away from populated areas and sensitive receptors?	☐	☐	
Can the project be sited on preferable topography?	☐	☐	
Will past, present, and foreseeable future proposals in the proximity of the site not result in cumulative emissions exceeding acceptable levels?	☐	☐	
Can the project layout be adjusted to avoid impacts?	☐	☐	
Can technologies and/or materials with minimal environmental impacts be used?	☐	☐	
Can separation or buffer distances be used to mitigate environmental impacts?	☐	☐	
Can the project site be screened with native plants to avoid visual impacts?	☐	☐	
Can the timing of project operations/construction be scheduled to avoid impacts to flora and fauna (e.g. during migration periods)?	☐	☐	
Are there opportunities to reduce, reuse and recycle waste generation from operations?	☐	☐	

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