



DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Biodiversity Assessment Method Operational Manual

Stage 2



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Environment, Energy and Science
Department of Planning, Industry and Environment
59 Goulburn Street, Sydney NSW 2000
PO Box A290, Sydney South NSW 1232
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or info@environment.nsw.gov.au
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Abbreviations

Abbreviation	Description
BAR	Biodiversity Assessment Report; includes Biodiversity Development Assessment Reports (BDARs), Biodiversity Certification Assessment Reports (BCARs) and Biodiversity Stewardship Site Assessment Reports (BSSARs)
BAM	Biodiversity Assessment Method 2017
BAM-C	Biodiversity Assessment Method Calculator
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BCT	Biodiversity Conservation Trust
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offsets Scheme
BRW	Biodiversity risk weighting
BSA	Biodiversity Stewardship Agreement
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
IBRA	Interim Biogeographic Regionalisation of Australia (version 7)
LLS Act	<i>Local Land Services Act 2013</i> (NSW)
LMBC	land management and biodiversity conservation
the Manual	Biodiversity Assessment Method Operational Manual
OEH	Office of Environment and Heritage NSW, now the Environment, Energy and Science Group in the Department of Planning, Industry and Environment
PCT	Plant community type
SAII	Serious and irreversible impact
TBDC	Threatened Biodiversity Data Collection
TEC	Collective term for threatened ecological communities (vulnerable ecological communities, endangered ecological communities, critically endangered ecological communities)
VI	Vegetation integrity

Introduction

NSW Biodiversity Offsets Scheme

The NSW *Biodiversity Conservation Act 2016* (BC Act), and Biodiversity Conservation Regulation 2017 (BC Regulation) outline the framework for addressing impacts on biodiversity from development and clearing. The framework requires a proponent to avoid, minimise and offset impacts on biodiversity from these actions using the Biodiversity Offsets Scheme (BOS).

The BOS includes the Biodiversity Assessment Method 2017 (BAM), which is enabled by section 6.7 of the BC Act. The BAM provides:

- a transparent, consistent, and scientifically-based approach for the assessment of biodiversity values on a proposed development, clearing or biodiversity stewardship site
- guidance on how a proponent can avoid and minimise potential biodiversity impacts
- a method for calculating the number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity.

The BAM also establishes the process to assess biodiversity for biodiversity stewardship agreements, which are voluntary in-perpetuity agreements entered into by landholders, to secure offset sites.

The types of development proposals that are assessed using the BAM include:

- applications for development consent under Part 4 of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act), other than an application for state significant development or for a complying development certificate, (see section 7.13(1) of the BC Act), and the modification of such consents
- applications for development consent for state significant development or for approval for state significant infrastructure under the EP&A Act (see section 7.14(1) of the BC Act), and the modification of such consents
- Part 5 activity, where the proponent has elected to obtain a biodiversity development assessment report (BAR) under Division 2 of the BC Act, (see section 7.15(1) of the BC Act), and the modifications of such approvals
- biodiversity certification of land (see sections 8.2 and 8.7(1) of the BC Act)
- applications to clear native vegetation on rural land under Division 6 of Part 5A of the NSW *Local Land Services Act 2013* (LLS Act) that do not meet the requirements of allowable activities or the Land Management (Native Vegetation) Code 2018
- clearing of native vegetation in urban areas and environmental conservation zones under the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 (i.e. clearing that does not need development consent under the EP&A Act), that exceeds the offset thresholds.

Biodiversity Assessment Method – Operational Manual

Purpose of this Manual

The Biodiversity Assessment Method Operational Manual (the Manual) provides operational guidance to assist applicants and accredited assessors in the application of the BAM. The Manual is a companion document to the BAM. In general, the Manual does not seek to repeat text in the BAM and therefore the two documents should be read together. Any updates to administrative structures, position titles and data sources since the BAM was last gazetted may also be reflected in the Manual.

Applicants and accredited assessors should refer to the [Biodiversity Assessment Method \(BAM\) Calculator User Guide](#) for guidance on the operation of the Biodiversity Assessment Method Calculator (the BAM-C).

Structure of the Manual

The Manual is structured to reflect the three stages of the BAM. Each stage is presented as a separate document to enable easy access to relevant information when progressing through the implementation of the BAM.

Stage 1: Biodiversity assessment identifies the types of biodiversity values on land, such as:

- land proposed as a development site, including for a Part 5 activity
- land subject to a vegetation clearing proposal which is required to be assessed by BAM under the LLS Act
- land proposed to be biodiversity certified
- land proposed as a stewardship site under a Biodiversity Stewardship Agreement.

In general Stage 1 focuses on the assessment of the landscape context, the vegetation integrity (VI) of native vegetation¹, and habitat suitability for threatened species. Stage 1 of the Manual has been published (see Resources).

Stage 2: Impact assessment (biodiversity values) applies the avoid, minimise and offset hierarchy and assesses direct, indirect and prescribed biodiversity impacts associated with proposed activities. This stage also provides for the application of the no net loss standard through the calculation of the offset requirements for impacts on the biodiversity values at a development site and the establishment of the credit class and offset trading group for ecosystem credits and species credits. **Stage 2 is the focus of this document.**

Note, at times throughout this document, ‘development site’ may be used to refer to a site where impacts are proposed, and therefore also includes land proposed for clearing or biodiversity certification.

Stage 3: Improving biodiversity values is used to assess the anticipated improvement (or gain) in the vegetation integrity of native vegetation and habitat suitability for threatened species, the required management actions, and preparation of a management plan at a stewardship site. This stage is also used to determine the number of biodiversity credits created at the site from the improvement in biodiversity values.

¹ Native vegetation is defined under s. 60B of the *Local Land Services Act 2013* as plants native to New South Wales (trees, understorey plants, ground cover, plants occurring in a wetland); established in New South Wales before European settlement.

Stage 2: Impact assessment (biodiversity values and prescribed impacts)

Introduction to Stage 2

The purpose of Stage 2 of the BAM is to assess the impact (loss or gain) on the biodiversity values on a site. Stage 2 of the Manual is divided into the following parts:

- Part 1 – Avoiding and minimising impacts to biodiversity values during project planning (Chapter 8 of the BAM)
- Part 2 – Assessing and mitigating residual impacts using best practice land use planning and conservation principles (Chapter 9 of the BAM)
- Part 3 – Thresholds for the assessment and offsetting of unavoidable impacts of development (Chapter 10 of the BAM)
- Part 4 – Applying the no net loss standard (Chapter 11 of the BAM).

Under the BAM, the proponent must apply the key principle of avoiding or minimising the **direct, indirect** and **prescribed** impacts on biodiversity values. A biodiversity offset is determined for the residual impacts on biodiversity values. These measures must be demonstrated in the Biodiversity Development Assessment Report (BDAR) or Biodiversity Certification Assessment Report (BCAR).

Documenting Stage 2 outcomes

The minimum information requirements to be recorded in the BDAR or BCAR for the application of Stage 2 are provided in Appendices 10 and 12 of the BAM. Stage 2 results in submission of a final BDAR or BCAR including the finalised BAM-C case in the Biodiversity Offsets and Agreement Management System (BOAMS).

The final reports and digital data are to be submitted using the Upload Files function in the BOAMS (see section 3.3.3 of the BOAMS User Guide). Digital files include:

- final BDAR or BCAR and appendices
- ESRI-compatible spatial datasets for all map components generated for the assessment (in single Zip file or geodatabase)
- digital copies (scanned hardcopies) of all field datasheets for the vegetation integrity assessment
- Excel spreadsheets with survey results.

Resources

A range of online resources are available to assist assessors with the application of the BAM. All online resources and websites referred to in the Manual are listed in Appendix A. Key resources include:

- [Biodiversity Offsets and Agreement Management System \(BOAMS\)](#) – the system used to administer the BOS. Assessors must use the BAM-C in BOAMS for assessing and submitting proposals. BOAMS houses the version of the BAM-C that can save BAM assessments, submit BAM related applications, generate a credit obligation or apply to sell or retire credits. For more information about how to use the BOAMS, the User Guide can be accessed from the Frequently Asked Questions module after logging in to BOAMS.

- Biodiversity Assessment Method Calculator (BAM-C) – the tool that operationalises the BAM, it calculates the number and type of credits required to offset the impacts of development on, or credits generated from improvements in, biodiversity values.

Two versions of the BAM-C exist:

- a public standalone version (open to all but will not save data or print reports)
- a version accessed through the BOAMS for assessors to use when working on BAM related applications (see above).

Updates to the BAM-C occur periodically; registered users will be notified accordingly. Refer to the Biodiversity Assessment Method (BAM) Calculator User Guide for information on how to use the BAM-C.

- Biodiversity Assessment Method Operational Manual – Stage 1 – the document that provides guidance for implementing Stage 1 of the BAM including practical advice and examples when assessing the landscape context, the vegetation integrity of native vegetation and habitat suitability for threatened species.
- BioNet Vegetation Classification – a publicly accessible online database; registration is required. The database contains information on plant community types (PCTs) described for New South Wales including general location, floristic composition and structure, condition benchmarks and per cent cleared information.
- BioNet Threatened Biodiversity Data Collection – a publicly accessible online database referred to as the TBDC; registration is required. The database contains information for listed threatened species, populations and ecological communities. It houses the information and data used in the BAM-C including whether a species is a ‘species’ credit or ‘ecosystem’ credit species, or both.
- BioNet Atlas – a publicly accessible online database that contains biodiversity observation data for New South Wales. The database includes support from NSW BioNet quick guides, information sheets, manuals and datasheets. Ecological consultants need to request a login that gives access to full location data.
- BioNet Systematic Flora Survey – systematic vegetation survey data for NSW, including full floristic survey sites, rapid sites and site vegetation condition information. The database provides basic read-only access to the BioNet Systematic Flora Survey data collection and is available through the BioNet Atlas web application. Login access is required to contribute to, analyse or export BioNet Systematic Flora Survey data.
- BioNet Web Services – NSW biodiversity data held in BioNet that has been made available via an Open Application Programming Interface (API). It enables organisations and individuals to directly integrate biodiversity data into their software systems.
- Guidance to assist a decision-maker to determine a serious and irreversible impact – the guide that provides criteria and supporting information to assist with the application of the principles to identify a serious and irreversible impact (SAII) defined in the BC Regulation. Decision-makers can use this document to help them form an opinion on whether an impact will be serious and irreversible
- SEED data portal – Sharing and Enabling Environmental Data (SEED) is a shared resource for environmental data which includes public access to NSW Department of Planning, Industry and Environment (DPIE), Environment, Energy and Science Group datasets.
- PlantNET NSW – an online database of the flora of New South Wales that contains the currently accepted taxonomy for plants found in the State, both native and exotic, online keys for plant identification, as per the published *Flora of New South Wales* and updates. Plant taxonomy and naming in BARs are expected to be consistent with *Flora of New South Wales*.
- Spatial datasets:

- BioNet NSW (Mitchell) Landscapes – Version 3.1
- NSW Interim Biogeographic Regionalisation of Australia (IBRA region and subregions) – Version 7
- NSW soil profiles
- hydrogeological landscapes
- acid sulfate soils risk
- digital cadastral database
- Vegetation Information Systems maps
- Geological sites of NSW.

1. Avoid and minimise impacts on biodiversity values

Chapter 8 of the BAM sets out guidance on how proponents can demonstrate they have undertaken reasonable measures to avoid or minimise impacts of the proposed development, activity or clearing on biodiversity values, in accordance with section 6.12 of the BC Act.

Avoid and minimise impacts on biodiversity values

Inadequate consideration of avoiding and/or minimising biodiversity impacts can compromise the approval of a development application.

Consideration at an early stage in project planning can provide the greatest opportunities to reduce impacts on biodiversity and therefore reduce overall development costs.

For example, avoiding and minimising early in the project planning can achieve savings in time (shorter review time by the determining authority) and/or costs (lower offset requirements) by locating developments in cleared areas or sites with non-native vegetation.

The following principles should be applied when determining measures to avoid and minimise impacts of a project on biodiversity:

- actions are applied as early as possible in the project life cycle, to inform potential development decisions
- reasonable measures must span the life of the project, from development site selection and planning through to the operational and rehabilitation phases
- all measures evaluated, even those not selected for implementation, must be documented in the BDAR or BCAR. Onsite measures that will minimise impacts of a development are then included in the conditions of consent, should the proposal be approved, and form the basis of construction and operational environmental management plans (where relevant).

1.1 Requirements for the BDAR or BCAR

The assessor must include the following information in the BDAR or BCAR (see Table 26 in Appendix 10 or, for streamlined assessments, Table 28 in Appendix 12 of the BAM).

Report section: Avoid and minimise impacts (location and design)

Information	Maps and data
<p>Demonstration of efforts to avoid or minimise impacts on native vegetation, threatened species habitat and prescribed impacts during project planning including:</p> <ol style="list-style-type: none"> 1. locating the project – <ul style="list-style-type: none"> o options considered (including maps and why they were not feasible/suitable) o analyses associated with alternative options (e.g. routes, locations, sites within the property, constraints) o justification for selecting proposed location 2. designing the project – <ul style="list-style-type: none"> o temporary and permanent ancillary construction and maintenance facilities required for the proposal o options for avoiding these features (e.g. alternative locations, engineering solutions, modes of technology, constraints) o justification for selecting proposed location o measures taken to minimise impacts o long-term management of areas avoided. 	<p>ArcGIS compatible shape files provided for all maps and spatial data.</p> <p>All maps are easy to read with clear headings, keys, colour ramps, symbols and geo-references.</p> <p>Map of alternative locations or sites within the development site that were considered when locating and designing the project including constraints to the final selection.</p> <p>Map of the final development footprint, including demarcation of any prescribed impacts and measures to minimise impacts.</p> <p>Showing the areas of biodiversity value on the site map of where impact has been avoided will assist in demonstrating the reasonable measures that the proponent has taken to avoid and minimise impacts.</p>

1.2 Types of development impacts

The proponent and assessor must seek to avoid the **impacts** of the development on all biodiversity values, including:

- threatened ecological communities (TECs)
- all native vegetation
- habitat for threatened species and TECs including those described as prescribed impacts, see BC Regulation clause 6.1
- individuals of threatened species and populations.

There are different types of development impacts that must be considered according to the BAM. The assessor is required to consider each of these in the BDAR or BCAR, setting out the measures taken to avoid and minimise impacts.

Direct impacts assessed by the BAM are those that result from clearing vegetation for a development. These impacts are predictable, usually occur at or near to the subject land² and can be readily identified during the planning and design phases of a development. Direct impacts may be permanent (e.g. construction of a railway or building) or temporary (e.g. only occurring over weeks or months) and may result in partial (e.g. ground cover, litter and functional attributes such as logs removed but all other structural components of the vegetation remain) or complete clearing.

² The BAM defines subject land as the land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a Biodiversity Stewardship Agreement.

Indirect impacts are development related activities not associated with clearing for the development footprint and are described in Paragraph 9.1.4.2 of the BAM. Examples include increased noise, dust, light spill, weeds and pathogens and edge effects that can be reasonably attributed to the development. Indirect impacts often:

- occur beyond the development footprint or even the development site
- have a lower or variable intensity of impact compared to direct impacts
- may be harder to predict spatially and temporally
- may have unclear boundaries of responsibility.

Despite uncertainty, indirect impacts must still be considered in the site selection, design and operational phases of a project.

Prescribed impacts are those that may affect biodiversity values in addition to, or instead of, impacts from clearing vegetation. These impacts may be difficult to quantify or offset as they often affect biodiversity values that are irreplaceable. Consequently, avoiding or minimising such impacts is critical. Prescribed impacts are listed in the BC Regulation (cl. 6.1) and replicated here:

- the impacts of development on the habitat of threatened species or ecological communities associated with:
 - karst, caves, crevices, cliffs and other geological features of significance
 - rocks
 - human made structures
 - non-native vegetation
- the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- the impacts of development on movement of threatened species that maintains their life cycle
- the impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development)
- the impacts of wind turbine strikes on protected animals
- the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.

The information on biodiversity values collected in Stage 1 of the BDAR or BCAR must be used by the proponent and assessor to design and plan the project. As part of this process, all components required for the proposal are to be considered including ancillary infrastructure, temporary structures (e.g. access tracks/haul roads only used during construction), and modifications to existing infrastructure (e.g. road widening). Examples include:

- If a mine requires the construction and operation of a new power line or access to a rail network, this must be assessed as part of the overall proposal, not as a separate assessment.
- Dwelling developments and subdivisions must include associated infrastructure such as driveways, sheds/carports, sewage/water facilities, utilities access and asset protection zones in their assessment.

1.2.1 Avoiding biodiversity impacts

The assessor must clearly present information on how potential impacts on biodiversity values have been avoided in the BDAR or BCAR.

Avoidance should be demonstrated through site selection (locating the development footprint in areas away from biodiversity values), project design (adapting density, design and layout of the project), and scheduling (timing activities to account for species behaviours such as breeding, migration).

Avoidance is of key importance to prescribed impacts.

Examples of measures to avoid impacts on biodiversity values include:

- alternatives for the location and design of the development have been reasonably considered, where evidence to justify the final setting is provided in the form of estimated increases in cost (as dollar values) or resources (e.g. additional 10 km of pipeline was required for option X, re-routing roads/powerlines would add an additional X% to the project budget) for alternatives
- details of constraints that have influenced the selection of the development's location (e.g. areas of biodiversity, wind modelling for a wind farm development, location of resource deposits for a mine development)
- constraints for matters other than biodiversity that might restrict the availability of alternative sites or footprints (e.g. areas of flooding, proximity to neighbours with odour or noise concerns, zonings)
- consideration of whether the areas of impact are focused away from threatened species habitat (e.g. karst systems, waterbodies, corridors) or vegetation in good condition (i.e. has a high VI score)
- whether the proposed development makes the best use of space (e.g. overlapping infrastructure to minimise impact area).

1.2.2 Minimising biodiversity impacts

Where an impact cannot be avoided then reasonable measures must be identified to minimise the proposed impact. Different impacts, and the measures proposed to minimise them, may only be relevant for a particular project, phase of a project or apply to a specific threatened species.

In considering this step the assessor should report on:

- industry best practices and standards (citing appropriate references or standards)
- the proportion of the total cost of the development that is dedicated to biodiversity protection, including the costs to undertake the onsite measures and the cost of fulfilling the offset requirement
- the risk of failure of the measure.

Any measures proposed to minimise impacts must be set out and justified in the BDAR or BCAR. Examples include:

- clearly marking and protecting areas of retained vegetation on the site during the construction phase
- designing fencing to prevent fauna vehicle strike along roads
- designing wind turbines to dissuade birds from perching and minimise the diameter of rotor swept area
- implementation of hygiene protocols to minimise the spread of weeds and pathogens by staff/machines/vehicles into areas of retained native vegetation or threatened species habitat.

Further examples of avoiding and minimising impacts on biodiversity are provided in Chapter 8 of the BAM.

1.2.3 Documentation

Documentation of how impacts on biodiversity values were avoided and minimised must include spatial identification of relevant avoided areas (including maps and digital files), analyses (including data), and explanations or justifications for avoiding areas of impact.

Measures or options considered but **not implemented** because they are not feasible and/or practical (e.g. due to site constraints) must be documented, as this will provide the consent authority with confidence that the proponent has fully complied with the BAM.

1.3 Modifications to approved projects

Modifications to a development consent that was not a pending or interim planning application and which was approved **after** the BC Act commenced, must address the original and proposed impacts. The BDAR must also consider any measures already taken to avoid, minimise or offset biodiversity impacts for the original development.

Modifications to a development consent that was approved **before** the BC Act commenced (or is a pending or interim planning application), may require a BDAR to address any additional impacts on biodiversity values. The BDAR only needs to address the newly proposed impacts. The BDAR must still describe any measures already taken to avoid, minimise or offset biodiversity impacts for the original development.

Where the proponent seeks to adjust the credit requirement set out in the consent conditions for the approved development, a modification is required. A BDAR must be prepared where additional surveys undertaken in accordance with the BAM are used to apply for project modification to amend the outcomes of the original assessment and impact assessment on native vegetation, TECs and threatened species habitat.

Where an application to modify a biodiversity certification includes a BCAR, the BCAR must be a revised version of the original to incorporate the newly proposed impacts, and must identify whether any areas of land proposed to be added to the biodiversity certification were subject to approved measures under the original certification to avoid or minimise biodiversity impacts.

2. Assessing and mitigating impacts using best practice land use planning and conservation principles

Once the proposed development footprint has been set, Chapter 9 of the BAM requires the assessor to determine the direct and indirect impacts on native vegetation and threatened species habitat as well as prescribed impacts.

The assessor must assess the impacts of the development using the information and data gathered from the assessment in Stage 1.

Assessors should:

- obtain accurate information about all aspects of the project to ensure impacts from the proposal that affect biodiversity values are captured
- ensure that all details of the proposed development are assessed for impacts to biodiversity
- keep regular contact with the proponent to ensure that changes to the project concept or design details are fully assessed in the BDAR or BCAR, particularly where constraints are identified as the assessment of the proposal proceeds
- evaluate changes to current land management, such as cessation of grazing, and proposed land management practices that may have biodiversity impacts.

The assessor will need to consider all activities and structures with the potential to affect biodiversity values including (but not limited to):

- location and specifications for security fencing (including barbed or razor wire)
- Rural Fire Service requirements for asset protection zones
- provision of services, such as pipelines and cables
- access tracks and road widening
- screening or landscape plantings
- stockpiles and material laydown areas.

2.1 Requirements for the BDAR or BCAR

The assessor must include the following information in the BDAR or BCAR (see Table 26 in Appendix 10 or, for streamlined assessments, Table 28 in Appendix 12 of the BAM).

Report section: Impact assessment

Information	Maps and data
<p>Determination of the impacts on native vegetation and threatened species habitat including:</p> <ul style="list-style-type: none"> • describing impacts of clearing • calculating the change in VI score and habitat suitability • describing the nature, extent, frequency, duration and timing of indirect and prescribed impacts including during 	<p>ArcGIS compatible shape files must be provided for all maps and spatial data.</p> <p>All maps must be easy to read with clear headings, keys, colour ramps, symbols and must be geo-referenced.</p> <p>Table of biodiversity mitigation measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility. Unique identifiers (e.g.</p>

Information	Maps and data
<ul style="list-style-type: none"> construction and operation phases, on adjacent vegetation describing impacts that are uncertain and their management/mitigation evaluating consequences of indirect and prescribed impacts documenting limitations to data, assumptions and predictions. 	<p>BIO01) should be included for tracking through management plans and compliance auditing.</p> <p>Map of sites within the subject land likely to be impacted by direct, indirect and prescribed impacts where applicable.</p>

2.2 Assessing the impact of clearing native vegetation, TECs and threatened species habitat

The final development footprint³ of the project, is the area of land that must be used to assess the impacts of clearing. Most projects will result in complete clearing of vegetation and threatened species habitat within the development footprint. In this scenario, the assessor must assess the proposed **future value** of each of the VI attributes as zero in the BAM-C. For land where biodiversity certification is proposed, the **future value** of each of the VI condition attributes must also be recorded as zero in the BAM-C, because all biodiversity values present on the site are expected to be cleared as part of a future development.

In circumstances where partial clearing of vegetation is proposed and remaining vegetation will be **maintained** (i.e. not degraded further over time), the assessor may determine that the future value of the relevant VI attributes are greater than zero (see Table 1). The assessor must provide a clear outline of the ongoing management to be undertaken to maintain the expected future value where only partial clearing of native vegetation is proposed.

Table 1 Examples of partial vegetation clearing within the development footprint and associated future vegetation integrity scores for relevant attributes

Type of clearing activity	Attributes affected	Attributes not affected
Asset Protection Zone – example is slashing or mowing understory vegetation to a specified height	<p>Tree cover and species richness attributes will be retained but could decline due to ongoing vegetation thinning from maintenance work (score above 0 but below current condition).</p> <p>Attributes relating to shrubs and other growth form groups that generally occur in the mid storey will be cleared (score 0).</p>	<p>Cover attributes for grass and forb growth form groups and functional attributes such as large trees could retain current condition score if unaffected by Asset Protection Zone work and managed appropriately.</p> <p>Specific habitat features (e.g. hollow bearing trees) or specific threatened species may be targeted for retention.</p>
Easements for services (e.g. electricity transmission lines, telephone lines) – example is removal of large shrubs and trees	Trees and shrubs cleared resulting in these growth form groups' richness and cover attributes scored at 0, along with functional attributes such	Grass and forb richness and cover could retain current condition scores if unaffected by easement clearing or digging. Where no clearing or

³ Development footprint is defined in the BAM as the area of land that is directly impacted on by a proposed development, or the land where biodiversity certification is conferred, including access roads and areas used to store construction materials.

Type of clearing activity	Attributes affected	Attributes not affected
	<p>as number of large trees, tree regeneration, tree stem size class.</p> <p>Functional attributes such as litter cover and fallen logs may be partially retained, leading to a decrease in score.</p>	<p>digging is required in sections of the easement it may be possible to retain current scores.</p> <p>Vegetation would require ongoing management, particularly to ensure that maintenance of the easement does not increase exotic cover in the retained areas.</p>
<p>Recreational open space (e.g. community park) – example is increase in visitor access</p>	<p>Loss of grass and forb growth forms (replaced by turf) and large trees (considered unsafe) are likely to be cleared (score 0); while attributes relating to shrub cover and richness may be partially retained, leading to a decrease in score.</p>	<p>Retention of attributes will be highly site-specific. Scores must reflect the potential ongoing decline of remaining attributes due to increased human disturbance (e.g. rubbish, trampling, weed invasion) and/or if ongoing management is proposed.</p>
<p>Maintaining line of sight for an airfield – tree thinning</p>	<p>Attributes relating to the tree growth form group are likely to be removed to accommodate 'obstacle limitation surface' (low or 0 scores).</p>	<p>All remaining attributes could be retained at current condition scores if managed appropriately.</p>

In vegetation zones where partial clearing of attributes is scored the assessor must determine the **future value** for those attributes that will be retained (i.e. not scored as zero). Where a mixture of complete and partial clearing occurs in the same vegetation zone the assessor must map and identify these as different **management zones**. The [BAM Calculator User Guide](#) provides instruction on entering this information into the BAM-C for stewardship sites. The same method can be applied to a development site where it is used to characterise different impacts within individual vegetation zones (see Box 1).

Partial clearing scores must reflect any likely degradation from changed land use patterns (e.g. increased threats) and/or future management proposed (e.g. to enable recruitment). When assessing the impacts of partial clearing, the assessor must refer to the average values in the original plot data and the benchmark value for each of the condition attributes.

Box 1: Using management zones for assessing impacts of a major project

A poultry production complex has been proposed within a paddock used for stock grazing. The site supports a grassy open woodland dominated by black box (*Eucalyptus largiflorens*) meeting the definition of PCT 16 (Zone 1). A long-term, conservative grazing regime has resulted in the paddock being vegetated by a native grassland that meets the benchmarks for PCT 45 *Plains grass grassland in the Riverina*. Vegetation integrity plots confirm that most of the site is PCT 45 in moderate/good – high condition (Zone 2), apart from a cleared area and small patch of degraded grassland near a watering point (Zone 3).

The proposed development footprint includes clearing for construction of two poultry sheds, adjoining infrastructure and a single-lane access road from the sheds to the site boundary. There is a requirement for a firebreak inside the site boundary, which is to be mown twice a year.

Three vegetation zones have been mapped (see Figure 1). Impacts to Zone 1 have been avoided due to flooding constraints. Biodiversity values in Zone 2 will have three types of impact: no impact ('No impact' Figure 1); partial loss of structural and floristic attributes due to mowing for the firebreak ('Mowing'); and total clearing for construction of the shed, ancillary infrastructure and road ("Total impact").

The areas subject to the different impacts in Zone 2 are entered into the BAM-C as management zones. The likely change to vegetation integrity attributes due to each impact is included in the future value score for management zones following the procedure in section 6.7 of the BAM Calculator User Guide.

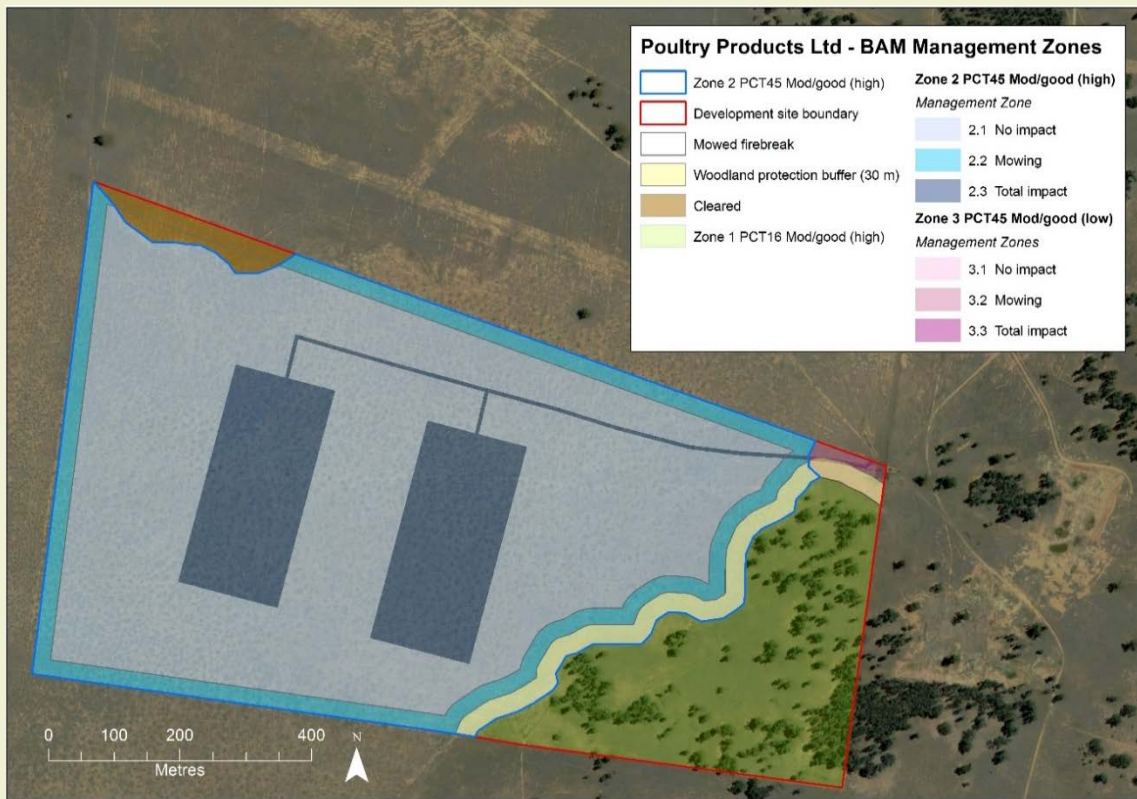


Figure 1 Example of map to illustrate areas of impact within vegetation zones

If it is unlikely the attribute will persist in the long term, or where ongoing management of the remaining biodiversity is not proposed the future values for the attribute should revert to zero. All partial clearing scores must be justified in the BDAR or BCAR (e.g. recruitment will be inhibited, increase in threats will be significant, weed management is only proposed for the short term).

The future VI score is determined for each vegetation zone (and any management zones) using Equations 8–14 and 17–18 in the BAM. These are calculated automatically by the BAM-C and are not repeated here.

Note that the vegetation condition assessment in BAM Stage 1 requires the assessor to record the number of trees with hollows (see Paragraph 5.3.4.29 of the BAM). The presence or absence of tree hollows does not influence the number of biodiversity credits required as part of the offset obligation. Instead, hollow bearing trees are assessed under habitat suitability (e.g. the presence of suitable breeding habitat for hollow nesting species) and form part of the credit profile for ecosystem credits (see BAM Operational Manual – Stage 1). It is important the assessor ensures that the location of their VI survey plots in the vegetation

zone are representative of the condition state of the vegetation. The location of plots should also seek to include hollow bearing trees where they are present.

2.3 Calculating the direct impact (the change in vegetation integrity score and habitat suitability)

The change in VI score is a key component in calculating the baseline number and type of biodiversity credits (ecosystem and some species credits) for the **direct impacts** of the proposed development. The baseline number of credits are those determined by the BAM that are required to be retired by the proponent.

Ecosystem credits are based on the change or loss in VI score of the proposed development on native vegetation and threatened species habitat through partial or complete clearing. These credits are automatically calculated for each vegetation zone in the BAM-C (see Equation 1 in the BAM).

Species credits where the unit of measure is 'area', are based on the loss of habitat taken as the change in VI score across all areas of suitable habitat for the species, as represented by the species polygon. Where the species polygon encompasses multiple vegetation zones, the BAM-C automatically collates the change in VI score for each vegetation zone within the species polygon to score the impact on species habitat (see Equation 2 in the BAM).

For threatened flora where the unit of measure is 'counts' of individuals, the assessor must record the number of individuals of the species that will be lost as a result of the proposed development. All individuals expected to be lost from the development must be captured within the species polygon. The VI score is not used in this assessment. Instead, the number of individuals within the species polygon is used to generate the baseline number of credits that are required to be retired by the proponent. These credits are automatically calculated in the BAM-C (see Equation 3 in the BAM).

For more on the unit of measure for a threatened species see the BAM Operational Manual – Stage 1 ('Survey data').

Impacts to threatened species habitat that is **not** native vegetation (e.g. caves, cliffs, human structures) are assessed as a prescribed biodiversity impact (see section 2.5 of this Manual). The assessment of prescribed biodiversity impacts does not directly contribute to the baseline number of biodiversity credits determined by the BAM-C. However, where these impacts cannot be minimised or mitigated, there may be a case to increase the credit requirement or propose compensatory measures to redress the proposed impacts, in the BDAR or BCAR, and for this requirement to form a condition of development consent (or approval).

2.4 Assessing indirect impacts on native vegetation and habitat

The BDAR or BCAR must contain a section documenting indirect impacts (see section 1.2 of this Manual). All indirect impacts to native vegetation and threatened species (and their habitat) within or beyond the development footprint must be identified. The BDAR or BCAR must describe the nature, extent, duration and consequences of the indirect impact on biodiversity values (see Table 2 for examples).

Table 2 Examples of different types of indirect impacts and the associated information to be documented in a BDAR or BCAR

Indirect impact	Impacted entities	Extent	Duration	Consequence
Dam construction: changed hydrology	Black box woodland (PCT 16)	Zone 1 (PCT 16)	Long-term	Loss of native species richness and cover in mapped vegetation downstream of the proposal site.
	Artesian springs wetland (PCT 66)	Zone 7 (PCT 66)		
Dam construction: increased sedimentation into downstream wetlands	TEC wetland and floodplain vegetation	Zone 7 (PCT 66)	Long-term	Loss of richness and cover in native species of impacted vegetation.
	Booroolong frog habitat	Streambed		Loss of Booroolong frog (<i>Litoria booroolongensis</i>) habitat leading to a decline in the population.
Weed invasion: inappropriate screening or landscape plantings	Grey box woodland TEC	Adjacent to Zone 5 (map included)	Potential long-term	Reduction in condition of TEC.
Subdivision: creation of informal tracks through adjacent vegetation leading to the beach.	Littoral rainforest TEC	Adjacent to Zone 4 (map included)	Long-term	Reduction in condition of the TEC, as a result, increased light penetration, weed and pathogen incursion, soil compaction from walking tracks.

Indirect impacts may occur at different stages of the development (e.g. construction or operation) or post-development because of changed land use patterns (e.g. increased likelihood of threats or changed hydrological processes).

Paragraph 9.1.4.2 of the BAM lists examples of indirect impacts the assessor must consider and, if relevant, address in the BDAR or BCAR. The list is not exhaustive, and assessors should use their best judgement when assessing indirect impacts of a project.

2.4.1 Using biodiversity credits to offset an indirect impact

Where indirect impacts on biodiversity cannot be avoided or adequately minimised (e.g. via mitigation measures or if mitigation fails), the proponent should consider retiring biodiversity credits to offset the proposed impact. Although the BAM does not determine a credit obligation for indirect impacts, the consent authority has the discretion to increase the number of biodiversity credits to be retired (or other conservation measures to be undertaken), if the increase is justified, having regard to the environment, social and economic impacts of the proposed development (see section 7.13(4) BC Act). These biodiversity credits are then additional to the baseline number of biodiversity credits determined by the BAM.

Proposing additional biodiversity credits to offset indirect impacts on retained or adjacent areas of native vegetation and threatened species or their habitat is becoming increasingly common. It is likely to be in response to the growing body of scientific evidence illustrating the suite of impacts on biodiversity adjacent to cleared land (e.g. 'edge effects'). Some examples of calculating credits for indirect impacts is provided in Box 2.

Box 2: Offsetting an indirect impact

The type of information provided in Table 2 can be used by the assessor to inform the best approach to estimate an offset for the indirect impact.

For example, map an area of vegetation adjacent to an existing vegetation zone, as a management zone. The area of the management zone can be defined by a set distance (e.g. an X metre buffer) from the outer edge of the direct impact area. The management zone is then used to estimate the indirect impact in terms of partial loss in the VI score. The partial loss (e.g. a percentage of the original condition), scored in future value of the vegetation in that management zone, is estimated by considering the impact of the changed land use on each of the condition attributes used to determine the VI score. Partial loss will depend on the type of development, the condition of retained vegetation and its proximity to the development.

Several major road infrastructure projects have used a 50 metre buffer along the edge of the direct impact footprint and, depending on the condition of the remaining vegetation, applied a percentage partial loss to the buffered area to generate a credit requirement.

Alternatively, some indirect impacts may result in the ‘sterilisation’ of remaining vegetation; for example, large-scale subdivisions often retain small remnants of native vegetation within the development footprint for recreation. If left unmanaged they are unlikely to remain viable in the long term due to incremental degradation (e.g. human disturbance, weed infestation). Often proponents agree to treat these areas as ‘cleared’ and offset the loss in biodiversity values accordingly.

2.5 Assessing prescribed biodiversity impacts

The prescribed impacts identified in Stage 1 of the BAM (section 6.7) must be assessed in accordance with section 9.2 of the BAM. In general, the assessment requires, for each prescribed impact identified, requires consideration of the:

- entities likely to use or inhabit the feature/s
- nature, extent and duration of the impact
- importance of the feature/s to the persistence of the entity and the consequences to the entity if the impact proceeds.

For many of these impacts the biodiversity values may be difficult to quantify, replace or offset, making avoiding or minimising prescribed impacts critical. Consequently, prescribed impacts are likely to be a specific point of consideration by the consent authority in forming their decision on whether to approve a proposal, and what conditions of consent could be applied to mitigate these impacts.

2.5.1 Entities likely to use or inhabit the feature/s

To generate the list of entities likely to use the feature/s identified as a prescribed impact in Stage 1, the assessor should consider:

- the list of candidate species produced by the BAM-C for the development site
- any BioNet records within the vicinity of the development site; here the assessor is attempting to capture those species that may have been filtered out of the candidate list by the BAM-C because they are not associated with PCTs on site

- information on species and threatened ecological communities occurrence from previous surveys, published and unpublished literature, local government data layers and other relevant sources
- information gained from field reconnaissance and site visits
- for wind farms, the bird and bat species resident in, or likely to fly over, the development site.

2.5.2 Nature, extent and duration of the impact

Similar to indirect impacts, the assessor must consider the types of impacts that could occur as a result of the various phases of development (e.g. operational, construction), whether these impacts will be permanent (e.g. rocky habitat is removed, water flow is redirected, alteration of cave microclimates due to loss of vegetation surrounding the entrance, removal of a shed used as a roost or breeding site for threatened bats) or temporary (e.g. short-term change in water flow, partial loss of connectivity between patches of vegetation that will be restored post-operational phase of the development). In the case of the latter, the duration of the impact will need to be documented.

The location of the prescribed impacts, including polygons identifying the extent of the impact, must be mapped on the Site and/or Location maps and included in the BDAR or BCAR. For example, wind farm developments should map the disturbance zones around wind turbines and the significant landscape and habitat features within the zone of disturbance (e.g. hollow bearing trees).

2.5.3 Consequences of the impact

For each prescribed impact the assessor will need to predict the likely consequences of the proposal and the impact it will have on all relevant species or ecological communities. Predictions must involve consideration of the effect on the species or community at the local, bioregional and state scales. The impact assessment should also consider any cumulative impacts (e.g. other large-scale or similar developments proposed within the region).

The factors used to predict consequences of the impact will depend on the prescribed impact and the target entity; for example, a development that fragments a wildlife corridor requires consideration of the target species' mobility, home range and life history characteristics as well as barriers to movement. Similarly, an estimated rate of vehicle strike for a development with ancillary roads would involve an analysis of the target species' abundance, movement patterns, home range and ability to cross barriers. Additional requirements for other prescribed impacts are outlined in section 9.2 of the BAM.

Predictions must be supported by evidence and documented in the BDAR or BCAR. Evidence could be in the form of:

- appropriate modelling (e.g. collision risk modelling for bird/bat strike by wind turbines)
- relevant literature, policies and guidelines (e.g. scientific publications, [Addendum to NSW Biodiversity Offsets Policy for Major Projects: Upland swamps impacted by longwall mining subsidence](#))
- unpublished but peer-reviewed reports
- consultation with species experts (documentation must include name of expert, qualifications, written advice, date advice received).

2.5.4 Using biodiversity credits to offset a prescribed impact

Prescribed impacts are difficult to quantify compared to direct, or even indirect, impacts. The BAM does not calculate biodiversity credits to offset a prescribed impact. The consent

authority has the discretion to increase the number of biodiversity credits to be retired (or other conservation measures to be undertaken), if the justification is due to environmental, social and economic impacts of the proposed development (see section 7.13(4) BC Act and clause 6.1.2 (b) BC Regulation). If mitigation measures or adaptive management are not applicable, the assessor and proponent should consider options to compensate for unavoidable prescribed impacts. Given there is no set method for determining a suitable quantum of credits to offset a prescribed impact, the assessor should clearly document the decision pathway and justification for suggested credit numbers or other compensatory actions in the BDAR or BCAR. Any biodiversity credits proposed are then additional to the baseline number of biodiversity credits determined by the BAM and will not be part of the credit report generated by the BAM-C.

Box 3: Direct and prescribed impacts for species credit species

Impacts on the habitat for some species credit species will result in **both** direct and prescribed impacts.

For example, impacts on habitat used by green and golden bell frogs (*Litoria aurea*) will generally result in baseline species credits generated from the loss of native vegetation in the area surrounding the waterbody on which they depend. These credits will form part of the credit report produced by the BAM-C and submitted with the BDAR or BCAR to the consent authority.

However, the loss of the waterbody feature itself will be assessed as a prescribed impact. Where the prescribed impact cannot be avoided or minimised, the proponent and assessor may consider options to compensate for this loss of habitat in the form of increased species credits or other actions that will directly benefit the species in the wild. These measures must be documented in the BDAR or BCAR as discussed in section 2.5 of this Manual.

In this situation, the map of the species polygon should clearly indicate areas that will generate a baseline credit as well as the areas that are a prescribed impact.

2.6 Mitigating and managing all impacts on biodiversity values

Impacts that cannot be avoided must be minimised. Reasonable measures to minimise impacts are discussed in Subsection 1.2.2 of this Manual. For all remaining impacts mitigation strategies should be implemented. Section 9.3 of the BAM outlines the requirements for a mitigation strategy, which includes:

- documenting mitigation measures for each residual impact, meaning:
 - the type of action
 - the detailed method to implement the action
 - schedule for implementation (location, timing and frequency)
 - the person/organisation responsible for undertaking the action
 - ecological measures for working out if the mitigation has been successful that adhere to SMART (Specific, Measurable, Achievable, Realistic, Timebound) principles
 - reporting requirements (timing and frequency)
 - how to determine when the action is complete (ecologically-based completion criteria)

- triggers for remedial actions leading to adaptive management (see section 2.7 of this Manual for information on adaptive management)
- consideration of the risk of failure including constraints to implementation such as financial, biophysical and resource availability
- evaluation of the remaining risks and associated consequence for biodiversity. Where the risk of failure remains high, consideration should be given to alternatives that assume failure such as additional offsets either in the form of credits or conservation actions (for example see Subsection 2.4.1 of this Manual on indirect impacts).

Section 9.3 of the BAM provides examples of mitigation measures for impacts in relation to the displacement of resident fauna during the different phases of development and indirect impacts on native vegetation, threatened species habitat and prescribed impacts. These examples are not exhaustive as each development proposal is unique and assessors must use their judgement when considering mitigation measures to include in a mitigation strategy.

Where mitigation measures are proposed for a large-scale development, each action must be numbered, with numbering maintained throughout the Environmental Impact Statement (EIS, see examples in Tables 3–5). This formatting will enable linking with management plans and streamline the review process for the consent authority. It will also assist to ensure the mitigation measures presented in the BDAR or BCAR are accurately transferred to the main EIS report.

Tables 3, 4 and 5 provides examples of the types of information expected for a mitigation strategy to manage a residual impact. Additional information may be appropriate depending on the specific project. Sections of the BDAR or BCAR would further describe elements of the impact and mitigation measures. Individual protocols would also be developed either in the BDAR, BCAR or a Biodiversity Management Plan (if required).

Table 3 Example of mitigation measures proposed in a BDAR, BCAR or Biodiversity Management Plan (if required) for impacts to biodiversity for a solar farm

Impact	Mitigation measure	Monitoring schedule	Responsibility
Native vegetation removal and disturbance potentially leading to weed incursion into adjacent retained native vegetation	Biodiversity measure 1: based on results of the ecological survey, targeted weed survey will be completed before works commence	Pre-construction (baseline data): maps of weed infestation location, report detailing species, cover and extent at each location	Site Environmental Officer
	Biodiversity measure 2: control of existing weeds (Bathurst Burr) will be undertaken before works commence to minimise spread of existing populations due to construction	During construction: weekly visual inspections to identify weed germination	Site Environmental Officer
Native vegetation removal and disturbance potentially leading to weed incursion into adjacent retained native vegetation	Biodiversity measure 3: before entering the site, wash all machinery and equipment to remove soil and weed seeds	During construction: visual inspection of all vehicles entering site	Site Supervisor

Impact	Mitigation measure	Monitoring schedule	Responsibility
	Biodiversity measure 4: all imported fill will be certified weed free	During construction: weekly inspections of all filled areas to identify weed germination	Site Environmental Officer
	Biodiversity measure 5: sterile exotic crops or ground cover will be used if plantings are required beneath solar panels	Post-construction: quarterly inspections for two years after works and annual inspections for the life of the project	Project Manager
	Biodiversity measure 6: control of weeds (high threat listed in an appendix to the report) throughout the site and adjacent vegetation over the life of the project, using ecologically appropriate methods	During construction: weekly visual inspections Post-construction: quarterly inspections for two years after works and annual inspections for the life of the project	Site Environmental Officer and Project Manager

Table 4 Example of operational weed management performance and completion criteria to be included in a BDAR, BCAR or Biodiversity Management Plan (if required) for impacts to biodiversity for a solar farm. The table links to Table 3.

Action	Performance criteria	Method	Completion criteria
Biodiversity measure 6: control of weeds (high threat listed in an appendix to the report) throughout the site and adjacent vegetation over the life of the project, using ecologically appropriate methods	Number of infestations of identified weed species equal to or less than baseline dataset Per cent cover for identified weed species in each management zone equal to or less than baseline dataset No occurrences of identified weed species in random plots sampled from adjacent vegetation	Survey at existing infestation locations Transect surveys throughout all areas of disturbance within the project site Permanently marked floristic plot sampling in randomly selected locations in adjacent native vegetation Opportunistic observations by all site staff	Ongoing for the life of the project

Table 5 Example triggers for adaptive management of weed infestations to be included in a BDAR, BCAR or Biodiversity Management Plan (if required) for impacts to biodiversity for a solar farm. The table links to Tables 3 and 4.

Action	Performance criteria	Trigger thresholds ⁴	Response	Reporting
Biodiversity measure 6: control of weeds (high threat listed in an appendix	Per cent cover for identified weed species in each	Any infestation in location not on baseline map	Eradication of new weed infestation according to	Weed contractor reports to Project Manager

⁴ Trigger thresholds are site-dependent and may differ from this example subject to specific project requirements, site factors, location and vegetation characteristics.

Action	Performance criteria	Trigger thresholds ⁴	Response	Reporting
to the report) throughout the site and adjacent vegetation over the life of the project, using ecologically appropriate methods	management zone equal to or less than baseline dataset		weed management protocol in appendix to the report	Extent polygons and survey results updated and submitted after each monitoring
	Per cent cover for identified weed species in each management zone equal to or less than baseline dataset	A >5% increase in extent for any mapped polygon	Control weeds according to weed management protocol in an appendix	Details included in annual report to DPIE
	Occurrence of identified weed species in adjacent native vegetation	Any infestation within native vegetation not identified during baseline survey	Eradication of new weed infestation according to weed management protocol in an appendix	

2.7 Management for uncertain impacts

Some impacts are difficult to predict or assess prior to commencement of the development. Section 9.4 of the BAM provides guidance to adaptively manage impacts that are uncertain, such as damage related to karst, caves or other rocky ecosystems; subsidence and upsidence from longwall mining; or wind turbine strike. The management of uncertain impacts requires the development of an adaptive management plan.

Adaptive management is essentially an adjustment of actions based on results, to achieve a specified outcome. It requires a trigger for necessary remedial action to be taken, such as adjusting the activity causing the impact or adjusting the mitigation measure. Monitoring should enable the proponent to determine if measures are being implemented as planned and provide an early warning of measures that are ineffective and/or the uncertain impact is being realised. Documentation of any adaptive management plan must, where relevant, include:

- baseline data to be used to monitor change; this must be collected pre-impact
- seasonal changes or relevant impacts to be measured
- monitoring techniques and effort based on best practice (e.g. published peer-reviewed guidelines)
- frequency and type of reporting
- completion and performance criteria that adhere to the SMART principles, and are ecologically-based; these can then act as triggers for management intervention actions
- information that will be necessary to measure the impact over time and consideration given to how these results could be used to inform ongoing (or future) operations.

For uncertain impacts that cannot be adaptively managed or where the risk of management failure is high the assessor and proponent should consider options to compensate for the loss in biodiversity values. Where this is proposed the assessor should clearly document the decision pathway and justification for suggested credit numbers or other compensatory

actions in the BDAR or BCAR. Any biodiversity credits proposed are then additional to the baseline number of biodiversity credits determined by the BAM and will not be part of the baseline credit report generated by the BAM-C.

The consent authority also has the discretion to increase the number of biodiversity credits to be retired (or other conservation measures to be undertaken) in relation to an uncertain impact, if the increase is justified having regard to the environmental, social and economic impacts of the proposed development (see section 7.13(4) BC Act).

Box 4 provides an example of a mitigation strategy that effectively manages an uncertain impact. The strategy also includes a final step to generate and retire credits should earlier measures set out in the mitigation strategy fail to prevent the impact.

Box 4: Upland swamps impacted by longwall mining subsidence

Upland swamps are perched freshwater wetlands that occur in shallow basins of low hills or mountains. Examples include Coastal Upland Swamps, Newnes Plateau Shrub Swamps, Montane Peatland and Swamp, Blue Mountains Swamps and Temperate Highland Peat Swamps on Sandstone.

Subsidence impacts from longwall mining on upland swamps are inherently more uncertain than the clearing of native vegetation and it takes time and monitoring to ascertain whether impacts have occurred. The *Addendum to NSW Biodiversity Offsets Policy for Major Projects* provides the framework to address these uncertain impacts and could be used as a model for developing an adaptive management strategy for uncertain impacts from other types of development. In general, the framework includes:

- indicators to detect impacts on the target entities (e.g. hydrological monitoring, species monitoring)
- monitoring program with timeframes (e.g. minimum two-year pre-impact monitoring), and design requirements (e.g. control sites to ensure that changes in indicators are a result of the development activity as opposed to natural variability)
- measurable thresholds at which impacts are likely to affect the target entities (e.g. quantifiable changes in hydrology within 12 months of the commencement of mining operations)
- steps to be undertaken once impact thresholds have been triggered (e.g. reporting results to the consent authority, review of results by an independent panel, changes to future longwall panel layout to avoid further impacts)
- the process to calculate, and retire, an offset requirement if thresholds are exceeded and impacts occur.

3. Thresholds for assessment and offsetting impacts of development

Once the development footprint has been finalised based on the relevant assessments undertaken as part of Stage 1 and Stage 2 of the BAM, the assessor can consider requirements for offsetting remaining impacts on biodiversity values.

3.1 Requirements for the BDAR or BCAR

The assessor must include the following information in the BDAR or BCAR (see Table 26 in Appendix 10 or, for streamlined assessments, Table 28 in Appendix 12 of the BAM). Note that this section of the BAM does not apply to Biodiversity Stewardship Agreements.

Report section: Impact summary

Information	Maps and data
<p>Identification of impacts:</p> <ul style="list-style-type: none"> on entities at risk of a serious and irreversible impact (SAIL), including addressing the assessment criteria in Subsection 10.2.2 (TECs) and 10.2.3 (species) of the BAM requiring offsets not requiring offsets not requiring further assessment. <p>All relevant information required by the consent authority to determine whether the proposed impact is serious and irreversible including:</p> <ul style="list-style-type: none"> clear documentation of the sources of information where confidence in the information provided is low or of questionable reliability how proposed additional measures will contribute to the recovery of the entity where information is not available, for example where impact thresholds for the entity have not been provided. 	<p>ArcGIS compatible shape files must be provided for all maps and spatial data.</p> <p>All maps must be easy to read with clear headings, keys, colour ramps and symbols.</p> <p>Maps must be geo-referenced.</p> <p>Mapped locations:</p> <ul style="list-style-type: none"> that support an entity at risk of a serious and irreversible impact (SAIL) where offsets are required where offsets are not required, and where no further assessment is required. <p>Maps illustrating the extent of a TEC or species distribution and any other data used to address the assessment criteria for an entity at risk of an SAIL.</p>

3.2 Entities that are at risk of a serious and irreversible impact

The concept of a serious and irreversible impact (SAIL) is fundamentally about protecting threatened species and threatened ecological communities that are most at risk of extinction from development or clearing activities. The BC Act and the LLS Act impose obligations on consent authorities in relation to impacts on biodiversity values that are likely to result in serious and irreversible harm. These obligations generally require a consent authority to determine whether any of the residual impacts of a proposed development, biodiversity certification or vegetation clearing on biodiversity values are serious and irreversible. The assessor must identify the entities at risk of an SAIL from the proposed development in the BDAR or BCAR.

The principles to determine an SAIL are outlined in the BC Regulation. The Department has also published supporting guidance that helps consent authorities interpret these principles. The principles broadly align with the criteria prepared by the International Union for the Conservation of Nature (IUCN) (IUCN 2017⁵, Keith et al. 2013⁶) to assess the extinction risk of species and ecological communities at the status of critically endangered. Critically endangered entities are those facing the greatest risk of extinction.

The Environment, Energy and Science Group within the Department of Planning, Industry and Environment has undertaken an assessment of all entities listed as threatened under the BC Act against the principles and associated criteria. Those considered to be at risk of an SAIL are:

- listed on the Department website
- available from BioNet in the Threatened Species Data Collection (TBDC)
- displayed in the BAM-C for a development, clearing or biodiversity certification proposal.

It is worth noting that misalignments in lists of entities between the above three sources may occur from time to time (e.g. a species is listed as at risk of a SAIL in the TBDC but does not display as such in the BAM-C). Inconsistencies are due to periodic updates to threatened species schedules and/or new information on a species, and associated timing of updates to the different sources. Assessors will be notified of any changes to the list of entities at risk of an SAIL and should check all sources to ensure they are addressing the appropriate entities in their assessment.

Where there is evidence a threatened entity meets one or more of the principles in the BC Regulation but it is not currently listed as at risk of an SAIL in any of the appropriate sources, the assessor must assess the entity in accordance with section 10.2 of the BAM. Further, the consent authority may require additional entities to be assessed under section 10.2.

Equally, where an assessor or consent authority considers an entity listed as at risk of an SAIL no longer meets any of the principles, they should contact the Department via the BAM support mailbox (bam.support@environment.nsw.gov.au) recommending reassessment of the entity. Quantitative evidence must be provided to support this reassessment, noting that the principles operate at the state scale.

The role of the assessor is to provide, via the BDAR or BCAR, all the relevant information required for the consent authority to make the determination on whether the proposed impact will be serious and irreversible. The assessment criteria for impacts on TECs at risk of an SAIL are in Subsection 10.2.2 of the BAM and for species, Subsection 10.2.3. **The assessor must address all the assessment criteria for each entity at risk of an SAIL.** The assessment must include:

- clear documentation of the sources of information used such as scientific literature, published and unpublished technical reports, databases, documented field observations or expert opinion (referred to as a ‘pers. comm.’ with the date of communication, qualifications, advice provided and contact details of the expert)
- geo-referenced maps illustrating the derivation of data to address assessment criteria relating to the extent, fragmentation or isolation of the TEC or species population within

⁵ IUCN Standards and Petitions Subcommittee 2017, *Guidelines for Using the IUCN Red List Categories and Criteria*, Version 13, prepared by the Standards and Petitions Subcommittee, downloadable from www.iucnredlist.org/documents/RedListGuidelines.pdf.

⁶ Keith DA, Rodríguez JP, Rodríguez-Clark KM, Nicholson E, Aapala K, Alonso A, et al. 2013, Scientific Foundations for an IUCN Red List of Ecosystems, *PLoS ONE* 8(5): e62111, doi.org/10.1371/journal.pone.0062111.

the development site and more broadly (e.g. in relation to Subsections 10.2.2 (d), (e), (f) and (h); 10.2.3 (f), (g) and (i))

- an indication of the confidence in the information provided (e.g. low confidence if information is inferred from other similar taxa or communities), or if it is of questionable reliability (e.g. from an unknown source, historical data)
- documentation of any additional conservation measures (i.e. above the credit requirement generated by the BAM-C) proposed and how these will contribute to the recovery of the entity
- where information is not available, for example where impact thresholds for the entity have not been provided (see Subsections 10.2.2 and 10.2.3 (c))
- references to sections of the BDAR or BCAR where the information has been documented (e.g. Subsections 10.2.2 and 10.2.3 (a)) and therefore does not need to be repeated.

The assessor is not required to provide a recommendation on whether the impact is serious and irreversible. It is for the consent authority to determine whether an impact will be serious and irreversible. Relevant legislation, policies and other documents do not need to be replicated in the BDAR or BCAR but merely referenced. The BDAR or BCAR should only contain information in accordance with the assessment criteria.

3.2.1 Threatened ecological community assessment criteria

The assessor is required to address the assessment criteria in Subsection 10.2.2 of the BAM for each TEC at risk of an SAIL that is to be impacted by the proposal.

Several of the assessment criteria involve consideration of the area and condition of the TEC to be directly and indirectly impacted (see Paragraph 10.2.2.1 (b), (d), (e) and (f)). These estimates must be made in hectares and based on assessing direct losses (e.g. through clearing), and indirect losses, such as changes in environmental factors that will degrade the TEC over time (e.g. fire regimes, hydrology, pollutants, species interactions, increased edge effects, disturbance, and disease, pathogens and parasites).

Estimates of the total current extent of the TEC at various geographic scales including within 1000 hectares and 10,000 hectares of the development footprint, IBRA subregion, IBRA region and the reserve system are to be reported in hectares **and** as the proportional change in extent of the TEC assuming project approval. For example, when reporting on extent of the TEC in the IBRA region, the assessor is to include in the BDAR or BCAR:

1. an estimate of the total extent in hectares of the TEC in New South Wales (often reported in the Listing Determination, the date of listing should be considered when using this information)
2. an estimate of the total extent in hectares of the TEC in the IBRA region where the project will occur
3. the area in hectares that will be removed due to the project
4. the extent remaining in the IBRA region post-clearing, in hectares and as a proportional loss of the total area.

While assessment criteria do not explicitly require reporting on the extent of the TEC in New South Wales this should be reported on, as this is the scale at which the principles of SAIL operate.

Several assessment criteria require consideration of the condition of the TEC. While condition at the site scale can be reported via the VI score, condition can also be assessed by:

- considering the list of species at the site compared to the list of characteristic species of the TEC (where available, often the Final Determination or a relevant decision in the Land and Environment Court will contain this information)
- a description of the state of the TEC in relation to key threats and the severity of their impact.

Reporting on the fragmentation and isolation (see Paragraph 10.2.2.1 (h)) of the TEC should include, but is not limited to:

- an estimate of the area of each of the remaining, but now isolated, remnants of the TEC (including a map)
- the maximum dispersal distances for characteristic native species (both fauna and flora) of the TEC (characteristic species are available from the Listing Determination)
- distance between isolated areas of the TEC, presented as:
 - average distance if the remnant is retained
 - average distance if the remnant is removed as proposed.

Such information is important in determining the level of exchange between remnants (genetic, dispersal, pollinator, etc.) and therefore the long-term viability of the TEC.

3.2.2 Species or population specific assessment criteria

The assessor is required to address the assessment criteria in Subsection 10.2.3 of the BAM for each species or population at risk of an SAIL that is to be impacted by the proposal.

Several of the assessment criteria involve consideration of the size of the population to be directly and indirectly impacted (see Paragraph 10.2.3.1 (b), (d), (g) and (i)). The estimate can be made using:

- the number of individuals (mature and immature) present in the population on the development site along with consideration of the area of habitat likely to contain soil seed bank or dormant tubers for plants, or suitable habitat for animals
- the number of individuals (mature and immature) to be impacted by the proposal
- if the species' unit of measure is 'area' or is assessed by mapped important areas (see BAM Operational Manual – Stage 1), through the provision of data on the number of individuals estimated on the development site (either by survey or expert report), and the number likely to be impacted, along with the areas of habitat at the development site and proportion to be impacted
- extent of occurrence and area of occupancy of the species in New South Wales and how/if this will be affected by the proposal (this helps to inform the importance of the local population to species persistence)
- the current population size of the species at various geographic scales including the reserve system in New South Wales, IBRA region and subregion.

While assessment criteria do not explicitly require reporting on the population size in New South Wales this should be included as it is the scale at which the principles of SAIL operate. All data are to be presented as whole numbers as well as percentages where appropriate; for example, the number and percentage of individuals that will be lost from the local population if the proposal is to proceed, as well as from the species' population at the scales of the NSW reserve system, IBRA region and subregion.

Assessment criteria relating to fragmentation and isolation of the population (see Paragraph 10.2.3.1 (g) and (f)) if the proposal proceeds will inform whether the existing population will remain viable post-impact. Consideration is to be given to:

- availability of habitat required to support the remaining population

- distance over which genetic exchange can occur (i.e. dispersal and pollination distance for the species)
- habitat available within dispersal distance.

Criteria relating to an increase in threats to the species or population (see Paragraph 10.2.3.1 (h)) should be assessed as changes in biotic and abiotic factors as a result of the project, including (but not limited to):

- fire regimes (frequency and severity)
- hydrology
- pollutants
- species interactions (e.g. increased competition, effects on pollinators or dispersal)
- increased edge effects (weed and feral animal encroachment)
- likelihood of disturbance, disease, pathogens or parasites.

3.3 Impacts that require an offset

The BAM includes thresholds that identify where no further assessment is required or where no offset is required for the proposed impact for some biodiversity values and/or areas of the subject land. These thresholds are described in Sections 10.3 and 10.4 of the BAM and are summarised here:

- An assessment of ecosystem credits is not required for areas on the subject land without native vegetation (in accordance with Chapters 4 or 5).
- An ecosystem credit obligation is not required for a vegetation zone that has a VI score of either:
 - <15 where the PCT is representative of an endangered or critically endangered ecological community
 - <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community
 - <20 where the PCT is not representative of a TEC or associated with threatened species habitat (as represented by ecosystem credits).

The required ecosystem credits, and species credits (as identified by section 6.4 of the BAM), are calculated in accordance with Chapter 11 of the BAM.

Areas of the subject land that do not contain native vegetation or that contain native vegetation below the condition thresholds listed above, must still be assessed for species credit species, in accordance with Chapter 6 of the BAM. Similarly, if the vegetation is a TEC that is at risk of an SAll then the criteria in Subsection 10.2.2 of the BAM must be addressed even if no offset is required.

4. No net loss standard

The net ecological outcome, or standard, of the BAM is no net loss of biodiversity. The standard is achieved by ensuring that the amount of credit required from an impact is at least equivalent to the amount of credit generated from an offset, notwithstanding specific exemptions.

The standard of no net loss is compared to a scenario in which neither the impact nor the offset occurred (i.e. a ‘business as usual’ scenario) and therefore assumes a level of ongoing decline in biodiversity (see Table 8 of the BAM). Biodiversity credits created at a biodiversity stewardship site account for this ongoing decline via the averted loss calculation embedded in gain metrics (see section 13.5 of the BAM).

4.1 Requirements for the BDAR or BCAR

The assessor must include the following information in the BDAR or BCAR (see Table 26 in Appendix 10 or, for streamlined assessments, Table 28 in Appendix 12 of the BAM). Note that this section of the BAM does not apply to Biodiversity Stewardship Agreements.

Report section: Impact summary

Information	Maps and data
<p>The assessor is required to report on:</p> <ul style="list-style-type: none"> the biodiversity risk weighting (BRW) for each ecosystem and species credit requirement generated the number of ecosystem credits for each PCT/TEC the number of species credits for each species credit species impacted by the proposal biodiversity credit report from the BAM-C, which defines the number and class of ecosystem and species credits from the proposed impact. 	<p>ArcGIS compatible shape files must be provided for all maps and spatial data.</p> <p>All maps must be easy to read with clear headings, keys, colour ramps and symbols. Maps must be geo-referenced.</p> <p>All digital data must be submitted using the Upload Files function in BOAMS:</p> <ul style="list-style-type: none"> digital shape files for all maps and spatial data completion of all required data fields in BOAMS and the BAM-C. <p>Finalised case in the BAM-C (can be returned to assessor for editing).</p>

4.2 Calculating the number and type of biodiversity credits

The BAM only generates a biodiversity offset requirement for residual impacts from the proposed development. The consent authority must be satisfied that all attempts have been made to avoid, minimise and mitigate impacts on biodiversity. **Therefore, it is important that the assessor clearly addresses and documents outcomes from the application of Chapters 8 and 9 of the BAM in the BDAR or BCAR. Few to no offsets may be required if impacts are avoided or minimised.**

Section 11.2 of the BAM outlines the calculations used to determine the offset requirement in the form of biodiversity credits. There are two broad biodiversity credit classes – ecosystem and species credits. These two credit classes are further described in Appendix B of the BAM Operational Manual – Stage 1.

The BAM-C automatically applies the metrics to generate the credit requirement. Credits for an entity at risk of an SAll will also be calculated and should be provided in the BDAR or

BCAR. The consent authority determines whether the impact is serious and irreversible as part of the development approval process. Where the consent authority determines the impact is **not** serious and irreversible, the proponent will be required to offset the impact to that entity. Where the consent authority determines the impact **is** serious and irreversible, certain development and clearing proposals cannot be approved, while others may be approved subject to additional and appropriate measures to minimise the impacts and/or a requirement to retire additional credits (above the baseline number) or undertake compensatory measures.

4.2.1 Ecosystem credits

The BAM-C applies Equation 1 of the BAM to calculate ecosystem credits for a vegetation zone. Calculations are based on the:

- change in VI score (as determined by Equation 19 of the BAM)
- biodiversity risk weighting for the PCT (or TEC) (see Box 5)
- area in hectares.

Equation 1 also includes a standard multiplier of '0.25', which is used to bring the quantum of credits to a manageable number. The multiplier is applied equally to loss and gain equations for ecosystem credits (see Equation 4 of the BAM); as such, it has no effect on offset ratios.

The credits calculated per vegetation zone using Equation 1 are then added together to determine the number of ecosystem credits required per PCT (or TEC).

For ecosystem credits, the sensitivity to loss component of the BRW is determined by the highest threat ranking for any listed TEC, or where there is no TEC, the per cent cleared status of the PCT (these data are available in BioNet) identified at the site. The sensitivity to gain component is derived from the ecosystem credit species associated with the PCT that has the highest sensitivity to gain ranking. A PCT (or TEC) that is not associated with, or does not provide habitat for, an ecosystem credit species will automatically be allocated a sensitivity to gain score of one (see Table 18 in the BAM).

Box 5: Biodiversity risk weighting

It is common practice to adjust metrics used in offset calculations by multipliers. Generally, multipliers are employed to address issues that are difficult to account for within the offset metric, such as:

- social equity and distributional issues (e.g. where offsets are located)
- a desire to ensure a particular long-term outcome (e.g. consideration of existing conservation targets, 'endgame' protection levels)
- temporary loss (i.e. loss of biodiversity/ecosystem services' benefits for stakeholders)
- sources of risk/uncertainty that the intended goal (such as No Net Loss, Net Gain) will not be achieved (e.g. uncertainty that impacts on entities can be adequately offset)
- to compensate for dissimilar biodiversity values between the impact and offset site or uncertainty in assessment processes/implementation/data (Rayment et al. 2014).

These are often referred to as 'risk multipliers' and are based on the precautionary principle. Risk multipliers serve to increase the basic size of an offset (as set by the underlying biodiversity currency and associated accounting model), thereby helping to

alleviate concerns that the offset may be insufficient to deliver the desired outcome (BBOP 2012).

The BRW is used as a basic risk multiplier in BAM credit calculations. It is comprised of two components:

- sensitivity to loss, which estimates the increased threat posed to an entity from offsetting the loss of habitat or population
- sensitivity to gain, which estimates the ability of a species to respond to improvements in habitat condition at an offset site.

For information on the factors that determine sensitivity to loss or gain for an entity see Appendix 7 of the BAM.

Notes:

BBOP 2012, Resource paper: *No Net Loss and Loss-Gain Calculations in Biodiversity Offsets*, Business and Biodiversity Offsets Programme (BBOP), Washington DC.

Rayment M, Haines R, McNeil D, Conway M, Tucker G and Underwood E 2014, Study on specific design elements of biodiversity offsets: *Biodiversity metrics and mechanisms for securing long-term conservation benefits*, Institute for European Environmental Policy and ICF International.

The assessor must report in the BDAR or BCAR the:

- BRW for each ecosystem credit requirement
- number of ecosystem credits calculated for each PCT (or TEC)
- biodiversity credit report from the BAM-C, which identifies the number and class of ecosystem credits from the proposed impact.

Where the total number of credits for a vegetation zone is less than one, the BAM-C will always round up to one credit.

4.2.2 Species credits

The calculation used to determine the species credits is dependent on the unit of measure used to assess the proposed impact. Species are either assessed by ‘area of suitable habitat’ (all threatened fauna and some threatened flora) OR ‘counts of individuals’ (remaining threatened flora). The unit of measure for a species is identified in the TBDC and appears in the BAM-C.

Equation 2 of the BAM is used to calculate credits for species assessed by the area of suitable habitat; it is based on the:

- condition of the habitat in the species polygon, taken as the change in VI score per vegetation zone
- BRW for the species
- area of habitat in hectares per vegetation zone.

The standard multiplier of 0.25 is also applied.

Equation 2 is applied per vegetation zone within a species polygon. The results for each vegetation zone are then added together to determine the number of species credits required for that species polygon. The area of habitat for a vegetation zone may be less than the total size of the vegetation zone; for example, where a species polygon is based on a 50 metre buffer of a creek line, but the vegetation zone continues beyond the 50 metre

buffer. Only the area of that vegetation zone within the species polygon is used in the calculations.

For species where the unit of measure is counts of individuals, credits are calculated using Equation 3 of the BAM. This equation is based on the change in the number of individuals from the proposed project and the BRW. No standard multiplier is required because species assessed by count are generally long-lived trees and shrubs with naturally low abundance.

The assessor must report in the BDAR or BCAR the:

- BRW for each credit requirement
- number of species credits calculated for each species credit species impacted by the proposal
- biodiversity credit report from the BAM-C, which defines the number and class of species credits from the proposed impact.

Where the total number of credits is less than one the BAM-C will always round up to one credit.

4.3 Offset rules and biodiversity credit classes

Once Stage 2 of the BAM is complete the proponent must consider how to meet any offset obligations. The biodiversity credit class assigned to ecosystem credits determines the type of credits that can be used to offset the impacts of developments via application of the offset rules. The offset rules are established through the BC Regulation; these include:

- retiring credits based on the like-for-like rules
- funding a biodiversity conservation action that benefits the threatened entity impacted by the development. The action must be listed in the Ancillary rules: Biodiversity conservation actions and meet the other requirements set out by the rules
- committing to deliver mine site ecological rehabilitation that creates the same ecological community or threatened species habitat (restricted to major mining projects)
- making a payment to the Biodiversity Conservation Fund managed by the Biodiversity Conservation Trust (BCT). The responsibility for delivering credit requirements is then transferred to the BCT.

The **like-for-like rules** seek to ensure biodiversity values lost from development are offset with the same or very similar biodiversity. The ecosystem credit rules require that:

- impacts on native vegetation must be offset with vegetation that is in the same area as the impact (based on near or adjacent IBRA subregion) and:
 - if a threatened ecological community (TEC) was impacted, the offset must be for the same threatened ecological community
 - if native vegetation that is not a TEC was impacted, the offset must be vegetation that is the same vegetation class and in the same or higher offset trading group (defined in Table 5 of the BAM).

In addition, if the impacted vegetation contained hollow bearing trees, this will appear on the credit profile and can only be matched with credits generated at a biodiversity stewardship site that also contains hollow bearing trees.

Species credits must be offset with the same threatened species that was impacted and may be sourced from a biodiversity stewardship site located anywhere in New South Wales.

The BC Regulation also contains variation rules that provide some flexibility by allowing offsetting within a broader suite of biodiversity that is the same, or more threatened, than

that impacted. The use of variations rules must be approved by the consent authority through conditions of consent.

There are restrictions around the use of variation rules including:

- the reasonable steps to seek like-for-like biodiversity credits
- the impacts on threatened entities excluded from variation.

A series of attributes are attached to ecosystem credits that enable the application of offset rules (including like-for-like offsets and variation rules), these are:

- name of the PCT impacted
- name of any TEC associated with the PCT
- offset trading group (see Table 5 of the BAM)
- vegetation class of the PCT
- vegetation formation of the PCT (only used in variation rules)
- presence of hollow bearing trees
- IBRA subregion.

For species credits these attributes include:

- the name of the species impacted
- IBRA subregions (only used in variation rules)
- threat status (taken from the BC Act; only used in variation rules)
- the taxonomic ranking (animals or plants; only used in variation rules).

The offset rules are policy settings and are established outside of the BAM, in the BC Regulation.

Appendix A – Websites and online resources

Acid sulfate soils risk

www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/acid-sulfate-soils

Application for login access to BioNet

www.environment.nsw.gov.au/atlaspublicapp/Registration.aspx

Areas of outstanding biodiversity value (AOBV)

www.environment.nsw.gov.au/biodiversity/outstandingbiodivvalue.htm

Biobanking and offsets scheme public registers

www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biobanking

Biodiversity Assessment Method Calculator

www.lmbc.nsw.gov.au/bamcalc

Biodiversity Assessment Method Calculator User Guide

www.lmbc.nsw.gov.au/bamcalc/app/assets/BAMTools_UserGuide.pdf

Biodiversity Conservation Regulation 2017

www.legislation.nsw.gov.au/regulations/2017-432.pdf

Biodiversity Offsets and Agreement Management System (BOAMS)

www.environment.nsw.gov.au/biodiversity/systemsregistersfees.htm

Biodiversity Values Map and Threshold Tool

www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap

BioNet Atlas

www.environment.nsw.gov.au/wildlifeatlas/about.htm

BioNet Atlas Search

www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

BioNet Flora Survey Data Collection

www.environment.nsw.gov.au/research/VISplot.htm

BioNet guides, information sheets, manuals and datasheets

www.bionet.nsw.gov.au/bionet-guides-manuals.htm

BioNet Threatened Biodiversity Data Collection (TBDC)

<https://www.environment.nsw.gov.au/asmslightprofileapp/Account/Login>

BioNet Vegetation Classification

www.environment.nsw.gov.au/research/Visclassification.htm

BioNet Vegetation Classification user manual

www.environment.nsw.gov.au/resources/bionet/bionet-vegetation-classification-user-manual-170340.pdf

BioNet Web Services

<https://data.bionet.nsw.gov.au/>

BioNet Web Services – Using Power Query: A BioNet Quick Guide

www.environment.nsw.gov.au/publications/bionet/150547-quick-guide-power-query.htm

Coastal management

www.planning.nsw.gov.au/Policy-and-Legislation/Coastal-management

Digital cadastral database

<https://sdi.nsw.gov.au/nswsdi/catalog/main/home.page>

Directory of Important Wetlands in Australia (DIWA)

www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands

Biodiversity Offset Scheme Public Registers (including biodiversity credits, transactions, biodiversity stewardship agreements)

www.environment.nsw.gov.au/publicregister

EPBC Act listed threatened species and ecological communities

www.environment.gov.au/epbc/what-is-protected/threatened-species-ecological-communities

Estuaries of NSW: Physical characteristics, tidal surveys and hydrographic surveys

www.environment.nsw.gov.au/estuaries/list.htm

Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)

www.dpi.nsw.gov.au/_data/assets/pdf_file/0009/468927/Policy-and-guidelines-for-fish-habitat.pdf

Geological sites of NSW

www.geomaps.com.au/scripts/geositeslist.php

Hydrogeological landscapes

www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/salinity/salinity-locations-and-mapping

Native Vegetation Integrity Benchmarks

www.environment.nsw.gov.au/research-and-publications/publications-search/native-vegetation-integrity-benchmarks

Native Vegetation Interim Type Standard

www.environment.nsw.gov.au/resources/nativeveg/10060nvintypestand.pdf

Native Vegetation Regulatory Map

www.environment.nsw.gov.au/biodiversity/regulatorymap.htm

NSW Guide to Surveying Threatened Plants

www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf

NSW Interim Biogeographic Regions of Australia (IBRA region and subregions) – Version 7

<http://environment.gov.au/land/nrs/science/ibra#ibra>

NSW (Mitchell) Landscapes – Version 3.1

datasets.seed.nsw.gov.au/dataset/7a1658be-a632-4d4c-8e94-5f9b3be31055

NSW (Mitchell) Landscapes Descriptions

www.environment.nsw.gov.au/resources/conservation/LandscapesDescriptions.pdf

NSW Soil Profiles

datasets.seed.nsw.gov.au/dataset/f66743bf-d395-4ab2-be41-87eae5009acc

NSW Threatened Species

www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species

OEH Threatened Species Survey and Assessment Guidelines

www.environment.nsw.gov.au/surveys/BiodiversitySurveyGuidelinesDraft.htm

PlantNET NSW

<http://plantnet.rbgsyd.nsw.gov.au/>

SEED environmental data sharing portal

www.seed.nsw.gov.au/edphome/home.aspx

State Vegetation Type Map

www.environment.nsw.gov.au/vegetation/state-vegetation-type-map.htm

Threatened species survey and assessment guidelines: field survey methods for fauna – amphibians

www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf

Vegetation Information Systems maps

www.environment.nsw.gov.au/research/VISmap.htm