Guide to determining terrestrial habitat quality

Methods for assessing habitat quality under the Queensland Environmental Offsets Policy

Version 1.3 February 2020

Queensland Government

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Purpose and application of this guide

Under the Queensland Environmental Offsets Framework[1], environmental offsets (offsets) may be required to counterbalance unavoidable significant residual impacts[2] from particular activities (prescribed activities[3]) on particular environmental values (prescribed environmental matters[4]). Offsets delivered under this framework must achieve a conservation outcome for the prescribed environmental matter impacted by the prescribed activity.

The *Environmental Offsets Act 2014* states that a conservation outcome is achieved by an offset for a prescribed activity if the offset is selected, designed and managed to maintain the viability of the prescribed environmental matter being impacted; that is, to maintain the status quo as if both the impact and offset had not occurred. The *Environmental Offsets Act 2014* also requires that an offset is of a size and scale proportionate to the significant residual impact on the prescribed environmental matter.

This non-statutory guide to determining terrestrial habitat quality sets out how to assess the suitability of an offset site relative to an impact site, determine the appropriate size and scale of an offset relative to an impact, conduct a baseline habitat quality assessment for an advanced offset application, and assess achievement of, or progress toward achieving, a conservation outcome at an offset site.

This guide provides methods for undertaking habitat quality assessments required under the Queensland Environmental Offsets Framework for the following prescribed environmental matter groups:

- prescribed regional ecosystems;
- terrestrial fauna habitat, including koala habitat outside of South East Queensland; and
- a koala habitat area in South East Queensland.

For these prescribed environmental matter groups, use of this guide is mandatory unless the Department of Environment and Science approves an alternative approach. Note that any requests to use an alternative method will need to demonstrate that the proposed method is suitable to measure changes in the prescribed environmental matter over time, can be replicated, and can meet the rules for a conservation outcome in this guideline.

Users of this guide must be suitably qualified with relevant ecological and technical knowledge and skills. Details of the assessor's qualifications and experience must be provided as supporting material with an offset delivery plan, monitoring report or advanced offset application.

For further advice about using this guide, please contact offsets@des.qld.gov.au.

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[1] The Queensland Environmental Offsets Framework includes the *Environmental Offsets Act 2014*, Environmental Offsets Regulation 2014 and the Queensland Environmental Offsets Policy.

[2] Significant residual impact is defined in section 8 of the *Environmental Offsets Act 2014*.

[3] Prescribed activities are defined in section 9 of the *Environmental Offsets Act 2014* and prescribed in Schedule 1 of the Environmental Offsets Regulation 2014.

[4] Prescribed environmental matters are defined in section 10 of the *Environmental Offsets Act 2014* and prescribed in section 5 and Schedule 2 of the Environmental Offsets Regulation 2014.

What is a habitat quality assessment?

Habitat quality is assessed using a combination of indicators that measure the overall viability of the site and its capacity to support a prescribed environmental matter. The method for assessing habitat quality is designed to be simple and repeatable.

The process starts with a desktop assessment to assess the landscape-scale attributes of the impact or offset site. For an offset site, the desktop assessment process will also indicate whether the site will meet the Queensland Environmental Offset Policy's required characteristics for the prescribed environmental matter. An on-ground assessment is then undertaken and the impact or offset site, which results in a score of habitat quality for each matter area.

An offset site must be considered an equivalent replacement of the habitat values lost at the impact site. The habitat scoring system involves scores out of 10, whereby a maximum score of 10 represents a fully intact system, scores of 4, 5 and 6 may indicate good quality regrowth or medium value habitat, and a minimum score of 0 would indicate a totally cleared or uninhabitable area.

For an impact site, a proponent may choose to assess habitat quality using one of two methods:

- the rapid assessment process, or
- the standard assessment process.

For an offset site, a proponent must assess habitat quality using the standard assessment process.

Rapid assessment process (impact site only)

For regional ecosystems and terrestrial fauna habitat, a rapid assessment process can be conducted as an alternative to the methods prescribed by this guide. The rapid assessment process assumes an impact site has a habitat quality score of 7 out of 10.

This score represents an average score of a generic remnant regional ecosystem in Queensland. It has been derived from Queensland Herbarium expert analysis and from Broad Vegetation Group (BVG) data obtained from the financial offsets calculator.

The rapid assessment process may only be applied to an impact site and cannot be used to predict habitat quality at an offset site. The offset site must be assessed using the relevant method prescribed by this guide or an alternative approach approved by the Department of Environment and Science.

Standard assessment process

The standard assessment process is to use the habitat quality assessment method prescribed in each chapter of this Guide. After calculating the habitat quality score of the impact site, this score can be input into the Land-based Offsets Multiplier Calculator to determine an offset size multiplier based on the applicable BVG or Species Functional Group. This multiplier can be used to determine the appropriate size of the offset site relative to the size of the impact. Note that the Land-based Offsets Multiplier Calculator uses fixed assumptions based upon the Commonwealth offset assessment guide, and on data provided by the Queensland Herbarium. These include assumptions about confidence in result and the predicted future quality with and without an offset. Offset applications that propose a conservation outcome at a lower multiplier than that calculated by the Land-based Offsets Multiplier Calculator will be considered on a case-by-case basis.

Setting out the site spatially

An impact or offset site must be delineated into one or more matter areas, which may be further divided into one or more assessment units, each containing one or more sampling sites as in Figure i below.
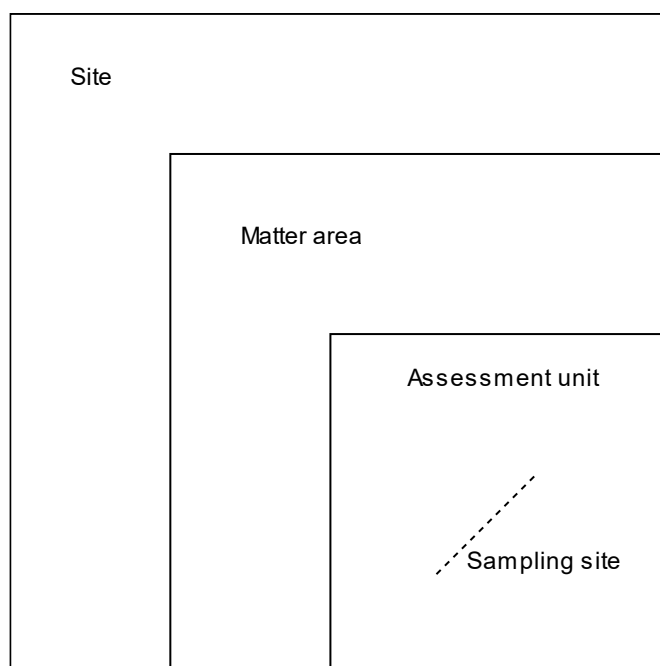

Figure i: Relationship between the site, matter area, assessment unit and sampling site

Matter areas

An impact or offset site may contain more than one prescribed environmental matter. The area that contains or represents the extent of an individual prescribed environmental matter is called a 'matter area'. A matter area may comprise the entire impact or offset site, or only a fraction of the impact or offset site. Additionally, a matter area does not need to be one continuous area; rather, a single matter area may comprise of unconnected patches across the impact or offset site. Two or more matter areas may co-exist or overlap spatially, wholly or partially, such as where a particular fauna species is associated with a particular regional ecosystem type.

At an offset site, including a site that is the subject of an advanced offset application, a matter area may either currently contain a prescribed environmental matter, or it may be capable of containing a prescribed environmental matter after management. For example, a cleared paddock may be capable of containing matter areas represented by the pre-clearing regional ecosystems mapped at that site.

Defining matter areas within an impact or offset site is necessary to ensure that a conservation outcome is achieved for each prescribed environmental matter for which an offset is required, and at an appropriate size and scale to achieve no net loss of that prescribed environmental matter.

For assessments conducted using this guide, a habitat quality score must be assigned to each matter area within the impact or offset site, rather than one score assigned to the site as a whole. This is required even where two or more prescribed environmental matters are co-located or overlap within the same area. An offset delivery plan, monitoring report or advanced offset application may not be accepted if this requirement is not met.

Example of matter area delineation
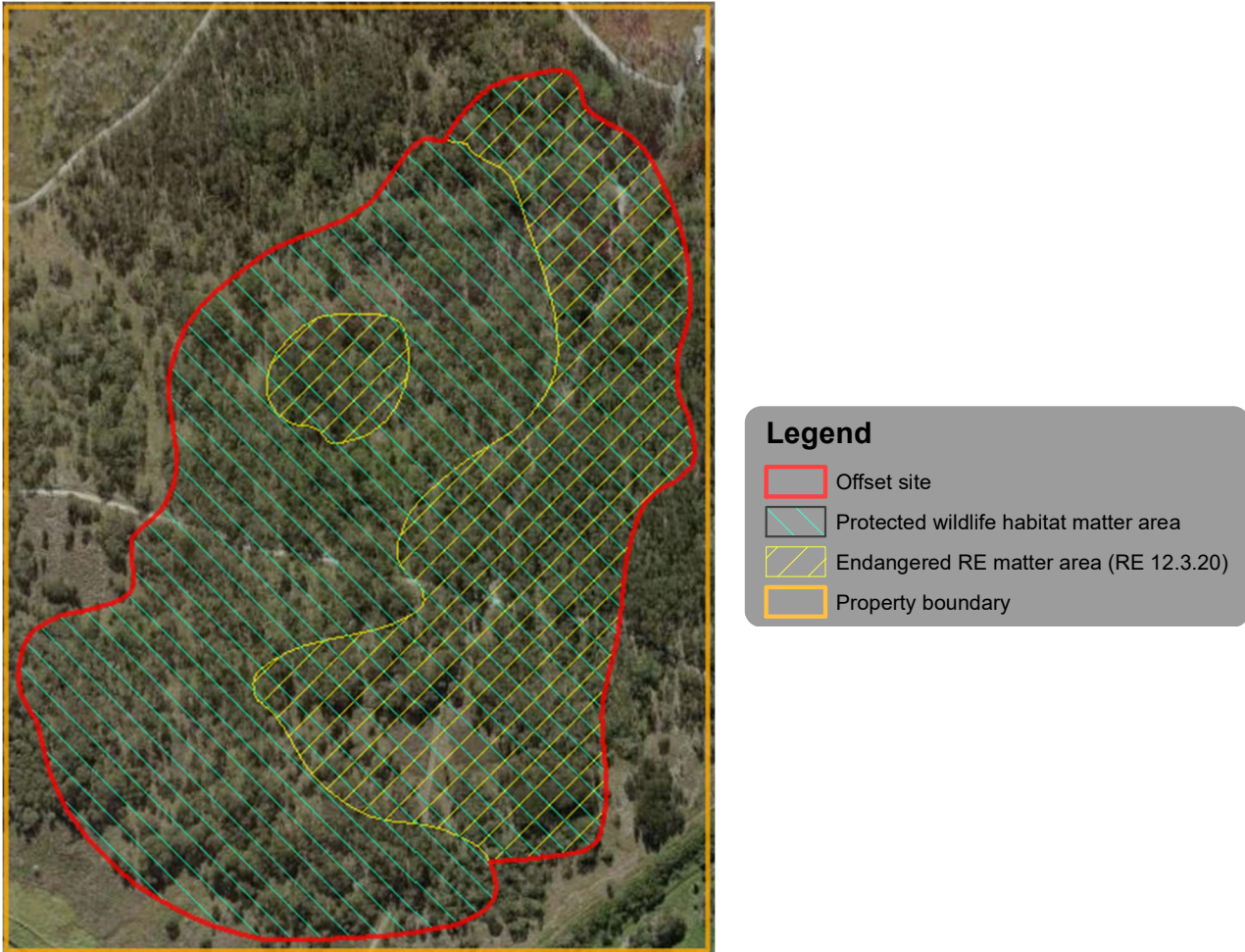
Figure ii Example of matter area delineation (not to scale)

Figure ii illustrates an example delineation of two matter areas within an offset site. In this example there are two prescribed environmental matters present on the offset site: protected wildlife habitat and endangered regional ecosystem 12.3.20.

Site-based assessments have confirmed that the extent of the endangered regional ecosystem matter area matches the mapped extent of regional ecosystem 12.3.20 within the offset site. Note that the matter area does not need to be contiguous, but can be composed of numerous discrete areas.

Protected wildlife habitat is not a mapped value. In this case, site-based assessments have determined that there is sufficient evidence that the protected wildlife habitat matter area covers the entire extent of the offset site.

Using this guide, a habitat quality score will be calculated for the protected wildlife habitat matter area and for the endangered regional ecosystem matter area, and these scores may differ.

Assessment units and sampling sites

An assessment unit is a defined area or group of areas within the matter area that is relatively homogenous in condition. Sampling sites, at which site-based attributes are assessed, are established within each assessment unit. Procedures for defining assessment units and selecting sampling sites are detailed in each chapter of this guide.

Chapter 1: Regional ecosystems

This chapter applies to impacts and offsets that relate to prescribed regional ecosystems[5] that:

- are endangered;
- are of concern;
- intersect with an area shown as a wetland on the vegetation management wetlands map; or
- are located within a defined distance from the defining banks of a relevant watercourse or relevant drainage feature.

Each of these prescribed regional ecosystem types are defined in Schedule 2 of the *Environmental Offsets Regulation 2014.*

When submitting the results of an assessment undertaken using this guide, all relevant supporting material must be included in the submission. A checklist of requirements to accompany an offset delivery plan, monitoring report or advanced offset application for assessments conducted in accordance with this chapter is provided in **Appendix 1**.

1.1 Policy requirements

The requirements for offsets for impacts on prescribed environmental matters other than protected areas are detailed in Chapter 2 of the Queensland Environmental Offsets Policy. Refer specifically to Section 2.2.1 'What all offsets must achieve under Chapter 2', and Section 2.3.1.6 'Characteristics of an offset site'.

The multipliers for offsets for regional ecosystems are located in Appendix 4 of the Queensland Environmental Offsets Policy. All regional ecosystem classes have a multiplier of 4 except for connectivity areas, for which the multiplier is set at 1.

A land-based offset can achieve a conservation outcome using a multiplier that is less than 4; however, this would need to be negotiated with and agreed to by the administering agency, which would need to be satisfied that a conservation outcome can be achieved using the proposed multiplier. The Land-based Offset Multiplier Calculator has been developed to assist in determining the offset multiplier required to achieve a conservation outcome for the regional ecosystem in question. The onus is on the proponent to provide evidence that the proposed multiplier is appropriate.

1.2 Offset site selection

The required characteristics for offset sites in relation to regional ecosystems are listed in Section 2.3.1.6 of the Queensland Environmental Offsets Policy. If these requirements cannot be met, the site is not suitable to deliver the offset.

Additionally, you must demonstrate that the proposed offset site is appropriately situated within the broader landscape to achieve a conservation outcome for the prescribed environmental matter in question. This is done by assessing and scoring the landscape-scale attributes of the offset site using the method prescribed by the Queensland Herbarium's BioCondition Assessment Manual. All references to the BioCondition Assessment Manual in this chapter are specific to Version 2.2. Additionally, you must also determine the proximity of the site to an ecological corridor.

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[5] Prescribed regional ecosystems are regional ecosystems located in a category B area (remnant vegetation) on the regulated vegetation management map, excluding regional ecosystems detailed in Schedule 5 of the *Vegetation Management Regulation 2012*. For further information see Schedule 2 of the Environmental Offsets Regulation 2014.

1.2.1 Assessing landscape-scale attributes

The measurable landscape-scale attributes in Box 1.1 describe the landscape surrounding the offset site and the influence this has on the site's vegetation quality. The attributes measured differ according to whether the subregion is fragmented or intact. Refer to **Section 6** of the BioCondition Assessment Manual to determine whether the subregion is fragmented or intact.

Box 1.1 – Landscape-scale attributes

For fragmented subregions:

Attribute	Maximum score
Size of patch	10
Context	5
Connectivity	5
Ecological corridors^	NA
TOTAL	**20**

For intact subregions:

Attribute	Maximum score
Distance to permanent water*	20
TOTAL	**20**

^ *This attribute is not assessed using the BioCondition Assessment Manual; instructions for assessing proximity to ecological corridors are provided in this section.*

* *This attribute should not be assessed for regional ecosystems for which distance to permanent water is redundant (i.e. mangrove ecosystems). Thus, for intact mangrove ecosystems, no landscape-scale attribute assessment is necessary.*

The assessment of particular landscape-scale attributes is redundant for certain ecosystem types. **Section 4, Table 4** of the BioCondition Assessment Manual details the assessable landscape-scale attributes and their weightings for wooded, grassland, shrubland and mangrove ecosystems. Refer to this section to:

1. adjust the standard attribute weightings to account for excluded attributes; and
2. calculate the maximum possible score that the site could achieve for landscape-scale attributes.

Conduct your assessment of the landscape-scale attributes of the offset site (except for 'ecological corridors') as detailed in **Section 6** of the BioCondition Assessment Manual. This assessment should be conducted at the overall site level, rather than at the matter area level. Relevant spatial mapping for this assessment can be downloaded from Queensland Spatial Catalogue (QSpatial).

For the purpose of this assessment, state your result as a numerical score out of 20, rather than as a percentage out of 20% as instructed by the BioCondition Assessment Manual.

Note that the BioCondition Assessment Manual method is designed to generate an overall vegetation condition score for a site, where site-based attributes comprise 80% of the score and landscape-scale attributes comprise the remaining 20%. In this guide however, site-based attributes and landscape-scale attributes are considered separately and are not combined into one score. This is because only the site-based attributes of an offset matter area are able to be managed as part of an offset, while the landscape-

scale attributes of an offset site are not. However, a proposed offset site must achieve at least a moderate landscape-scale attribute score to demonstrate that its position in the landscape is appropriate for delivering an offset that achieves a conservation outcome. The minimum acceptable landscape-scale attribute score will be determined by the administering agency on a case-by-case basis.

Ecological corridors

An 'ecological corridor' is represented as any riparian or terrestrial feature within the 'CORR_TYPE' attribute table of the 'Queensland biodiversity and vegetation offsets special features' map, which is available on QSpatial. This mapping can also be viewed on Queensland Globe in the 'Statewide Biodiversity Corridors' layer.

This attribute is only relevant to fragmented landscapes. To assess this attribute:

1. Determine the proximity of the site to a state, bioregional, regional or subregional corridor (terrestrial or riparian); and
2. Assess and state whether the site is (a) not located within, (b) sharing a common boundary with, or (c) located within (in whole or in part) an ecological corridor.

1.2.1.1 Justify offset site selection

After conducting an assessment of the proposed offset site's landscape-scale attributes, construct a brief justification for your offset delivery plan or advanced offset application of the site's suitable position within the landscape for delivering an offset that achieves a conservation outcome for the prescribed environmental matter(s) in question. The administering agency will consider your justification when deciding if the proposed offset site is suitable for delivering an offset.

When considering the location and context of the proposed offset site, identify any risks or potentially unmanageable factors or processes that may prevent the achievement of a conservation outcome for the prescribed environmental matter(s), such as high non-native plant cover or exposure to frequent disturbance. If any such risks are present at the site, the site may not be suitable for delivering an offset. If you wish to submit an offset delivery plan or an advanced offset application for a site where such risks are present, you must clearly identify these and describe how they will be managed in your offset delivery plan or advanced offset application. The administering agency will consider this information when deciding if the proposed offset site is suitable for delivering an offset.

1.3 Demonstrating a conservation outcome

To demonstrate the achievement of a conservation outcome using the habitat quality assessment method in section 1.4 of this chapter, the offset must meet the following two criteria:

1. After 20 years, the offset matter area habitat quality score must be at least 1 point greater than the impact matter area habitat quality score (prior to the impact); and

2. After 20 years, the offset matter area habitat quality score must have achieved an overall habitat quality gain of at least 2 points.

An offset delivery plan must describe the management actions that will be implemented at the offset site to achieve the required improvement in habitat quality score. The most appropriate management actions for an offset will differ depending on the prescribed environmental matter and the landscape context, but may be informed by the lowest-scoring site-based attributes (see Box 1.4) at the offset matter area as these attributes will have the greatest potential for improvement with management.

If you propose a habitat quality gain of more than 2 points, or an achieved habitat quality score of 9 or 10,

your offset delivery plan must clearly detail and justify the effectiveness of the actions proposed to achieve this result, as in these instances it becomes less certain that the conservation outcome can be achieved.

In some cases, a habitat quality score of more than 10 must be achieved to meet these criteria, or a 2-point gain in 20 years may not be possible due to the nature and growth rate of the particular ecosystem. Advice and agreement must be sought from the administering agency about what will be considered a conservation outcome in either case.

1.4 Habitat quality assessment method

Habitat quality at an impact or offset matter area is assessed in accordance with the Queensland Herbarium's BioCondition Assessment Manual method for assessing site-based attributes. In the BioCondition Assessment Manual, site-based attributes are scored relative to a 'benchmark', which is a document containing site-based attribute measurements for vegetation within a particular regional ecosystem in an undisturbed state with most of its natural values intact. The Queensland Herbarium has developed BioCondition benchmarks for regional ecosystems across Queensland, and more benchmarks are currently being developed.

This assessment results in a habitat quality score out of 10 for the entire matter area. A maximum score of 10 represents a fully-intact regional ecosystem.

This method can be employed to:

- assess the habitat quality of an impact or offset matter area;
- determine the appropriate size and scale of an offset relative to an impact;
- monitor the progress of an offset matter area over time;
- demonstrate that a conservation outcome has been achieved at an offset matter area; and
- undertake the baseline habitat quality assessment required for an advanced offset application.

As habitat quality scores are used to compare the quality of the impact and offset matter areas, as well as to monitor offset matter areas over time, it is vital that the method is applied consistently to allow for meaningful comparison of the scores. If a previous version of this guide or another method approved by the Department of Environment and Science was used to undertake a baseline habitat quality assessment, you must use that same method to complete any subsequent assessments undertaken for monitoring purposes.

The rest of this chapter provides instructions for completing each of the following steps of the habitat quality assessment:

1. Define assessment units
2. Select sampling sites
3. Assess site-based attributes
4. Calculate matter area habitat quality score

1.4.1 Define assessment units - stratified sampling approach

An assessment unit is a defined area or group of areas of <u>at least 1 ha in total size</u> within the matter area that is relatively homogenous in that it contains only one regional ecosystem type that is of a reasonably consistent broad condition state[6] (see Box 1.2 for definitions of broad condition states). This approach must be employed to capture variance in the structure, function and quality of vegetation across a matter area.

1.4.1.1 Determine number of assessment units

The number of assessment units defined will depend on the number of different regional ecosystem types that exist within the matter area, as well as any variation in the condition of these regional ecosystems.

If there is significant variation in the condition of vegetation of the same regional ecosystem, define distinct assessment units within that regional ecosystem to capture this variation. For example, a matter area that comprises two different regional ecosystems – RE12.3.2 and RE12.12.5 – may contain a patch of remnant RE12.3.2 with little to no presence of weeds, a patch of remnant RE12.3.2 in poorer condition with a high presence of weeds, and a patch of RE12.12.5 high-value regrowth that is fairly homogenous. This matter area would require three assessment units.

In the example above, the matter area contains two different regional ecosystems. However, for assessments conducted using this guide, if the prescribed environmental matter being assessed is a **prescribed regional ecosystem**, all assessment units within the matter area should contain **only that regional ecosystem**.

A matter area that contains a single regional ecosystem type in homogenous condition would only require a single assessment unit to represent the entire matter area.

1.4.1.2 Determine shape of assessment units

An assessment unit does not need to be one continuous area. In some instances, a regional ecosystem of the same broad condition state exists as unconnected patches throughout the matter area (see Figure 1.1). In this instance, a single assessment unit may comprise of two or more discrete areas. Where an assessment unit comprises of two or more discrete areas, it is useful to identify each polygon comprising that assessment unit with a unique name (see Table 1.1).

1.4.1.3 Define assessment units

Initially, delineate the matter area into assessment units by examining mapped remnant, regrowth or non-remnant regional ecosystems. Queensland Government regional ecosystem mapping portal and spatial datasets can be downloaded for free from the Queensland Spatial Catalogue (QSpatial) or accessed using Queensland Globe.

After this preliminary desktop assessment, conduct a site-based assessment to confirm the regional ecosystem classification and assess the broad condition state on the ground to determine whether further assessment unit delineation is required.

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[6] "Broad condition state" refers to whether the vegetation is remnant, regrowth or non-remnant (see Box 1.2).
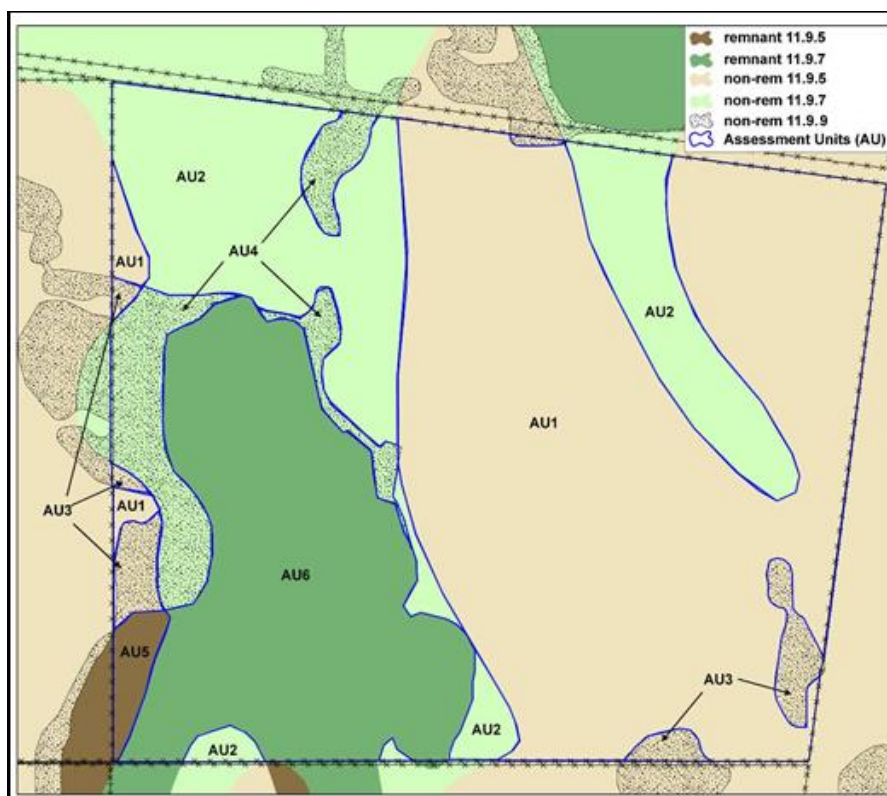
Figure 1.1: Example of assessment unit delineation
(Eyre *et al*. 2015)

Table 1.1: Example of assessment unit delineation tabulation

Assessment Unit	Assessment Unit (discrete polygon)	Regional Ecosystem	Broad Condition State	Area (ha) (discrete polygon)	Area (ha) (total area)
AU1	N/A	RE12.3.2	Remnant (pristine/no weeds)	1.2	1.2
AU2	AU2a	RE12.3.2	Remnant (weeds)	1.8	2.3
	AU2b		Remnant (weeds)	0.5	
AU3	AU3a	RE12.3.2	High-value regrowth (grazed)	3.4	5.9
	AU3b		High-value regrowth (not grazed)	2.5	
AU4	N/A	RE12.12.15	Remnant (weeds)	1.2	1.2
AU5	AU5a	RE12.12.15	Non-remnant (young wood regrowth)	2.2	3.5
	AU5b		Non-remnant (young wood regrowth)	1.3	
AU6	N/A	RE12.12.15	Non-remnant (cleared)	0.2	0.2

1.4.2 Select sampling sites

Once the assessment units have been defined, select sampling sites within each assessment unit at which site-based attributes will be assessed.

1.4.2.1 Determine number of sampling sites

Table 1.2 indicates the number of sampling sites that should be used relative to the size of the assessment unit. It may be possible to reduce the number of sampling sites if you can demonstrate that the vegetation in the assessment unit is consistently homogenous. See Box 1.3 and Figure 1.2 for further detail about how to streamline sampling sites.

Table 1.2: Guide to number of sampling sites relative to assessment unit size

Assessment unit size	Suggested number of sampling sites
0–50 hectares (ha)	At least two
50–100ha	Three
100–500ha	Four
500–1000ha	Five
More than 1000ha	Six

Box 1.3 – Streamlining sampling sites

The number of sampling sites required for each assessment unit as described in Table 1.2 can be reduced (streamlined) if it can be demonstrated that an assessment unit contains multiple discrete polygons that are uniform or in the same general condition.

If taking this approach, you must provide evidence of this uniformity and consistency in vegetation condition across the assessment unit. Evidence may include recent remote sensing or aerial imagery that must be supported by sufficient photographic evidence and the GPS locations of the sites.
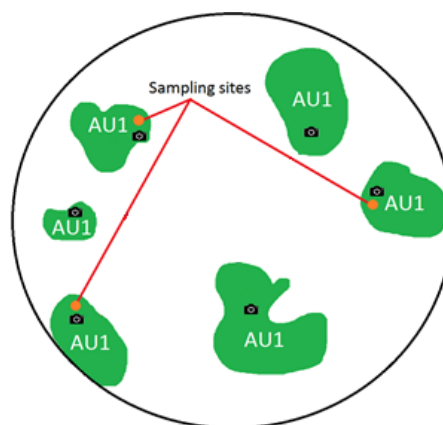
Figure 1.2: Diagram illustrating 'streamlining' as outlined in Box 1.3

1.4.2.2 Determine distribution of sampling sites

Distribute sampling sites throughout the assessment unit in a way that captures the typical structure and function of the vegetation in the assessment unit. Sampling sites should be at least 50m from any major disturbance. For example, sampling sites should not be located in weedy, disturbed roadside areas if the rest of the assessment unit is relatively undisturbed.

1.4.2.3 Record assessment unit and sampling site details

Once assessment units and sampling sites have been defined, record:

- The size of the matter area (in hectares);
- The regional ecosystem and broad condition state of each assessment unit;
- The size of each assessment unit (in hectares);
- Co-ordinates of the zero point of each sampling site; and
- Compass bearing along the transect at each sampling site.

This information must be included in your offset delivery plan, advanced offset application or monitoring report, along with a spatial representation of the matter area including all assessment units and sampling sites.

1.4.3 Assess site-based attributes

The measurable site-based attributes in Box 1.4 indicate the structure, function and composition of a regional ecosystem.

Attribute	Maximum* weighting (%)
Box 1.4 – Site-based attributes	
Number of large native trees	15
Tree canopy height (emergent, canopy and sub-canopy)	5
Recruitment of woody perennial species (in the ecologically dominant layer)	5
Tree canopy cover (%) (emergent, canopy and sub-canopy)	5
Native shrub layer cover (%)	5
Coarse woody debris	5
Native plant species richness for trees, shrubs, grasses, and forbs/others	20
Non-native plant cover	10
Native perennial grass cover (%)	5
Organic litter cover	5
MAXIMUM* TOTAL	**80**

Note that in the BioCondition method, site-based attributes comprise 80% of the overall score and the remaining 20% is based on landscape-scale attributes. For the purposes of this habitat quality assessment method, only site-based attributes are assessed and the resulting percentage out of 80%* is converted to a numerical score out of 10.

* Weightings, and therefore maximum total, may be less for particular ecosystem types that naturally lack certain site-based attributes.

Site-based attribute assessment is conducted as per the BioCondition Assessment Manual.

If the ecosystem that is being assessed at the site naturally lacks a certain site-based attribute, that attribute must be excluded from the BioCondition scoring procedure. BioCondition benchmarks indicate which attributes are applicable to a particular regional ecosystem. **Section 4, Table 4** of the BioCondition Assessment Manual details the assessable site-based attributes and their weightings for wooded, grassland, shrubland and mangrove ecosystems. Refer to this section to:

1. adjust the standard attribute weightings to account for excluded attributes; and
2. calculate the maximum possible score that the site could achieve for site-based attributes.

1.4.3.1 When to undertake field assessments

Refer to **Section 3.3** of the BioCondition Assessment Manual to determine the best time to assess site-based attributes. Any divergence from these recommendations should be justified in your advanced offset application, offset delivery plan or monitoring report.

1.4.3.2 Resources required

The following equipment is recommended:

- the BioCondition Assessment Manual including all appendices

- benchmark documents for each of the regional ecosystems assessed (available on the Queensland Government website) (a reference site should be used where there is no available benchmark; see The Queensland Herbarium's Method for the Establishment and Survey of Reference Sites for BioCondition). Refer to **Section 2.3** of the BioCondition Assessment Manual for more information on benchmarks and reference sites.

- Regional Ecosystem technical descriptions and/or regional ecosystem descriptions which can be found on the Queensland Government website.

- Global Positioning System (GPS)

- compass (to lay out the area)

- a camera

- 100m transect tape

- 1m x 1m quadrat for measuring ground cover

- star pickets to mark the 0m and 50m point along the transect

- a diameter tape or a smaller measuring tape

- a clinometer, hypsometer or ruler for measuring tree heights

- clipboard, pencils and erasers

- 50m transect tape (optional)

- 50m transect tape (optional)

- flagging tape (optional)

- plant identification books (optional)

1.4.3.3 Set up the sampling site

Set up the sampling site in accordance with **Section 3.4** of the BioCondition Assessment Manual. Any divergence from this should be justified in your advanced offset application, offset delivery plan or monitoring report.

1.4.3.4 Benchmarks

In the BioCondition Assessment Manual, site-based attributes are scored relative to a 'benchmark', which is a document containing site-based attribute measurements for vegetation within a particular regional ecosystem in an undisturbed state with most of its natural values intact. The Queensland Herbarium has developed BioCondition benchmarks for regional ecosystems across Queensland, and more benchmarks are currently being developed.

Where a BioCondition benchmark has not been developed for a regional ecosystem, reference sites that best represent that regional ecosystem in its undisturbed state must be identified and surveyed in accordance with the Queensland Herbarium's Method for the Establishment and Survey of Reference Sites for BioCondition. The Queensland Herbarium should also be consulted during this process to ensure appropriate reference sites are selected.

1.4.3.5 Assess site-based attributes

Conduct your assessment of site-based attributes as detailed in **Section 5** of the BioCondition Assessment Manual. Record your results in the BioCondition field assessment sheet, also available in **Appendix 2** of the BioCondition Assessment Manual. Use a new sheet for each sampling site.

Collect photographic evidence from each sampling site as detailed in **Section 3.4** and **Appendix 4** of the BioCondition Assessment Manual.

Appendices 1-9 of the BioCondition Assessment Manual provide supporting information for conducting this assessment.

1.4.4 Calculate matter area habitat quality

Calculations must be detailed within an offset delivery plan, monitoring report or advanced offset application.

1.4.4.1 Calculate BioCondition score for each sampling site

The habitat quality score for a sampling site is calculated by adding the scores obtained for each site-based attribute, and then dividing by the maximum possible score for the regional ecosystem in question (e.g. 80 for wooded ecosystems, 30 for grassland ecosystems, 45 for shrubland ecosystems and 65 for mangrove ecosystems) to standardise the total as a score between 0 and 1. Calculate the BioCondition score for each sampling site using the following equation:

$$\mathrm{BC}_x = \frac{a + b + c + d + e + f + g + h + i + j}{\mathrm{SBA}_{\max\%}}$$

Where:

BC_x = BioCondition score for sampling site x

a = Score for 'number of large trees' attribute

b = Score for 'tree canopy height' attribute

c = Score for 'recruitment of woody perennial species' attribute

d = Score for 'tree canopy cover' attribute

e = Score for 'native shrub layer cover' attribute

f = Score for 'coarse woody debris' attribute

g = Score for 'native plant species richness for trees, shrubs, grasses, and forbs/others' attribute

h = Score for 'non-native plant cover' attribute

i = Score for 'native perennial grass cover' attribute

j = Score for 'organic litter cover' attribute

$\mathrm{SBA}_{\max\%}$ = the maximum site-based score that can be obtained for site-based attributes $a - j$ that are relevant to the regional ecosystem being assessed (e.g. 80 for a wooded ecosystem, 30 for a grassland ecosystem).

Repeat for each sampling site.

1.4.4.2 Calculate BioCondition score for each assessment unit

The BioCondition score for each assessment unit is the average of the scores of the sampling sites within it. Calculate the BioCondition score for each assessment unit using the following equation:

$$BC_{AUx} = \frac{BC_1 + BC_2 + \dots BC_N}{N}$$

Where:

BC_{AUx} = BioCondition score for assessment unit x

BC_1 = BioCondition score for sampling site 1 within the assessment unit

BC_2 = BioCondition score for sampling site 2 within the assessment unit

BC_y = BioCondition score for sampling site N within the assessment unit

N = Number of sampling sites within the assessment unit

Repeat for each assessment unit within the matter area.

1.4.4.3 Calculate area-weighted BioCondition score for each assessment unit

Calculate an area-weighted score for each assessment unit to generate a 'per-hectare' score using the following equation:

$$WBC_{AUx} = \frac{BC_{AUx} \times A}{T}$$

Where:

WBC_{AUx} = Weighted BioCondition score for assessment unit x

BC_{AUx} = BioCondition score for assessment unit x (as calculated in 1.4.4.2)

A = Area (in hectares) of assessment unit x

T = Total area (in hectares) of the matter area

Repeat for each assessment unit within the matter area.

1.4.4.4 Calculate BioCondition score for the matter area

Calculate the BioCondition score for the entire matter area using the following equation:

$$BC_{matter\ area} = WBC_{AU1} + WBC_{AU2} + \dots WBC_{AUN}$$

Where:

$BC_{matter\ area}$ = The BioCondition score for the entire matter area

WBC_{AU1} = Weighted BioCondition score for assessment unit 1

WBC_{AU2} = Weighted BioCondition score for assessment unit 2

WBC_{AUN} = Weighted BioCondition score for assessment unit N

1.4.4.5 Convert matter area BioCondition score to score out of 10

Convert the matter area BioCondition score into a score out of 10 by multiplying the matter area BioCondition score by 10.

$$BC_{\text{matter area (out of 10)}} = BC_{\text{matter area}} \times 10$$

The result is the final habitat quality score for the matter area. Round the habitat quality score to the nearest two decimal places.

Chapter 2: Terrestrial fauna habitat

This chapter applies to impacts and offsets that relate to habitat for an animal that is listed as endangered, vulnerable, near threatened or special least concern under the *Nature Conservation (Wildlife) Regulation 2006*, except for koala habitat in South East Queensland. It can be applied to koala habitat outside South East Queensland. It is limited to terrestrial species or species that inhabit both the terrestrial and aquatic environment where the impact and offset is for its terrestrial habitat.

When submitting the results of an assessment undertaken using this guide, all relevant supporting material must be included in the submission. A checklist of requirements to accompany an offset delivery plan, monitoring report or advanced offset application for assessments conducted in accordance with this chapter is provided in **Appendix 2**.

2.1 Policy requirements

The requirements for offsets for impacts on prescribed environmental matters other than protected areas are detailed in Chapter 2 of the Queensland Environmental Offsets Policy. Refer specifically to Section 2.2.1 'What all offsets must achieve under Chapter 2', and Section 2.3.1.6 'Characteristics of an offset site'.

The offset multipliers for habitat for threatened fauna are in Table 4.5.1 of the Queensland Environmental Offsets Policy. The maximum multiplier is 4. A land-based offset can achieve a conservation outcome using a multiplier of less than 4; however, this would need to be negotiated with and agreed to by the administering agency, which would need to be satisfied that a conservation outcome can be achieved using the proposed multiplier. The onus is on the proponent to provide evidence that the proposed multiplier is appropriate.

2.2 Offset site selection

In relation to an offset required for impacts to the habitat of an endangered, vulnerable, near threatened or special least concern fauna species, the offset site must contain or be capable of containing a self-sustaining population of that same impacted species, either permanently or from time to time. If this requirement cannot be met, the site is not suitable to deliver an offset for that species' habitat.

Where the species being impacted has distinct subspecies or subpopulations, you should also consider whether the offset site can support that same subspecies or subpopulation.

Additionally, you must demonstrate that the proposed offset site is appropriately situated within the broader landscape to achieve a conservation outcome for the species in question. This is done by assessing and scoring the landscape-scale attributes of the offset site using the method prescribed by the Queensland Herbarium's BioCondition Assessment Manual. All references to the BioCondition Assessment Manual in this chapter are specific to Version 2.2.

2.2.1 Demonstrate that the site contains or is capable of containing the species

Conduct a desktop assessment to confirm the suitability of the proposed offset site for supporting the species in question. Then, conduct an on-site assessment following the instructions in Figure 2.1 to determine the suitability of the proposed offset site for delivering an offset for the species' habitat.

If the proposed site is not capable of containing the species, it is not suitable to deliver the offset, and you should not proceed with a habitat quality assessment for the site. An alternative site should be identified.

Your survey method, results and conclusions must be detailed and justified in your offset delivery plan or advanced offset application.

Figure 2.1: Decision flowchart for determining the suitability of a proposed offset site to deliver an offset for an endangered, vulnerable, near threatened or special least concern fauna species

STEP 1: Conduct a targeted fauna survey at the proposed offset site to assess the presence of the species within area. The method in the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland should be used for vertebrate species. There are also a range of targeted species survey guidelines that have been developed by the Queensland Government and Commonwealth Government, which may be used. For invertebrate species, you must identify and employ a scientifically supported method for undertaking the survey, and provide evidence to justify its use.

Does the site evidently contain the species?

YES → **The site may be suitable to deliver the offset**

NO

STEP 2: Conduct a targeted fauna survey in the area immediately surrounding the proposed offset site to assess the presence of the species within that area.

If the species is detected, it may be demonstrated that the proposed offset site is capable of containing the species if <u>ALL</u> of the following criteria are met:

- the proposed offset site is directly connected to habitat that currently contains the species;
- the proposed offset site contains, or is capable of containing with management, all of the biotic and abiotic requirements for the species as determined by a review of the literature (which may include published conservation advice, recovery plans, species profiles, peer-reviewed scientific literature, essential habitat factors, species mapping and modelling), such as particular vegetation communities, hydrology, soil types, altitude, climate, and other species-specific habitat elements;
- the species can move freely and safely from the surrounding area into the proposed offset site, or will be able to with management; and
- the factors that are currently preventing the species from inhabiting the offset site can be mitigated or eliminated with management as part of the offset.

Is the site capable of containing the species with management?

YES → **The site may be suitable to deliver the offset**

Continue with habitat quality assessment

NO

The site is <u>not</u> suitable to deliver the offset

Do not continue with habitat quality assessment. Identify an alternative site.

2.2.2 Assess landscape-scale attributes

The measurable landscape-scale attributes in Box 2.1 describe the landscape surrounding the offset site and the influence this has on the site's vegetation quality. The attributes measured differ according to whether the subregion is fragmented or intact. Refer to **Section 6** of the BioCondition Assessment Manual to determine whether the subregion is fragmented or intact.

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Box 2.1 – Landscape-scale attributes

For fragmented subregions:

Attribute	Maximum score
Size of patch	10
Context	5
Connectivity	5
Ecological corridors^	NA
TOTAL	**20**

For intact subregions:

Attribute	Maximum score
Distance to permanent water*	20
TOTAL	**20**

^ *This attribute is not assessed using the BioCondition Assessment Manual; instructions for assessing proximity to ecological corridors are provided in this section.*

* *This attribute should not be assessed for regional ecosystems for which distance to permanent water is redundant (i.e. mangrove ecosystems). Thus, for intact mangrove ecosystems, no landscape-scale attribute assessment is necessary.*

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The assessment of particular landscape-scale attributes is redundant for certain ecosystem types. **Section 4, Table 4** of the BioCondition Assessment Manual details the assessable landscape-scale attributes and their weightings for wooded, grassland, shrubland and mangrove ecosystems. Refer to this section to:

1. adjust the standard attribute weightings to account for excluded attributes; and
2. calculate the maximum possible score that the site could achieve for landscape-scale attributes.

Conduct your assessment of landscape-scale attributes (except for 'ecological corridors') as detailed in **Section 6** of the BioCondition Assessment Manual. This assessment should be conducted at the overall site level, rather than at the matter area level. Relevant spatial mapping for this assessment can be downloaded from Queensland Spatial Catalogue (QSpatial).

For the purpose of this assessment, state your result as a numerical score out of 20, rather than as a percentage out of 20% as instructed by the BioCondition Assessment Manual.

Note that the BioCondition method is designed to generate an overall condition score for vegetation, where site-based attributes comprise 80% of the score and landscape-scale attributes comprise the remaining 20%. In this guide however, site-based attributes and landscape-scale attributes are considered separately and are not combined into one score. This is because only the site-based attributes of an offset matter area

are able to be managed as part of an offset, while the landscape-scale attributes of an offset site are not. However, a proposed offset site must achieve at least a moderate landscape-scale attribute score to demonstrate that its position in the landscape is appropriate for delivering an offset that achieves a conservation outcome. The minimum acceptable landscape-scale attribute score will be determined by the administering agency on a case-by-case basis.

Ecological corridors

An 'ecological corridor' is represented as any riparian or terrestrial feature within the 'CORR_TYPE' attribute table of the 'Queensland biodiversity and vegetation offsets special features' map, which is available on QSpatial. This mapping can also be viewed on Queensland Globe in the 'Statewide Biodiversity Corridors' layer.

This attribute is only relevant to fragmented landscapes. To assess this attribute:

1. Determine the proximity of the site to a state, bioregional, regional or subregional corridor (terrestrial or riparian); and
2. Assess and state whether the site is (a) not located within, (b) sharing a common boundary with, or (c) located within (in whole or in part) an ecological corridor.

2.2.2.1 Justify offset site selection

After conducting an assessment of the proposed offset site's landscape-scale attributes, construct a brief justification for your offset delivery plan or advanced offset application of the site's suitable position within the landscape for delivering an offset that achieves a conservation outcome for the species in question. The administering agency will consider your justification when deciding if the proposed offset site is suitable for delivering an offset.

When considering the location and context of the proposed offset site, identify any risks or potentially unmanageable factors or processes that may prevent the achievement of a conservation outcome for the species, such as high non-native plant cover or exposure to frequent disturbance. If any such risks are present at the site, the site may not be suitable for delivering an offset. If you wish to submit an offset delivery plan or an advanced offset application for a site where such risks are present, you must clearly identify these and describe how they will be managed in your offset delivery plan or advanced offset application. The administering agency will consider this information when deciding if the proposed offset site is suitable for delivering an offset.

2.3 Demonstrating a conservation outcome

To demonstrate the achievement of a conservation outcome using the habitat quality assessment method in section 2.4 of this chapter, the offset must meet the following two criteria:

1. After 20 years, the offset matter area habitat quality score must be at least 1 point greater than the impact matter area habitat quality score (prior to the impact); and
2. After 20 years, the offset matter area habitat quality score must have achieved an overall habitat quality gain of at least 2 points.

An offset delivery plan must describe the management actions that will be implemented at the offset site to achieve the required improvement in habitat quality score. The most appropriate management actions for an offset will differ depending on the prescribed environmental matter and the landscape context, but may be informed by the lowest-scoring site-based attributes (see Box 2.4) and species habitat attributes (see Table

2.3) at the offset matter area as these attributes will have the greatest potential for improvement with management.

If you propose a habitat quality gain of more than 2 points, or an achieved habitat quality score of 9 or 10, your offset delivery plan must clearly detail and justify the effectiveness of the actions proposed to achieve this result, as in these instances it becomes less certain that the conservation outcome can be achieved.

In some cases, a habitat quality score of more than 10 must be achieved to meet these criteria, or a 2-point gain in 20 years may not be possible due to the nature and growth rate of the particular ecosystem. Advice and agreement must be sought from the administering agency about what will be considered a conservation outcome in either case.

For some terrestrial fauna species, the condition of vegetation at a site as measured by the Queensland Herbarium's BioCondition Assessment Manual is a suitable indicator of that site's ability to support that species. Where vegetation condition is not an indicator of habitat quality, an alternative assessment method must be employed that accounts explicitly for the quality and availability of habitat attributes required by that species.

Assessors using this guide are required to undertake and submit the results of both the site-based attribute assessment and the species habitat attribute assessment outlined in section 2.4. Either the site-based attribute score or the species habitat attribute score, or a combination of both, will be used as the basis for measuring the conservation outcome, as determined by the Department of Environment and Science depending on the species in question.

2.4 Habitat quality assessment method

Habitat quality at an impact or offset matter area is determined based on an assessment of the following attributes:

- **Site-based attributes** are assessed in accordance with the Queensland Herbarium's BioCondition method, and indicate the general vegetation condition in the matter area compared to a reference site in an undisturbed state with most of its natural values intact (a BioCondition benchmark); and
- **Species habitat attributes** indicate the matter area's ability to support a particular fauna species based on that species' specific habitat requirements.

The assessment of each set of attributes results in a habitat quality score out of 10 for the entire matter area. For the fauna species in question, a maximum score of 10 indicates a fully intact habitat and a minimum score of 0 would indicate an uninhabitable area.

For some fauna species, the site-based attribute score is an appropriate indicator of habitat quality because general vegetation condition is a suitable proxy of habitat value for that species. For other fauna species this will not be appropriate, and the species habitat attribute score must be used to indicate habitat quality. Assessors utilising this habitat quality assessment method should conduct and submit the results of both a site-based attribute and species habitat attribute assessment for the species in question. Based on the species and the nature of the offset, the Department of Environment and Science will decide whether the site-based attribute score or species habitat attribute score will be used as the basis for measuring a conservation outcome. For further information, contact offsets@des.qld.gov.au.

The method prescribed in this chapter can be employed to:

- assess the habitat quality of an impact or offset matter area in relation to a terrestrial fauna species;
- determine the appropriate size and scale of an offset relative to an impact;
- monitor the progress of an offset matter area over time;
- demonstrate that a conservation outcome has been achieved at an offset matter area; and
- undertake the baseline habitat quality assessment required for an advanced offset application.

As habitat quality scores are used to compare the quality of the impact and offset matter areas, as well as to monitor offset matter areas over time, it is vital that the method is applied consistently to allow for meaningful comparison of the scores. If a previous version of this guide or another method approved by the Department of Environment and Science was used to undertake a baseline habitat quality assessment, you must use that same method to complete any subsequent assessments undertaken for monitoring purposes.

The rest of this chapter provides instructions for completing each of the following steps of the habitat quality assessment:

1. Define assessment units
2. Select sampling sites
3. Assess site-based attributes
4. Assess species habitat attributes
5. Calculate matter area habitat quality score

2.4.1 Define assessment units – stratified sampling approach

An assessment unit is a defined area or group of areas of <u>at least 1 ha in total size</u> within the matter area that is relatively homogenous in that it contains only one regional ecosystem type that is of a reasonably consistent broad condition state[7] (see Box 2.2 for definitions of broad condition states). This approach must be employed to capture variance in the structure, function and quality of habitat across a matter area.

2.4.1.1 Determine number of assessment units

The number of assessment units defined will depend on the number of different regional ecosystem types that exist within the matter area, as well as any variation in the condition of these regional ecosystems.

If there is significant variation in the condition of vegetation of the same regional ecosystem, define distinct assessment units within that regional ecosystem to capture this variation. For example, a matter area that comprises two different regional ecosystems – RE12.3.2 and RE12.12.5 – may contain a patch of remnant RE12.3.2 with little to no presence of weeds, a patch of remnant RE12.3.2 in poorer condition with a high presence of weeds, and a patch of RE12.12.5 high-value regrowth that is fairly homogenous. This matter area would require three assessment units.

A matter area that contains a single regional ecosystem type in homogenous condition would only require a single assessment unit to represent the entire matter area.

2.4.1.2 Determine shape of assessment units

An assessment unit does not need to be one continuous area. In some instances, a regional ecosystem of the same broad condition state exists as unconnected patches throughout the matter area (see Figure 2.2). In this instance, a single assessment unit may comprise of two or more discrete areas. Where an assessment unit comprises of two or more discrete areas, it is useful to identify each polygon comprising that assessment unit with a unique name (see Table 2.1).

2.4.1.3 Define assessment units

Initially, delineate the matter area into assessment units by examining mapped remnant, regrowth or non-remnant regional ecosystems. Queensland Government regional ecosystem mapping portal and spatial datasets can be downloaded for free from the Queensland Spatial Catalogue (QSpatial) or accessed using Queensland Globe.

After this preliminary desktop assessment, conduct a site-based assessment to confirm the regional ecosystem classification and assess the broad condition state on the ground to determine whether further assessment unit delineation is required.

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[7] "Broad condition state" refers to whether the vegetation is remnant, regrowth or non-remnant (see Box 2.2).
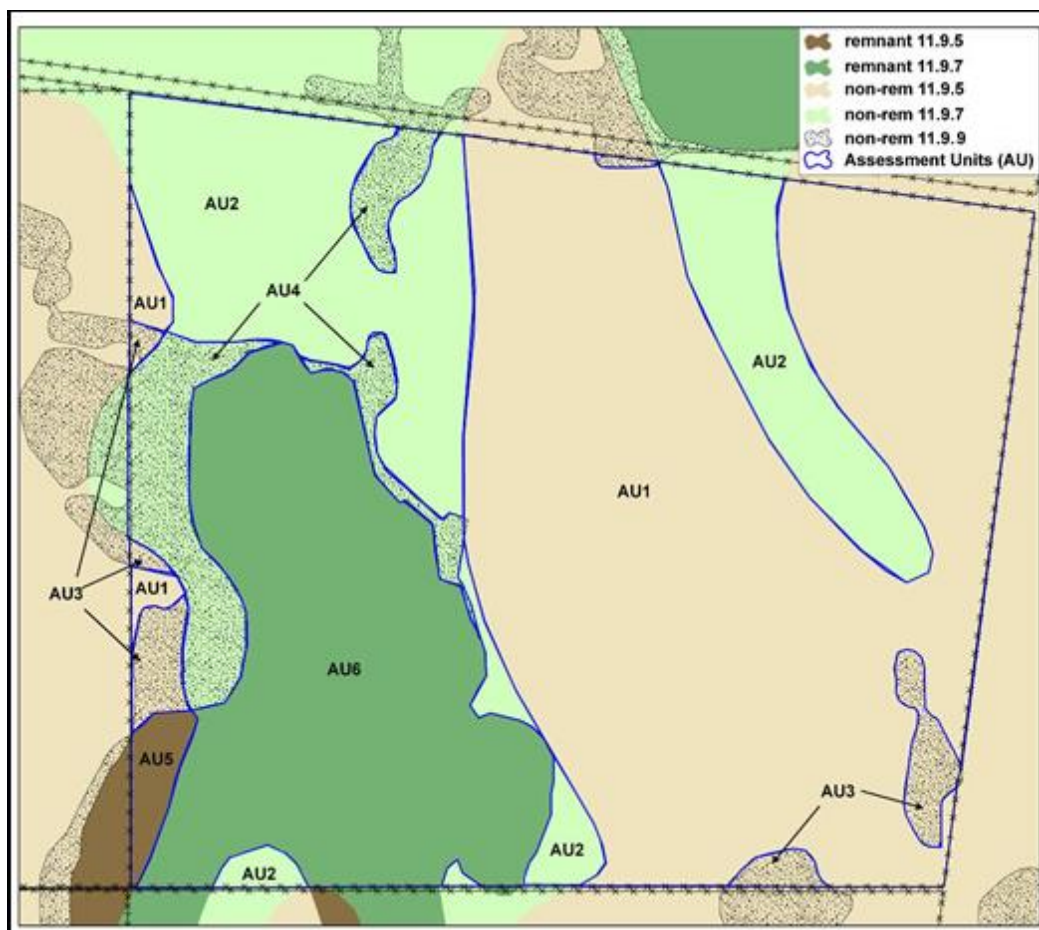
Figure 2.2 Example of assessment unit delineation
(Eyre *et al*. 2015)

Table 2.1: Example of assessment unit delineation tabulation

Assessment Unit	Assessment Unit (discrete polygon)	Regional Ecosystem	Broad Condition State	Area (ha) (discrete polygon)	Area (ha) (total area)
AU1	N/A	RE12.3.2	Remnant (pristine/no weeds)	1.2	1.2
AU2	AU2a	RE12.3.2	Remnant (weeds)	1.8	2.3
	AU2b		Remnant (weeds)	0.5	
AU3	AU3a	RE12.3.2	High-value regrowth (grazed)	3.4	5.9
	AU3b		High-value regrowth (not grazed)	2.5	
AU4	N/A	RE12.12.15	Remnant (weeds)	1.2	1.2
AU5	AU5a	RE12.12.15	Non-remnant (young wood regrowth)	2.2	3.5
	AU5b		Non-remnant (young wood regrowth)	1.3	
AU6	N/A	RE12.12.15	Non-remnant (cleared)	0.2	0.2

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**Box 2.2 - Definitions of broad condition states for delineating assessment units
(adapted from Eyre *et al.* 2015)**

Remnant vegetation

Remnant vegetation is defined in the *Vegetation Management Act 1999* as vegetation shown on the regulated vegetation management map as a category B (remnant) area. This includes vegetation that contains an endangered, of concern or least concern regional ecosystem.

Where there are no maps available, remnant vegetation is defined as vegetation where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy.

In grassland ecosystems, remnant status is assigned to grasslands that:

d) Have not been ploughed in the last 15 years (generally detectable on Landsat imagery);
e) Contain >20% of the native species normally found in the ecosystem under the same ecological and seasonal conditions (as defined in benchmark documents or REDD); and
f) Have a high ratio of native species to exotic species (>5:1).

Regrowth vegetation

For this guide, regrowth vegetation is vegetation defined as high-value regrowth under the *Vegetation Management Act 1999*, which is vegetation that is shown on the regulated vegetation management map as category C (high-value regrowth) or category R (regrowth watercourse and drainage feature) area. This includes vegetation that contains an endangered, of concern or least concern regional ecosystem.

Where there are no maps available, high-value regrowth vegetation is defined as vegetation located:

c) On freehold land, indigenous land, or land that is the subject of a lease under the *Land Act 1994* for agriculture or grazing purposes or an occupation licence under that Act; and
d) In an area that has not been cleared (other than for relevant clearing activities) for at least 15 years, if the area is an endangered, of concern or least concern regional ecosystem.

Non-remnant vegetation

Non-remnant vegetation is vegetation that does not meet the characteristics of remnant or regrowth vegetation as described above. It can also include:

c) Young woody regrowth, defined as woody vegetation of any endangered, of concern or least concern regional ecosystem that has been cleared since 31 December 1989. This can be mapped using SLATS woody cover and assigned to the most likely regional ecosystem by referring to the pre-clearing regional ecosystem mapping; and
d) Significantly modified vegetation that fails to meet the characteristics of remnant, regrowth or young woody regrowth. This may include areas that have been heavily thinned or logged, urban and cropping land, significantly disturbed vegetation, modified grass land or cleared areas.

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2.4.2 Select sampling sites

Once the assessment units have been defined, select sampling sites within each assessment unit at which site-based attributes will be assessed.

2.4.2.1 Determine number of sampling sites

Table 2.2 indicates the number of sampling sites that should be used relative to the size of the assessment unit. It may be possible to reduce the number of sampling sites if you can demonstrate that the vegetation in the assessment unit is consistently homogenous. See Box 2.3 and Figure 2.3 for further detail about how to streamline sampling sites.

Table 2.2: Guide to number of sampling sites relative to assessment unit size

Assessment unit size	Suggested number of sampling sites
0–50 hectares (ha)	At least two
50–100ha	Three
100–500ha	Four
500–1000ha	Five
More than 1000ha	Six

Box 2.3 – Streamlining sampling sites

The number of sampling sites required for each assessment unit as described in Table 2.2 can be reduced (streamlined) if it can be demonstrated that an assessment unit contains multiple discrete polygons that are uniform or in the same general condition.

If taking this approach, you must provide evidence of this uniformity and consistency in vegetation condition across the assessment unit. Evidence may include recent remote sensing or aerial imagery that must be supported by sufficient photographic evidence and the GPS locations of the sites.
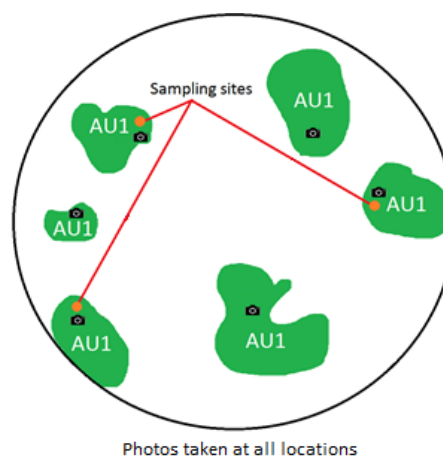

Figure 2.3: Diagram illustrating 'streamlining' as outlined in Box 2.3

2.4.2.2 Determine distribution of sampling sites

Distribute sampling sites throughout the assessment unit in a way that captures the typical structure and function of the vegetation in the assessment unit. Sampling sites should be at least 50m from any major disturbance. For example, sampling sites should not be located in weedy, disturbed roadside areas if the rest of the assessment unit is relatively undisturbed.

2.4.2.3 Record assessment unit and sampling site details

Once assessment units and sampling sites have been defined, record:

- The size of the matter area (in hectares);
- The regional ecosystem and broad condition state of each assessment unit;
- The size of each assessment unit (in hectares);
- Co-ordinates of the zero point of each sampling site; and
- Compass bearing along the transect at each sampling site.

This information must be included in your offset delivery plan, advanced offset application or monitoring report, along with a spatial representation of the matter area including all assessment units and sampling sites.

2.4.3 Assess site-based attributes

The measurable site-based attributes in Box 2.4 indicate the structure, function and composition of a regional ecosystem.

Attribute	Maximum* weighting (%)
Box 2.4 – Site-based attributes	
Number of large native trees	15
Tree canopy height (emergent, canopy and sub-canopy)	5
Recruitment of woody perennial species (in the ecologically dominant layer)	5
Tree canopy cover (%) (emergent, canopy and sub-canopy)	5
Native shrub layer cover (%)	5
Coarse woody debris	5
Native plant species richness for trees, shrubs, grasses, and forbs/others	20
Non-native plant cover	10
Native perennial grass cover (%)	5
Organic litter cover	5
MAXIMUM* TOTAL	**80**

Note that in the BioCondition method, site-based attributes comprise 80% of the overall score and the remaining 20% is based on landscape-scale attributes. For the purposes of this habitat quality assessment method, only site-based attributes are assessed and the resulting percentage out of 80% is converted to a numerical score out of 10.*

* Weightings, and therefore maximum total, may be less for particular ecosystem types that naturally lack certain site-based attributes.

Site-based attribute assessment is conducted as per the BioCondition Assessment Manual.

If the ecosystem that is being assessed at the site naturally lacks a certain site-based attribute, that attribute must be excluded from the BioCondition scoring procedure. BioCondition benchmarks indicate which attributes are applicable to a particular regional ecosystem. **Section 4, Table 4** of the BioCondition Assessment Manual details the assessable site-based attributes and their weightings for wooded, grassland, shrubland and mangrove ecosystems. Refer to this section to:

1. adjust the standard attribute weightings to account for excluded attributes; and
2. calculate the maximum possible score that the site could achieve for site-based attributes.

2.4.3.1 When to undertake field assessments

Refer to **Section 3.3** of the BioCondition Assessment Manual to determine the best time to assess site-based attributes. Any divergence from these recommendations should be justified in your advanced offset application, offset delivery plan or monitoring report.

2.4.3.2 Resources required

The following equipment is recommended:

- the BioCondition Assessment Manual including all appendices

- benchmark documents for each of the regional ecosystems assessed (available on the Queensland Government website) (a reference site should be used where there is no available benchmark; see The Queensland Herbarium's Method for the Establishment and Survey of Reference Sites for BioCondition). Refer to **Section 2.3** of the BioCondition Assessment Manual for more information on benchmarks and reference sites.

- Regional Ecosystem technical descriptions and/or regional ecosystem descriptions which can be found on the Queensland Government website.

- Global Positioning System (GPS)

- compass (to lay out the area)

- a camera

- 100m transect tape

- 50m transect tape (optional)

- 1m x 1m quadrat for measuring ground cover

- star pickets to mark the 0m and 50m point along the transect

- a diameter tape or a smaller measuring tape

- a clinometer, hypsometer or ruler for measuring tree heights

- clipboard, pencils and erasers

- 50m transect tape (optional)

- flagging tape (optional)

- plant identification books (optional)

2.4.3.3 Set up the sampling site

Set up the sampling site in accordance with **Section 3.4** of the BioCondition Assessment Manual. Any divergence from this should be justified in your advanced offset application, offset delivery plan or monitoring report.

2.4.3.4 Benchmarks

In the BioCondition Assessment Manual, site-based attributes are scored relative to a 'benchmark', which is a document containing site-based attribute measurements for vegetation within a particular regional ecosystem in an undisturbed state with most of its natural values intact. The Queensland Herbarium has developed BioCondition benchmarks for regional ecosystems across Queensland, and more benchmarks are currently being developed.

Where a BioCondition benchmark has not been developed for a regional ecosystem, reference sites that best represent that regional ecosystem in its undisturbed state must be identified and surveyed in accordance with the Queensland Herbarium's Method for the Establishment and Survey of Reference Sites for BioCondition. The Queensland Herbarium should also be consulted during this process to ensure appropriate reference sites are selected.

2.4.3.5 Assess site-based attributes

Conduct your assessment of site-based attributes as detailed in **Section 5** of the BioCondition Assessment Manual. Record your results in the BioCondition field assessment sheet, also available in **Appendix 2** of the BioCondition Assessment Manual. Use a new sheet for each sampling site.

Collect photographic evidence from each sampling site as detailed in **Section 3.4** and **Appendix 4** of the BioCondition Assessment Manual.

Appendices 1-9 of the BioCondition Assessment Manual provide supporting information for conducting this assessment.

2.4.4 Assess species habitat attributes

Species habitat attributes indicate a matter area's capacity to support a species for all or part of its life cycle, whether permanently or from time to time. Species habitat attributes are assessed and scored for the entire matter area. The species habitat attributes and their respective weightings are listed in Table 2.3. This section prescribes a method for scoring each of these attributes.

Table 2.3: Species habitat attributes and their weightings

Species Habitat Attribute	Weighting (%)
Quality and availability of food and habitat required for foraging	25
Quality and availability of habitat required for shelter and breeding	25
Quality and availability of habitat required for mobility	25
Absence of threats	25

2.4.4.1 Literature review

Undertake a comprehensive literature review of the species to identify the factors that constitute, and have the ability to affect, each of the attributes listed in Table 2.3 for the species. Collate the findings of your literature review to detail the following:

- what constitutes suitable habitat for the species and the factors that influence habitat suitability;
- the factors that affect the species' ability to occupy an area;
- the factors that affect the survival and reproductive success of the species;
- methods to assess each of the above factors;
- factors that affect your ability to accurately measure the above factors;
- the species' conservation status, population size and population distribution in Queensland;
- the species' life history strategy, including its life cycle, ecological requirements (biotic and abiotic elements that must be present for the species to be present particularly for foraging, shelter, breeding and mobility), population dynamics (birth and death rates, immigration and emigration) and utilisation distribution (distribution, home range, dispersal, seasonal use patterns);

- the known and potential threats to the species, including human-induced threats such as inappropriate land management, habitat loss and fragmentation as well as ecological threats such as climate change, predation and competition; and
- behaviours of the species that may influence its detection during surveys.

This review may include, but is not limited to, peer-reviewed scientific literature, Conservation Advices, Recovery Plans, Species Profile and Threats Database (SPRAT), Back on Track Species Prioritisation Framework, Species Recovery Information Gateway – The Spring, WildNet, Wildlife Online, Atlas of Living Australia, Regional Ecosystem Description Database (REDD), recorded sightings, essential habitat factors[8] and species mapping and modelling.

If there is insufficient literature or knowledge regarding the particular species, you may broaden the scope of the literature review to report on relevant information from similar species and ecosystems (Eyre *et al.* 2018). Alternatively, an expert elicitation can be conducted by eliciting knowledge from a panel of experts in the species to supplement limited empirical data. In either instance, you must clearly identify any data deficiencies in an advanced offset application, offset delivery plan or monitoring report, and explain how these were managed and any assumptions made.

2.4.4.2 When to undertake a matter area assessment

You must determine the most appropriate time to undertake an on-ground assessment species habitat attributes based on the influence of the time of day, season and/or climate events on the species' activity and the presence and quality of resources at the site. The timing of the assessment must be justified in any advanced offset application, offset delivery plan or monitoring report.

Future assessments must be conducted under conditions as similar as possible to the initial assessment to ensure results can be meaningfully compared.

2.4.4.3 Quality and availability of food and habitat required for foraging, shelter and breeding, and mobility

This section outlines the assessment requirements for following three species habitat attributes:

- Quality and availability of food and habitat required for foraging;
- Quality and availability of habitat required for shelter and breeding; and
- Quality and availability of habitat required for mobility.

To assess each attribute, you must first select number of indicators of that attribute. An indicator is a measurable entity related to a specific information requirement (Foundations of Success 2012). In this context, an indicator is an aspect of the habitat, such as a particular vegetation condition or resource, which indicates the matter area's capacity to support the species in question. Examples of indicators are listed in Box 2.5.

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[8]Essential habitat factors are one component used to create the essential habitat map under the *Vegetation Management Act 1999.* Essential habitat factors are components of the species' habitat that is necessary or desirable for the species at any stage of its lifecycle including regional ecosystem type, vegetation community type, soil types, altitude and position in the landscape. An area of known essential habitat for an endangered or vulnerable animal can be searched using the Queensland Government's Vegetation Map or Property Report, which provides a summary of the essential habitat factors for the species (page 3 of the report).

Attribute	Indicators	Notes
Quality and availability of food and habitat required for foraging	• **Particular plant species** • **Availability of prey species** • **Grass seeds** • **Flowering or fruiting plants** • **Termite mounds** • **Watercourses**	
Quality and availability of habitat required for shelter and breeding	• **Hollows** • **Logs** • **Caves** • **Large shady trees** • **Cracking clays** • **Rocky outcrops**	Habitat required for shelter may include habitat factors required to avoid predation or other threats, rest or seeking shelter from the elements (e.g. heat, rain, cyclones etc.). Many of the habitat features required for breeding may overlap with those required for shelter, such as hollows, caves, etc. As part of this attribute however, you must also consider any habitat factors required for breeding other than those that also provide shelter and include these in your assessment.
Quality and availability of habitat required for mobility	• **Particular vegetation structure** • **Particular vegetation composition** • **Vegetated corridors** • **Shade** • **Snags** • **Riparian vegetation**	Habitat required for mobility relates to the species' ability to move within the matter and, if relevant, to and from adjacent patches of habitat. Mobility capacity between adjacent patches of suitable habitat will only be relevant to species that naturally inhabit an area that is larger than the matter area. The literature review should have identified the species' utilisation distribution; for example, its usual habitat size, home range or dispersal range, which will inform whether this should be assessed.

For each selected indicator, you must develop a suitable rating system. If the indicator cannot be measured directly or reliably, a suitable surrogate indicator must be used instead. The rest of this section deals with selecting and measuring indicators.

Scientific justification of the selected indicators, surrogate indicators and methods for their measurement must be provided as part of your offset delivery plan, monitoring report or advanced offset application.

Select indicators

For each attribute, identify and select indicators, both biotic and abiotic, that constitute that attribute. There is no limit to the number of indicators you can select, but you must include all of those factors that are required for the species' long-term viability. Indicators should be responsive to management, such that a measurable improvement in their quality or availability can be achieved as a result of direct or indirect management actions. Note that indicators may overlap with the site-based attributes listed in Box 2.4.

Initially, use the information collected in the literature review to identify indicators. Subsequently, undertake reconnaissance desktop and on-site assessments to identify any additional indicators, such as those that may be specific to the matter area. For certain species, it may be appropriate or necessary to seek advice from an expert on the species.

Many indicators will be able to be measured directly and, where possible, this is the preferred option. For example, if the indicator is hollow logs, the number of hollow logs in the matter area that would be suitable for the species to use as shelter could be counted. Where the indicator cannot be reliably or practicably measured, a surrogate indicator must instead be selected (Foundations of Success, 2009). For example, where the indicator is insects for food, it may be difficult to measure insect abundance directly. Instead, the number of hollows and cracks where insects reside could be used as a surrogate indicator.

Assessment of an indicator may be undertaken across the entire matter area or, where this is not practicable, assessments can be undertaken at a number of sampling sites representative of the matter area.

Indicators can be measured quantitatively (numerically), such as in terms of area, count or percentage, or qualitatively (by description) and then converted to a numerical score.

Develop a rating scale for each indicator

The three species habitat attributes dealt with in this section each contribute 25% to the overall species habitat score and consequently are each assigned a score out of 25.

Each indicator must be given a whole number score between 0 and 25, where 0 represents an unavailable resource, 1 represents the lowest quality and/or availability, and 25 represents the highest quality and/or availability. For simplicity, however, it is recommended that a rating system of 0 to 5 is used and the score multiplied by 5.

First, for the selected indicator, determine the worst- and best-case scenarios for the matter area using scientific benchmarks, general ecological concepts, comparisons to other similar systems, or expert opinion (Foundations of Success, 2009). The worst-case scenario (that the resource is not available) represents the lowest score possible, and the best-case scenario represents the highest score possible. Then, discern continuous categories of quality or availability for each score within these bounds. Categories can be quantitative (e.g. area, percentage, count, height) or qualitative (e.g. low, high, widespread, limited).

As an example, tree hollows of a particular size may be an indicator for a species of glider for the 'habitat required for shelter and breeding' attribute. For the matter area in question, it is practical to conduct a simple count of tree hollows of that size. It may be determined that a count of 10 hollows in that area represents the best-case scenario, and 0 hollows represents the worst-case scenario. Scoring categories may be determined as follows:

Score	0	1	2	3	4	5
Description	0 hollows	1-2 hollows	3-4 hollows	5-6 hollows	7-8 hollows	9-10 hollows

Score indicators and species habitat attributes

After developing a rating scale for each indicator:

1. Undertake a site-based assessment of the selected indicator using the developed rating scale.
2. Multiply the score by 5 to convert it into a score between 0 and 25.
3. Repeat this process for each indicator selected to assess the species habitat attribute.
4. Calculate each species habitat attribute score by averaging the indicator scores for that attribute. For example, if three indicators for the 'quality and availability of habitat required for shelter and breeding' for the glider were scored at 9, 12 and 15, the score for the 'quality and availability of habitat required for shelter and breeding' attribute would be 12 (out of 25).

2.4.4.4 Absence of threats

This attribute indicates the magnitude of all known or potential threats within, or within close proximity to, the matter area that may negatively impact on the species' habitat and/or the species' ability to exist and persist in the matter area.

Identify threats to species and its habitat & select threat factors

Initially, use the information collected in the literature review to identify all known and potential threats that may negatively impact the species and its habitat within, and within close proximity to, the matter area. Subsequently, undertake reconnaissance desktop and on-site assessments to identify any additional threats, such as those that may be specific to the matter area.

On-site assessments may also result in the removal of threats from the list where a particular threat is highly unlikely to be relevant to the matter area within a reasonable time period. Refine your list of threat factors accordingly.

Examples of threats are provided in Box 2.6.

Box 2.6 – Example of threats

- Weeds that prevent the establishment of suitable habitat for the species or the species' ability to use the habitat
- Clearing or development (current or future) that may impact on the species' habitat or increase injury or mortality to the species
- Presence of pest species that impact on the species' habitat (e.g. pigs) or increase stress, injury or mortality to the species (e.g. dogs, cats, foxes)
- Inappropriate fire regimes
- Erosion or land degradation that impacts hydrological regimes and water quality
- Competition from other species that utilise the same ecological niche as the species
- Presence of native species that predate on the species
- Evidence of disease or pathogens
- Major barriers preventing movement of the species either within the habitat or to surrounding habitat

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Assess each threat factor

To assess each threat factor, conduct a targeted desktop and on-site assessment of the matter area and the adjacent area. Rate the scope and severity of each threat factor for the entire matter area according to the descriptions in Box 2.7.

Box 2.7 – How to rate the scope and severity of each threat factor (adapted from IUCN-CMP, 2007)

Scope: The proportion of the species' habitat or local population within the matter area that can reasonably be expected to be affected by the threat within ten years given the continuation of current circumstances and trends (IUCN-CMP, 2007). The five-point rating scale is:

1. **Very High:** The threat is likely to be pervasive in its scope, affecting the species' habitat or the species' local population across all or most (80-100%) of its occurrence or population within the matter area.
2. **High:** The threat is likely to be widespread in its scope, affecting the species' habitat or the species' local population across a majority (60-79%) of its occurrence or population within the matter area.
3. **Medium:** The threat is likely to be restricted in its scope, affecting the species' habitat or the species' local population across some (40-59%) of its occurrence or population within the matter area.
4. **Low:** The threat is likely to be narrow in its scope, affecting the species' habitat or the species' local population across small proportion (20-39%) of its occurrence or population within the matter area.
5. **Very Low:** The threat is likely to be very narrow in its scope, affecting the species' habitat or the species' local population across a negligible proportion (1-19%) of its occurrence or population within the matter area.

Severity: Within the scope, the level of damage from the threat to the species' habitat/local population that can reasonably be expected given the continuation of current circumstances and trends (IUCN-CMP, 2007). The five-point rating scale is:

1. **Very High:** Within the scope, the threat is likely to destroy or reduce the species' habitat/local population by 80-100% within ten years or three generations.
2. **High:** Within the scope, the threat is likely to seriously degrade or reduce the species' habitat/local population by 40-79% within ten years or three generations.
3. **Medium:** Within the scope, the threat is likely to moderately degrade or reduce the species' habitat/local population by 11-39% within ten years or three generations.
4. **Low:** Within the scope, the threat is likely to only slightly degrade or reduce the species' habitat/local population by 6-10% within ten years or three generations.
5. **Very Low:** Within the scope, the threat is likely to have a negligible damage or will only degrade or reduce the species' habitat/local population by 1-5% within ten years or three generations.

Using the ratings for scope and severity assigned to each threat factor, determine the corresponding score between 1 and 25 for each threat factor using the threat matrix in Table 2.4 below. A threat factor with a score of 1 poses a very high threat to the species, and a threat factor with a score of 25 poses a very low threat to the species.

Each selected threat factor, and its scope and severity ratings, must be detailed and justified in your offset delivery plan, advanced offset application or monitoring report.

Table 2.4: Threat matrix for scoring each threat factor according to its scope and severity

Threat Matrix (adapted from IUCN-CMP, 2007)			Severity				
			Very High	High	Medium	Low	Very Low
			1	2	3	4	5
Scope	Very High	1	1	2	3	4	5
	High	2	2	4	6	8	10
	Medium	3	3	6	9	12	15
	Low	4	4	8	12	16	20
	Very Low	5	5	10	15	20	25

Assign final score for absence of threats

The final score for the 'absence of threats' attribute is that of the lowest scoring (i.e. most threatening) threat factor. For example, if four threat factors were identified and assigned scores of 3, 5, 15 and 17, the overall score for absence of threats will be 3.

2.4.5 Calculate matter area habitat quality

Calculations must be detailed within an offset delivery plan, monitoring report or advanced offset application.

2.4.5.1 Calculate BioCondition score for each sampling site

The habitat quality score for a sampling site is calculated by adding the scores obtained for each site-based attribute, and then dividing by the maximum possible score for the regional ecosystem in question (e.g. 80 for wooded ecosystems, 30 for grassland ecosystems, 45 for shrubland ecosystems and 65 for mangrove ecosystems) to standardise the total as a score between 0 and 1. Calculate the BioCondition score for each sampling site using the following equation:

$$BC_x = \frac{a + b + c + d + e + f + g + h + i + j}{SBA_{max\%}}$$

Where:

BC_x	= BioCondition score for sampling site x
a	= Score for 'number of large trees' attribute
b	= Score for 'tree canopy height' attribute
c	= Score for 'recruitment of woody perennial species' attribute
d	= Score for 'tree canopy cover' attribute
e	= Score for 'native shrub layer cover' attribute
f	= Score for 'coarse woody debris' attribute
g	= Score for 'native plant species richness for trees, shrubs, grasses, and forbs/others' attribute
h	= Score for 'non-native plant cover' attribute
i	= Score for 'native perennial grass cover' attribute
j	= Score for 'organic litter cover' attribute
$SBA_{max\%}$	= the maximum site-based score that can be obtained for site-based attributes $a - j$ that are relevant to the regional ecosystem being assessed (e.g. 80 for a wooded ecosystem, 30 for a grassland ecosystem).

Repeat for each sampling site.

2.4.5.2 Calculate BioCondition score for each assessment unit

The BioCondition score for each assessment unit is the average of the scores of the sampling sites within it. Calculate the BioCondition score for each assessment unit using the following equation:

$$BC_{AUx} = \frac{BC_1 + BC_2 + \ldots BC_N}{N}$$

Where:

BC_{AUx} = BioCondition score for assessment unit x

BC_1 = BioCondition score for sampling site 1 within the assessment unit

BC_2 = BioCondition score for sampling site 2 within the assessment unit

BC_x = BioCondition score for sampling site N within the assessment unit

N = Number of sampling sites within the assessment unit

Repeat for each assessment unit within the matter area.

2.4.5.3 Calculate area-weighted BioCondition score for each assessment unit

Calculate an area-weighted score for each assessment unit to generate a 'per-hectare' score using the following equation:

$$WBC_{AUx} = \frac{BC_{AUx} \times A}{T}$$

Where:

WBC_{AUx} = Weighted BioCondition score for assessment unit x

BC_{AUx} = BioCondition score for assessment unit x (as calculated in 2.4.5.2)

A = Area (in hectares) of assessment unit x

T = Total area (in hectares) of the matter area

Repeat for each assessment unit within the matter area.

2.4.5.4 Calculate BioCondition score for the matter area

Calculate the BioCondition score for the entire matter area using the following equation:

$$BC_{matter\ area} = WBC_{AU1} + WBC_{AU2} + \ldots WBC_{AUN}$$

Where:

$BC_{matter\ area}$ = The BioCondition score for the entire matter area

WBC_{AU1} = Weighted BioCondition score for assessment unit 1

WBC_{AU2} = Weighted BioCondition score for assessment unit 2

WBC_{AUN} = Weighted BioCondition score for assessment unit N

2.4.5.5 Convert matter area BioCondition score to score out of 10

Convert the matter area BioCondition score into a score out of 10 by multiplying the matter area BioCondition score by 10.

$$BC_{matter\ area\ (out\ of\ 10)} = BC_{matter\ area} \times 10$$

2.4.5.6 Calculate matter area species habitat score

Calculate the species habitat score (out of 100) for the matter area by summing the four species habitat attributes scores:

$$SH_{matter\ area} = SHA_1 + SHA_2 + SHA_3 + SHA_4$$

Where:

$SH_{matter\ area}$	= The species habitat score for the entire matter area
SHA_1	= Score for species habitat attribute 1: quality and availability of food and habitat required for foraging
SHA_2	= Score for species habitat attribute 2: quality and availability of habitat required for shelter and breeding
SHA_3	= Score for species habitat attribute 3: quality and availability of habitat required for mobility
SHA_4	= Score for species habitat attribute 4: absence of threats

2.4.5.7 Convert matter area species habitat score to score out of 10

Convert the matter area species habitat score into a score out of 10 by dividing it by 10.

$$SH_{matter\ area\ (out\ of\ 10)} = \frac{SH_{matter\ area}}{10}$$

Chapter 3: Koala habitat in South East Queensland

This chapter applies to impacts and offsets that relate to koala habitat in South East Queensland (SEQ)[9].

Koala habitat in SEQ includes the following prescribed environmental matters where they are located within SEQ:

- Koala habitat areas identified in the Koala Conservation Plan Map under the Nature Conservation (Koala) Conservation Plan 2017 (see Schedule 2, section 6(3) of the *Environment Offsets Regulation 2014*);

- Essential habitat for koala identified on the essential habitat map under the *Vegetation Management Act 1999* (see Schedule 2, section 2(3)(b) of the *Environment Offsets Regulation 2014*); and

- An area that is not mapped as habitat, but which contains or is likely to contain koalas (see Schedule 2, section 6(4) of the *Environment Offsets Regulation 2014*).

This chapter may also be applied to impacts and offsets that relate to koala habitat outside SEQ instead of Chapter 2: Terrestrial fauna habitat.

When submitting the results of an assessment undertaken using this guide, all relevant supporting material must be included in the submission. A checklist of requirements to accompany an offset delivery plan, monitoring report or advanced offset application for assessments conducted in accordance with this chapter is provided in **Appendix 3**.

3.1 Policy requirements

The requirements for proponent-driven offsets for koala habitat in SEQ are detailed in Chapter 2A of the Queensland Environmental Offsets Policy.

The Queensland Environmental Offsets Policy lists the following definitions relevant to this chapter:

- **koala habitat tree** means a tree of any of the following genera – *Angophora, Corymbia, Eucalyptus, Lophostemon* and *Melaleuca*.
- **non-juvenile koala habitat tree** means a koala habitat tree that is more than 4m high <u>or</u> has a trunk with a circumference of more than 31.5cm at 1.3m above the ground.

The Queensland Environmental Offsets Policy requires an offset to be of a size and scale proportionate to the impact to the prescribed environmental matter. The size and scale of an offset for non-juvenile koala habitat trees in SEQ is determined based on:

1. The number of non-juvenile koala habitat trees that will be impacted;
2. The number of koala habitat trees that must be established as an offset to achieve a conservation outcome, which is three new koala habitat trees for every one non-juvenile koala habitat tree impacted; and
3. The area required to establish the number of koala habitat trees that must be established as the offset.

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[9] South East Queensland is the area identified as the South East Queensland region under the South East Queensland Regional Plan. This includes the local government areas of Brisbane City Council, City of Gold Coast, Ipswich City Council, Lockyer Valley Regional Council, Logan City Council, Moreton Bay Regional Council, Noosa Shire Council, Redland City Council, Scenic Rim Council, Somerset Regional Council, Sunshine Coast Council and (part of) Toowoomba Regional Council.

Number of non-juvenile koala habitat trees impacted

To determine the offset requirement, you must first determine the number of non-juvenile koala habitat trees to be impacted.

Where the impact matter area is relatively small, the number of non-juvenile koala habitat trees in the impact matter area can be counted. Where it is impractical to count every non-juvenile koala habitat tree, either the stratified sampling approach described in section 3.4.1 of this chapter, or the average stem density approach described in sections 3.4.2.1 – 3.4.2.5 of this chapter, can be used to estimate the number of non-juvenile koala habitat trees to be impacted.

Number of koala habitat trees required to be offset

Multiply the number of non-juvenile koala habitat trees to be impacted by three to determine the offset requirement.

A conservation outcome can be achieved by planting new trees (e.g. tube stock) and managing these trees until they are established (i.e. become non-juvenile koala habitat trees), or by managing juvenile koala habitat trees that already exist on the offset site until they are established (i.e. become non-juvenile koala habitat trees).

Area required to establish number of required koala habitat trees

The Queensland Environmental Offsets Policy requires that koala habitat trees must be established at densities that will produce a mature density reflective of the existing or pre-clearing regional ecosystem(s) at the offset site. You must therefore determine whether the proposed offset site is large enough to meet this requirement using the average stem density approach detailed in section 3.4.2.1 – 3.4.2.4 and 3.4.2.6 of this chapter.

3.2 Demonstrating a conservation outcome

To demonstrate that an offset has achieved a conservation outcome for koala habitat in SEQ, the offset must:

1. establish the required number of non-juvenile koala habitat trees;
2. establish trees that are native to the regional ecosystem at the offset site;
3. establish trees at a mature density reflective of the regional ecosystem at the offset site; and
4. contain or be capable of containing a self-sustaining population of koalas.

3.3 Offset site selection

The requirements for proponent-driven offsets for koala habitat in SEQ are detailed in **Section 2.3.1.6** of the Queensland Environmental Offsets Policy. One of these requirements is that the offset site must contain or be capable of containing a self-sustaining population of koalas, either permanently or from time to time. If this requirement cannot be met, the site is not suitable to deliver an offset for koala habitat.

Additionally, you must demonstrate that the proposed offset site is appropriately situated within the broader landscape to achieve a conservation outcome for koalas. This is done by assessing and scoring the landscape-scale attributes of the offset site using the method prescribed by the Queensland Herbarium's BioCondition Assessment Manual. All references to the BioCondition Assessment Manual in this chapter are specific to Version 2.2.

3.3.1 Demonstrate that the site contains or is capable of containing koalas

Before undertaking the habitat quality assessment method described in this chapter, conduct a targeted fauna survey at the offset site to assess the presence, or potential presence, of koalas. The method prescribed in the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland is recommended.

If evidence of koalas is not detected within the proposed offset site but is detected nearby, the proposed offset site could be demonstrated to be capable of containing koalas if, for example:

- the offset site is directly connected to habitat that contains koalas and those koalas can move freely and safely into the offset site; or
- the offset site is within the current home range of an individual or population of koalas but is currently not utilised due to poor habitat condition or threats that could be managed as part of the offset.

Use the results of your targeted survey to conclude that:

- the site evidently contains koalas;
- the site contains no evidence of koalas, but could contain koalas with targeted management; or
- the site contains no evidence of koalas, and is unlikely to contain koalas even with targeted management.

If the site is unlikely to contain koalas even with targeted management, it is not suitable for delivering a koala habitat offset.

3.3.1.1 Assess landscape-scale attributes

The measurable landscape-based attributes in Box 3.1 describe the landscape surrounding the matter area and the influence this has on the matter area's vegetation quality. The attributes measured differ according to whether the subregion is fragmented or intact. Refer to **Section 6** of the BioCondition Assessment Manual to determine whether the subregion is fragmented or intact.

Box 3.1 – Landscape-scale attributes

For fragmented subregions:

Attribute	Maximum score
Size of patch	10
Context	5
Connectivity	5
Ecological corridors^	NA
TOTAL	**20**

For intact subregions:

Attribute	Maximum score
Distance to permanent water*	20
TOTAL	**20**

^ *This attribute is not assessed using the BioCondition Assessment Manual; instructions for assessing proximity to ecological corridors are provided in this section.*

* *This attribute should not be assessed for regional ecosystems for which distance to permanent water is redundant (i.e. mangrove ecosystems). Thus, for intact mangrove ecosystems, no landscape-scale attribute assessment is necessary.*

The assessment of particular landscape-scale attributes is redundant for certain ecosystem types. **Section 4, Table 4** of the BioCondition Assessment Manual details the assessable landscape-scale attributes and their weightings for wooded, grassland, shrubland and mangrove ecosystems. Refer to this section to:

1. adjust the standard attribute weightings to account for excluded attributes; and
2. calculate the maximum possible score that the site could achieve for landscape-scale attributes.

Conduct your assessment of landscape-scale attributes (except for 'ecological corridors') as detailed in **Section 6** of the BioCondition Assessment Manual. Relevant spatial mapping for this assessment can be downloaded from Queensland Spatial Catalogue (QSpatial). State your result as a numerical score out of 20, rather than as a percentage out of 20% as instructed by the BioCondition Assessment Manual.

Note that the BioCondition method is designed to generate an overall condition score for vegetation, where site-based attributes comprise 80% of the score and landscape-scale attributes comprise the remaining 20%. In this guide however, site-based attributes and landscape-scale attributes are considered separately and are not combined into one score. This is because only the site-based attributes of an offset matter area are able to be managed as part of an offset, while the landscape-scale attributes of an offset site are not. However, a proposed offset site must achieve at least a moderate landscape-scale attribute score to demonstrate that its position in the landscape is appropriate for delivering an offset that achieves a conservation outcome.

Ecological corridors

An 'ecological corridor' is represented as any riparian or terrestrial feature within the 'CORR_TYPE' attribute table of the 'Queensland biodiversity and vegetation offsets special features' map, which is available on QSpatial. This mapping can also be viewed on Queensland Globe in the 'Statewide Biodiversity Corridors' layer.

This attribute is only relevant to fragmented landscapes. To assess this attribute:

1. Determine the proximity of the site to a state, bioregional, regional or subregional corridor (terrestrial or riparian); and
2. Assess and state whether the site is (a) not located within, (b) sharing a common boundary with, or (c) located within (in whole or in part) an ecological corridor.

Justify offset site selection

After conducting an assessment of the proposed offset site's landscape-scale attributes, construct a brief justification for your offset delivery plan or advanced offset application of the site's suitable position within the landscape for delivering an offset that achieves a conservation outcome for koalas. The administering agency will consider your justification when deciding if the proposed offset site is suitable for delivering an offset for koala habitat.

When considering the location and context of the proposed offset site, identify any risks or potentially unmanageable factors or processes that may prevent the achievement of a conservation outcome for the koala habitat, such as exposure to frequent disturbance or high potential for increasing habitat fragmentation. If any such risks are present at the site, the site will be unlikely to be suitable for delivering an offset. If you wish to submit an offset delivery plan or an advanced offset application for a site where such risks are present, you must clearly identify these and describe how they will be managed in your offset delivery plan or advanced offset application. The administering agency will consider this information when deciding if the proposed offset site is suitable for delivering an offset for koala habitat.

3.4 Habitat quality assessment method

Habitat quality assessments for impacts or offsets related to koala habitat in SEQ may be conducted may be conducted differently depending on their purpose. Refer to Table 3.1 to determine which components of this habitat quality assessment method you are required to complete.

Table 3.1: Assessment requirements for each assessment type

Purpose of assessment	Assessment requirements	Sections to complete
Assess habitat quality at an <u>impact matter area</u>	Count number of non-juvenile koala habitat trees to be impacted	<u>Simple tree count</u> OR <u>Stratified sampling approach</u> (**Section 3.4.1**) OR <u>Average stem density approach</u> (**Sections 3.4.2.1 – 3.4.2.5**)
Assess habitat quality at a <u>potential offset site</u> to determine its suitability for delivering an offset	Determine number of non-juvenile koala habitat trees that could be established based on the site's existing or pre-clearing regional ecosystem type	<u>Average stem density approach</u> (**Sections 3.4.2.1 – 3.4.2.4 and 3.4.2.6**)
Assess habitat quality at a <u>potential offset site</u> for an advanced offset application		
Assess habitat quality at an <u>offset matter area</u> to evaluate its achievement of, or progress towards achieving, a conservation outcome	Determine number of koala habitat trees established in the offset matter area as a result of the offset	<u>Simple tree count</u> OR <u>Stratified sampling approach</u> (**Section 3.4.1**)

3.4.1 Stratified sampling approach

The stratified sampling approach can be used to estimate the number of non-juvenile koala habitat trees in a matter area where it is impractical to conduct a simple tree count.

The stratified sampling approach involves the partitioning of a matter area into assessment units. Sampling sites (or transects) are placed within each assessment unit in locations that best represent the assessment unit. Using this approach, non-juvenile koala habitat trees are counted at each sampling site and this number is subsequently extrapolated to indicate the number of non-juvenile koala habitat trees in the entire matter area.

3.4.1.1 Define the assessment units

Delineate the matter area into assessment units. An assessment unit is a defined area or group of areas within the matter area that is relatively homogenous in that it contains only one regional ecosystem type that is of a reasonably consistent broad condition state[10]. This approach must be employed to capture variance in the structure, function and quality of habitat across a matter area.

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[10] "Broad condition state" refers to whether the vegetation is remnant, regrowth or non-remnant (see Box 1.1 in Chapter 1).

An assessment unit does not need to be one continuous area. In some instances, a regional ecosystem of the same broad condition state exists as unconnected patches throughout the matter area. In this instance, a single assessment unit may comprise of two or more discrete areas.

To define assessment units for the matter area:

1. Create a map of the matter area being assessed that identifies:
   a. the extent of the matter area (in hectares);
   b. the extent and type of any remnant regional ecosystems;
   c. the extent and type of any regrowth regional ecosystems; and
   d. the extent and type of any non-remnant regional ecosystems[11].
2. Using this map, delineate assessment units for the matter area. An assessment unit should:
   a. contain a unique regional ecosystem; and
   b. be of the same broad condition state (e.g. remnant, regrowth or non-remnant).

3.4.1.2 Select sampling sites

Once the assessment units have been defined, select sampling sites within each assessment unit. Table 3.2 indicates the number of sampling sites that should be used relative to the size of the assessment unit.

Table 3.2: Guide to number of sampling sites relative to assessment unit size

| Assessment unit size	Suggested number of sampling sites
0–50 hectares (ha)	At least two
50–100ha	Three
100–500ha	Four
500–1000ha	Five
More than 1000ha	Six

Distribute sampling sites throughout the assessment unit in a way that captures the typical structure and function of the vegetation in the assessment unit.

3.4.1.3 Survey the sampling sites

Set up each sampling site by laying a 100m x 50m transect (see Figure 3.1). At each assessment site, record the number of non-juvenile koala habitat trees that fall within the 100m x 50m transect. Non-juvenile koala habitat trees that lie on the border of the sampling site should be counted on one side and excluded on the opposite side (e.g. include trees on the border of the northern boundary of the sampling site, and exclude trees on the border of the southern boundary of the sampling site).

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[11] Relevant spatial mapping (remnant, regrowth and non-remnant (pre-clearing) regional ecosystem mapping) for this assessment can be downloaded from Queensland Spatial Catalogue (QSpatial).

Figure 3.1: Layout of a sampling site for counting non-juvenile koala habitat trees using the stratified sampling approach
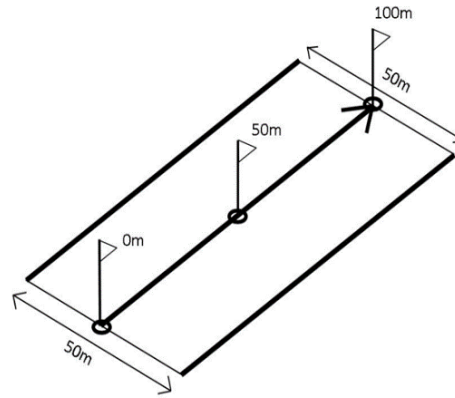
If you are using the stratified sampling approach to assess habitat quality at an offset matter area to evaluate its achievement of, or progress towards achieving a conservation outcome, <u>you must only count those koala habitat trees that were established as part of the offset</u>. Any koala habitat trees that were not established as part of the offset must be excluded from the count.

3.4.1.4 Determine the average number of non-juvenile koala habitat trees across the sampling sites within each assessment unit

Within each assessment unit, add the number of non-juvenile koala habitat trees counted at each sampling site and divide by the number of sampling sites in the assessment unit.

$$\text{NJKHT}_{\text{SS average}} = \left(\frac{\text{SS}_1 + \text{SS}_2 + \cdots \text{SS}_x}{\text{N}_{\text{SS}}} \right)$$

Where:

$\text{NJKHT}_{\text{SS average}}$ Average number of non-juvenile koala habitat trees for the sampling sites within an assessment unit

SS_1 Number of non-juvenile koala habitat trees counted in sampling site 1

SS_2 Number of non-juvenile koala habitat trees counted in sampling site 2

SS_x Number of non-juvenile koala habitat trees counted in sampling site x

N_{SS} Number of sampling sites in the assessment unit

3.4.1.5 Estimate the number of non-juvenile koala habitat trees in each assessment unit

To estimate the number of non-juvenile koala habitat trees in each assessment unit, multiply the average number of non-juvenile koala habitat trees calculated for the sampling sites within each assessment unit by 2 to provide a per hectare estimate of the number of non-juvenile koala habitat trees, then multiply by the number of hectares comprising the assessment unit.

$$\text{NJKHT}_{\text{AU}x} = \text{NJKHT}_{\text{SS average}} \times 2 \times \text{A}_{\text{AU}x}$$

Where:

$\text{NJKHT}_{\text{AU}x}$ Number of non-juvenile koala habitat trees in assessment unit x

$\text{NJKHT}_{\text{SS average}}$ Average number of non-juvenile koala habitat trees for the sampling sites within an assessment unit calculated in previous step

A_{AU} Area of assessment unit x in hectares

Repeat for each assessment unit.

3.4.1.6 Estimate the number of non-juvenile koala habitat trees in the matter area

To estimate the number of non-juvenile koala habitat trees within the entire matter area, add the estimated number of non-juvenile koala habitat trees within all assessment units.

$$\text{NJKHT}_{\text{MA}} = \text{NJKHT}_{\text{AU1}} + \text{NJKHT}_{\text{AU2}} + \cdots \text{NJKHT}_{\text{AU}N}$$

Where:

NJKHT_{MA} Number of non-juvenile koala habitat trees in the matter area

$\text{NJKHT}_{\text{AU1}}$ Number of non-juvenile koala habitat trees in assessment unit 1

$\text{NJKHT}_{\text{AU2}}$ Number of non-juvenile koala habitat trees in assessment unit 2

$\text{NJKHT}_{\text{AU}N}$ Number of non-juvenile koala habitat trees in assessment unit N

3.4.2 Average stem density approach

The average stem density approach can be used to determine the average stem density of non-juvenile koala habitat trees that would likely occur within a mature regional ecosystem based on technical descriptions of that regional ecosystem.

This approach can provide an estimate of the number of non-juvenile koala habitat trees being impacted in an impact matter area to determine the number of koala habitat trees that need to be established in the offset matter area. It can also provide an indication of the number of non-juvenile koala habitat trees that could be established in an offset matter area. This is important when selecting the offset site to ensure the offset matter area is large enough to establish the number of koala habitat trees that require offsetting.

The Queensland Herbarium has developed a number of Regional Ecosystem Technical Descriptions for regional ecosystems across Queensland by measuring specific attributes in relatively undisturbed examples of a particular regional ecosystem. These technical descriptions provide a detailed description of the normal range in structure and floristic composition of remnant regional ecosystems and their component vegetation communities across the climatic, natural disturbance and geographic range of the regional ecosystem.

Where a Regional Ecosystem Technical Description has not been developed for a particular regional ecosystem of interest, relatively undisturbed reference sites can be sampled to develop technical descriptions for the regional ecosystem. Advice should be sought from the Queensland Herbarium for guidance on appropriate reference sites and the method that should be followed.

3.4.2.1 Identify the regional ecosystems in the matter area

Identify the regional ecosystems within the matter area (existing or pre-clearing). On a map, delineate each regional ecosystem type in a distinct polygon and label the area of each polygon in hectares.

3.4.2.2 Determine average stem density per hectare

Determine the average stem density (stems per hectare) in each regional ecosystem within the matter area using the Regional Ecosystem Technical Descriptions developed by the Queensland Herbarium.

The average stem density is provided as "stem density/ha avg" in the Regional Ecosystem Technical Descriptions (see Figure 3.2). The canopy (T1) and sub-canopy (T2) are the most relevant strata of the regional ecosystem[12] for this application as they are the most likely to contain non-juvenile koala habitat trees. In some regional ecosystems, the low tree layers (T3) and shrub (S1) stratums may also have non-juvenile koala habitat trees. These strata should therefore be included in the density calculation.

If a particular region is known to have densities that differ significantly from the average densities cited in the Regional Ecosystem Technical Description, it may be reasonable to use densities that are more representative of a mature regional ecosystem in that locality. The Queensland Herbarium must be consulted and agree that the proposed densities are reasonable and representative of a mature regional ecosystem in that locality. This will likely require the sampling of relatively undisturbed, examples of the regional ecosystem in the same region as the matter area.

If a Regional Ecosystem Technical Description is not available for a regional ecosystem in the matter area, reference sites that best represent that regional ecosystem in its undisturbed state must be identified and surveyed. The Queensland Herbarium must be consulted during this process to ensure appropriate reference sites are selected and advise on the most appropriate method for determining average stem density at the reference site.

Calculate the average stem density per hectare of a regional ecosystem by adding the average stem densities cited for the strata that contain non-juvenile koala habitat trees (e.g. T1, T2, T3, S1).

$$\text{ASD}_{\text{RE}x} = \text{ASD}_{\text{S1}} + \text{ASD}_{\text{S2}} + \cdots \text{ASD}_{\text{S}y}$$

Where:

$\text{ASD}_{\text{RE}x}$ Average stem density per hectare in regional ecosystem x where "x" is a particular regional ecosystem polygon

ASD_{S1} Average stem density per hectare in stratum 1

ASD_{S2} Average stem density per hectare in stratum 2

$\text{ASD}_{\text{S}y}$ Average stem density per hectare in stratum y

Repeat for each regional ecosystem within the matter area.

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[12] In some instances, the regional ecosystem may only have one of these strata.

Eucalyptus racemosa open-forest on dunes and sand plains. Usually deeply leached soils

Pre-clearing area (ha), remnant area (ha) and per cent remaining: 73,622   69,695   95%

Species recorded: Total: 146; woody: 65; ground: 125; Avg. spp./site: 30.2; std dev.: 4.8, 33 site(s)

Basal area: Avg./site: 18.6 m²/ha, range: 8.0 - 30 m²/ha, std. deviation: 6 m²/ha, 33 site(s)

Structural formation: Open-forest: 36%; woodland: 30%; closed-forest: 12%; low woodland: 9%; low open-forest: 6%; open-woodland: 3%; low open-woodland: 3%, 33 site(s)

Representative sites: 16458, 16466, 16469, 16482, 16483, 16484, 19914, 27232, 27236, 27242, 27243, 27245, 27246, 27247, 27249, 27250, 27251, 27255, 27256, 27257, 27258, 27261, 27266, 27267, 27268, 27269, 27271, 27273, 27274, 27275, 27276, 27279, 27284.

Stratum: **T1**

Height avg. = 13.5m, range 6-28m, 33 sites

Crown cover avg. = 54.2%, range 10.0-93.0%, 33 sites

Stem density/ha avg. = 262, range 40-1200, 32 sites

Dominant species (relative cover, frequency): Eucalyptus racemosa subsp. racemosa (67, 100%), Corymbia gummifera (28, 27%), Banksia aemula (18, 21%), Angophora leiocarpa (14, 27%), Corymbia intermedia (12, 48%)

Frequent species (cover, frequency): Eucalyptus racemosa subsp. racemosa (37, 100%), Corymbia intermedia (7, 48%), Angophora leiocarpa (8, 27%), Corymbia gummifera (14, 27%), Banksia aemula (11, 21%), Eucalyptus pilularis (5, 21%), Allocasuarina torulosa (8, 18%), Lophostemon confertus (6, 15%), Eucalyptus planchoniana (21, 12%), Eucalyptus robusta (3, 3%)

Stratum: **T2**

Height avg. = 7.4m, range 4-12m, 31 sites

Crown cover avg. = 14.9%, range 5.0-40.0%, 31 sites

Stem density/ha avg. = 462, range 40-1540, 28 sites

Dominant species (relative cover, frequency): Banksia aemula (70, 76%), Corymbia intermedia (21, 30%), Allocasuarina torulosa (19, 33%), Leptospermum trinervium (14, 30%), Lophostemon confertus (14, 24%)

Frequent species (cover, frequency): Banksia aemula (11, 76%), Allocasuarina torulosa (3, 33%), Corymbia intermedia (4, 30%), Leptospermum trinervium (2, 30%), Lophostemon confertus (2, 24%), Angophora leiocarpa (3, 15%), Eucalyptus racemosa subsp. racemosa (2, 15%), Banksia serrata (3, 12%), Corymbia gummifera (2, 12%), Monotoca sp. (Fraser Island P.Baxter 777) (2, 9%), Acacia leiocalyx (3, 6%), Banksia integrifolia (2, 6%), Elaeocarpus reticulatus (4, 6%), Alphitonia excelsa (3%), Callitris columellaris (3%), Endiandra sieberi (1, 3%), Eucalyptus pilularis (3%), Leptospermum polygalifolium (4, 3%), Leucopogon pimeleoides (3, 3%), Melaleuca nodosa (3, 3%), Monotoca scoparia (15, 3%), Persoonia stradbrokensis (9, 3%)

Figure 3.2: Extract from the Regional Ecosystem Technical Description identifying the relevant information used to determine the average stem density in a mature regional ecosystem.

3.4.2.3 Determine average stem density of non-juvenile koala habitat trees per hectare

The average stem density per hectare calculated for each regional ecosystem must be adjusted to exclude trees that are not koala habitat trees.

For each regional ecosystem, use the BioCondition Benchmark to identify the number of large non-eucalypt trees per hectare (see Figure 3.3).

Where a BioCondition Benchmark for the regional ecosystem has not been published, reference sites that best represent that regional ecosystem in its undisturbed state must be identified and surveyed in accordance with the Queensland Herbarium's Method for the Establishment and Survey of Reference Sites for BioCondition. The Queensland Herbarium should also be consulted during this process to ensure appropriate reference sites are selected.

Calculate the average stem density per hectare of koala habitat trees in a regional ecosystem by subtracting the 'number of large non-eucalypt trees per hectare', as specified in the BioCondition Benchmark, from the average stem density per hectare of the regional ecosystem calculated in the previous step.

$$\mathrm{ASDKHT}_{\mathrm{RE}x} = \mathrm{ASD}_{\mathrm{RE}x} - \mathrm{nonKHT}_{\mathrm{RE}x}$$

Where:

$\mathrm{ASDKHT}_{\mathrm{RE}x}$ Average stem density of koala habitat trees per hectare in regional ecosystem x where "x" is a particular regional ecosystem polygon

$\mathrm{ASD}_{\mathrm{RE}x}$ Average stem density per hectare in regional ecosystem x

$\mathrm{nonKHT}_{\mathrm{RE}x}$ Number of large non-eucalypt trees per hectare in regional ecosystem x

Repeat for each regional ecosystem within the matter area.

Corymbia intermedia +/- Lophostemon confertus +/- Banksia spp. +/- Callitris columellaris open-forest on beach ridges usually in southern half of bioregion

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	6
		Shrub:	9
		Grass:	8
		Forbs and other:	10
Trees: Tree canopy	Tree canopy median height (m):		15
	Tree canopy cover (%):		80
Tree sub-canopy	Tree sub-canopy median height (m):		6
	Tree sub-canopy cover (%):		17
Large trees	Large eucalypt tree dbh threshold (cm):		40
	Number of large eucalypt trees per hectare:		29
	Large non-eucalypt tree dbh threshold (cm):		33
	Number of large non-eucalypt trees per hectare:		45

Typical tree species: Corymbia intermedia (pink bloodwood), Lophostemon confertus (brush box), Callitris columellaris (white cypress pine)

Shrubs:	Native shrub cover (%):	15

Typical shrub species: Alphitonia excelsa (soap tree), Monotoca sp. (Fraser Island P.Baxter 777), Acacia disparrima subsp. disparrima (southern salwood)

Ground cover (%):	Native perennial grass cover (%):	12
	Organic litter cover (%):	75

Typical ground cover species: Themeda triandra (kangaroo grass), Lomandra longifolia (spiny mat rush), Pteridium esculentum (common bracken), Dianella caerulea var. vannata

Coarse woody debris: Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare: 673

Non-native plant cover   0

Typical non-native species: Lantana camara^, Opuntia stricta^ (smooth pest pear), Passiflora suberosa^ (corky passion flower), Ageratum houstonianum (blue billygoat weed), Asparagus africanus^ (asparagus fern)

Figure 3.3: Extract from the BioCondition Benchmark identifying the relevant information used to determine the average number of large non-eucalypt trees per hectare in a regional ecosystem.

3.4.2.4 Determine theoretical capacity of non-juvenile koala habitat trees within regional ecosystem polygon

Calculate the theoretical capacity of non-juvenile koala habitat trees within each regional ecosystem polygon by multiplying the average stem density of koala habitat trees per hectare in that regional ecosystem (calculated in the previous step) by the area of the regional ecosystem polygon in hectares.

$$KHT_{REx} = ASDKHT_{REx} \times A_{REx}$$

Where:

KHT_{REx} Theoretical number of non-juvenile koala habitat trees that could exist or be established in regional ecosystem x where "x" is a particular regional ecosystem polygon

$ASDKHT_{REx}$ Average stem density of koala habitat trees per hectare in regional ecosystem x

A_{REx} Area of regional ecosystem x in hectares

Repeat for each regional ecosystem polygon within the matter area.

3.4.2.5 Additional steps to estimate number of non-juvenile koala habitat trees being impacted

Only complete this section if you are using the average stem density approach to estimate the number of non-juvenile koala habitat trees within an impact matter area.

Sum the theoretical number of non-juvenile koala habitat trees that could exist in each regional ecosystem polygon.

$$NJKHT_{IMA} = KHT_{RE1} + KHT_{RE2} + \cdots KHT_{REx}$$

Where:

$NJKHT_{IMA}$ Estimated number of non-juvenile koala habitat trees within the impact matter area

KHT_{RE1} Theoretical number of non-juvenile koala habitat trees that could exist in regional ecosystem polygon 1

KHT_{RE2} Theoretical number of non-juvenile koala habitat trees that could exist in regional ecosystem polygon 2

KHT_{REx} Theoretical number of non-juvenile koala habitat trees that could exist in regional ecosystem polygon x where "x" is a particular regional ecosystem polygon

The remaining steps in this section only apply to offset matter areas.

3.4.2.6 Additional steps for determining number of non-juvenile koala habitat trees that could be contained within an offset matter area

Only complete this section if you are estimating the number of non-juvenile koala habitat trees that could be established within an offset matter area, or assessing whether the offset matter area is of a suitable size to deliver a koala habitat offset.

Determine the actual number of non-juvenile koala habitat trees that could be established in each regional ecosystem polygon

If an offset matter area already contains mature trees, this will affect the number of koala habitat trees that can be established as part of an offset. Therefore, existing trees of any species that meet the size requirements for a non-juvenile koala habitat tree[13] within a regional ecosystem polygon must be counted and subtracted from the theoretical number of non-juvenile koala habitat trees that could be established in that regional ecosystem polygon as part of an offset.

In each regional ecosystem polygon, count the number of trees of any species that are more than 4m high <u>or</u> have a trunk with a circumference of more than 31.5cm at 1.3m above the ground. Where the offset matter area is small enough, this can be done by conducting a simple tree count. Where it is impractical to count every tree, a stratified sampling approach can be used, however instead of counting only non-juvenile koala habitat trees, all trees that meet the size requirements for a non-juvenile koala habitat tree within the assessment site would be counted.

Subtract this number from the theoretical number of non-juvenile koala habitat trees that could be established in that regional ecosystem polygon. The result represents the actual estimate of non-juvenile koala habitat trees that could be established in that regional ecosystem polygon. Complete this calculation for each regional ecosystem in the offset matter area.

$$AKHT_{REx} = KHT_{REx} - ET_{REx}$$

Where:

$AKHT_{REx}$	Actual number of non-juvenile koala habitat trees that could be established in regional ecosystem polygon x where "x" is a particular regional ecosystem polygon
KHT_{REx}	Theoretical number of non-juvenile koala habitat trees that could exist in regional ecosystem polygon x
ET_{REx}	Number of existing trees in regional ecosystem polygon x that are more than 4m high or have a trunk with a circumference of more than 31.5cm at 1.3m above the ground.

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[13] In the Queensland Environmental Offsets Policy, 'non-juvenile koala habitat tree' means a koala habitat tree that is more than 4m high OR has a trunk with a circumference of more than 31.5cm at 1.3m above the ground.

Determine the actual number of non-juvenile koala habitat trees that could be established within the offset matter area

To determine the actual number of non-juvenile koala habitat trees that could be established within the entire offset matter area, sum the actual number of non-juvenile koala habitat trees that could be established in each regional ecosystem polygon.

$$NJKHT_{OMA} = AKHT_{RE1} + AKHT_{RE2} + \cdots AKHT_{REx}$$

Where:

$NJKHT_{OMA}$ Actual number of non-juvenile koala habitat trees that could be established within the offset matter area

$AKHT_{RE1}$ Actual number of non-juvenile koala habitat trees that could be established in regional ecosystem polygon 1

$AKHT_{RE2}$ Actual number of non-juvenile koala habitat trees that could be established in regional ecosystem polygon 2

$AKHT_{REx}$ Actual number of non-juvenile koala habitat trees that could be established in regional ecosystem polygon x where "x" is a particular regional ecosystem polygon

If $NJKHT_{OMA}$ equates to less than the number of non-juvenile koala habitat trees that need to be established to deliver the offset, the offset matter area assessed is not suitable to deliver the offset. In this case, additional area or an alternative offset site will need to be identified.

References

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Foundations of Success 2009, *Conceptualizing and Planning Conservation Projects and Programs: A Training Manual*, Foundation of Success, Bethesda, Maryland, USA.

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Appendix 1: Assessment checklist for offsets for impacts to regional ecosystems

Use this checklist to ensure that you submit the necessary information about assessments undertaken in accordance with Chapter 1 of this guide with an offset delivery plan, monitoring report or advanced offset application.

Section 1.1: Policy requirements	
Requirement:	*Relevant subsection(s) of this guide:*
☐ State the proposed multiplier and explain how it was determined, including scientific evidence to justify its appropriateness. If a multiplier of less than 4 has been agreed to by the administering agency: ☐ State the proposed multiplier; ☐ Explain how it was determined including scientific evidence to justify its appropriateness; and ☐ Provide evidence of agreement by the administering agency.	
Section 1.2: Offset site selection criteria	
Requirement:	*Relevant subsection(s) of this guide:*
☐ Provide evidence that the proposed offset site fulfils the requirements for characteristics of an offset site listed in Section 2.3.1.6 of the Queensland Environmental Offsets Policy.	
☐ Identify whether the subregion is fragmented or intact. ☐ Provide details of the GIS tool(s) used to measure each attribute. ☐ State the maximum landscape-scale attribute score for the ecosystem type. ☐ State, and provide evidence to justify, the score for each landscape-scale attribute and the combined score. ☐ State whether the site is not located within, sharing a common boundary with, or located within (in whole or in part) an ecological corridor	1.2.1 Assess landscape-scale attributes
☐ Justify the site's suitable position within the landscape for delivering an offset that achieves a conservation outcome for the prescribed environmental matter(s) in question. ☐ Identify and describe risks that may prevent the achievement of a conservation outcome for the prescribed environmental matter(s) in question (if applicable).	1.2.1.1 Justify offset site selection

Section 1.3: Demonstrating a conservation outcome	
Requirement:	***Relevant subsection(s) of this guide:***
If you are proposing a habitat quality gain of 2 points or more: ☐ detail and justify the effectiveness of the management actions proposed to achieve this result; and ☐ provide evidence of agreement by the administering agency about what will be considered a conservation outcome. If you are proposing an achieved habitat quality score of 9, 10, or more than 10: ☐ detail and justify the effectiveness of the management actions proposed to achieve this result; and ☐ provide evidence of agreement by the administering agency about what will be considered a conservation outcome. If a 2-point habitat quality gain within 20 years is not considered possible: ☐ provide evidence of agreement by the administering agency about what will be considered a conservation outcome.	
Section 1.4: Habitat quality assessment method	
Requirement:	***Relevant subsection(s) of this guide:***
Provide: ☐ The size of the matter area (in hectares); ☐ Spatial representation of the matter area; ☐ Spatial representation of the assessment units in the matter area; ☐ Spatial representation of the sampling sites in each assessment unit; and ☐ The regional ecosystem and broad condition state of each assessment unit. State: ☐ The size of each assessment unit (in hectares); ☐ Co-ordinates of the zero point of each sampling site; and ☐ Compass bearing along the transect at each sampling site. If streamlining sampling sites: ☐ Provide evidence of uniformity and consistency in vegetation condition across the assessment unit to justify streamlined approach.	1.4.1 Define assessment units & 1.4.2 Select sampling sites

☐	Justify any divergence from the recommended procedure for setting up the sampling site (if applicable).	1.4.3 Assess site-based attributes
☐	If no BioCondition benchmark is available for the regional ecosystem being assessed, provide details of the reference site surveyed and method employed to select and survey the reference site (if applicable).	
☐	Justify the timing of the site-based attribute assessment.	
☐	Include completed BioCondition field assessment sheet (Appendix 2 of the BioCondition Assessment Manual) for each sampling site, ensuring all relevant sections of the form are completed.	
☐	Provide photographic evidence from each sampling site in accordance with Section 3.4 and Appendix 4 of the BioCondition Assessment Manual.	
☐	State the percentages (of the benchmark) calculated for each attribute at each sampling site.	
☐	State the scores assigned to each attribute at each sampling site.	
Include calculations and results determined for the:		1.4.4 Calculate matter area habitat quality
☐	BioCondition scores for each sampling site in the matter area;	
☐	BioCondition scores for each assessment unit in the matter area;	
☐	Area-weighted BioCondition scores for each assessment unit in the matter area;	
☐	BioCondition score for the matter area; and	
☐	BioCondition score for the matter area out of 10.	
Other requirements		
☐	Provide evidence that the assessor is suitably qualified to conduct the habitat quality assessment.	

Appendix 2: Assessment checklist for offsets for impacts to terrestrial fauna habitat

Use this checklist to ensure that you submit the necessary information about assessments undertaken in accordance with Chapter 2 of this guide with an offset delivery plan, monitoring report or advanced offset application.

Section 2.1: Policy requirements	
Requirement:	*Relevant subsection(s) of this guide:*
☐ State the proposed multiplier and explain how it was determined, including scientific evidence to justify its appropriateness. If a multiplier of less than 4 has been agreed to by the administering agency: ☐ State the proposed multiplier; ☐ Explain how it was determined including scientific evidence to justify its appropriateness; and ☐ Provide evidence of agreement by the administering agency.	
Section 2.2: Offset site selection criteria	
Requirement:	*Relevant subsection(s) of this guide:*
☐ Provide evidence for fulfilment of the offset site selection criteria, including: - details and justification of method employed; - results of targeted fauna surveys; and - conclusions drawn about species presence or potential presence at the site.	2.2.1 Demonstrate that the site contains or is capable of containing the species
☐ Identify whether the subregion is fragmented or intact.	2.2.2 Assess landscape-scale attributes
☐ Provide details of the GIS tool(s) used to measure each attribute.	
☐ State the maximum landscape-scale attribute score for the ecosystem type.	
☐ State, and provide evidence to justify, the score for each landscape-scale attribute and the combined score.	
☐ State whether the site is not located within, sharing a common boundary with, or located within (in whole or in part) an ecological corridor	
☐ Justify the site's suitable position within the landscape for delivering an offset that achieves a conservation outcome for the species in question.	

☐	Identify and describe risks that may prevent the achievement of a conservation outcome for the species in question (if applicable).	2.2.2.1 Justify offset site selection

Section 2.3: Demonstrating a conservation outcome

Requirement:	*Relevant subsection(s) of this guide:*
If you are proposing a habitat quality gain of 2 points or more: ☐ detail and justify the effectiveness of the management actions proposed to achieve this result; and ☐ provide evidence of agreement by the administering agency about what will be considered a conservation outcome. If you are proposing an achieved habitat quality score of 9, 10, or more than 10: ☐ detail and justify the effectiveness of the management actions proposed to achieve this result; and ☐ provide evidence of agreement by the administering agency about what will be considered a conservation outcome. If a 2-point habitat quality gain within 20 years is not considered possible: ☐ provide evidence of agreement by the administering agency about what will be considered a conservation outcome.	

Section 2.4: Habitat quality assessment method

Requirement:	*Relevant subsection(s) of this guide:*
Provide: ☐ The size of the matter area (in hectares); ☐ Spatial representation of the matter area; ☐ Spatial representation of the assessment units in the matter area; ☐ Spatial representation of the sampling sites in each assessment unit; and ☐ The regional ecosystem and broad condition state of each assessment unit. State: ☐ The size of each assessment unit (in hectares); ☐ Co-ordinates of the zero point of each sampling site; and	2.4.1 Define assessment units & 2.4.2 Select sampling sites

☐ Compass bearing along the transect at each sampling site. If streamlining sampling sites: ☐ Provide evidence of uniformity and consistency in vegetation condition across the assessment unit to justify streamlined approach.	
☐ Justify any divergence from the recommended procedure for setting up the sampling site (if applicable). ☐ If no BioCondition benchmark is available for the regional ecosystem being assessed, provide details of the reference site surveyed and method employed to select and survey the reference site (if applicable). ☐ Justify the timing of the site-based attribute assessment. ☐ Include completed BioCondition field assessment sheet (Appendix 2 of the BioCondition Assessment Manual) for each sampling site, ensuring all relevant sections of the form are completed. ☐ Provide photographic evidence from each sampling site in accordance with Section 3.4 and Appendix 4 of the BioCondition Assessment Manual. ☐ State the percentages (of the benchmark) calculated for each attribute at each sampling site. ☐ State the scores assigned to each attribute at each sampling site.	2.4.3 Assess site-based attributes

☐   Provide a literature review containing all details listed in subsection 2.4.4.1, including a reference list and details of any additional advice sought.
 	
☐   Identify any data deficiencies encountered in the literature review and describe:
     • how these were managed; and
     • any assumptions made.
 	
☐   Justify the timing of species habitat attribute assessment.
 	
☐   Identify and justify all indicators selected, sorted by attribute.
 	
☐   Provide details and justification of method used to measure each indicator.
 	
☐   Describe and justify rating scales developed for each indicator.
 	
☐   Provide details and justification of scores assigned to each indicator.
 	
☐   List the species' class under the *Nature Conservation Act 1992.*
 	
☐   Provide details and justification of selected threat factors.
 	
☐   Provide results and justification of assessment of threat factors.
 	
☐   State scores calculated for each species habitat attribute.
	2.4.4 Assess species habitat attributes

☐ Provide details of any assessment constraints or assumptions.		
Include calculations and results determined for the: ☐ BioCondition scores for each sampling site in the matter area; ☐ BioCondition scores for each assessment unit in the matter area; ☐ Area-weighted BioCondition scores for each assessment unit in the matter area; ☐ BioCondition score for the matter area; ☐ BioCondition score for the matter area out of 10; ☐ Species habitat score for the matter area; and ☐ Species habitat score for the matter area out of 10.	4.4.5 Calculate matter area habitat quality	
Other requirements		
☐ Provide evidence that the assessor is suitably qualified to conduct the habitat quality assessment.		

Appendix 3: Assessment checklist for offsets for impacts to koala habitat in South East Queensland

Use this checklist to ensure that you submit the necessary information about assessments undertaken in accordance with Chapter 3 of this guide with an offset delivery plan, monitoring report or advanced offset application.

Section 3.1: Policy requirements	
Requirement:	**Relevant subsection(s) of this guide:**
☐ State the number of non-juvenile koala habitat trees that will be impacted. ☐ Describe the method for determining the number of non-juvenile koala habitat trees that will be impacted (i.e. count / stratified sampling approach / average stem density approach).	3.1.1 Number of non-juvenile koala habitat trees impacted
☐ State the method proposed to establish new koala habitat trees at the offset site.	3.1.2 Number of koala habitat trees required to be offset
Section 3.3: Offset site selection criteria	
Requirement:	**Relevant subsection(s) of this guide:**
☐ Provide evidence for fulfilment of the offset site selection criteria, including: • details and justification of method employed; • results of targeted fauna surveys; and • conclusions drawn about species presence or potential presence at the site.	3.3.1 Demonstrate that the site contains or is capable of containing koalas
☐ Identify whether the subregion is fragmented or intact. ☐ Provide details of the GIS tool(s) used to measure each attribute. ☐ State the maximum landscape-scale attribute score for the ecosystem type. ☐ State, and provide evidence to justify, the score for each landscape-scale attribute and the combined score. ☐ State whether the site is not located within, sharing a common boundary with, or located within (in whole or in part) an ecological corridor	3.3.1.1 Assess landscape-scale attributes
☐ Justify the site's suitable position within the landscape for delivering an offset that achieves a conservation outcome for the species in question ☐ Identify and describe risks that may prevent the achievement of a conservation outcome for the species in question (if applicable)	3.3.1.1 Justify offset site selection

Section 3.4: Habitat quality assessment method	
Requirement:	**Relevant subsection(s) of this guide:**
Provide (if applicable): ☐ The size of the matter area (in hectares); ☐ Spatial representation of the matter area; ☐ Spatial representation of the assessment units in the matter area; ☐ Spatial representation of the sampling sites in each assessment unit; ☐ The regional ecosystem and broad condition state of each assessment unit; ☐ The size of each assessment unit (in hectares); ☐ The number of non-juvenile koala habitat trees recorded at each sampling site; and ☐ The calculations and results determined for the number of non-juvenile koala habitat trees in the matter area. State (if applicable): ☐ The size of each assessment unit (in hectares); ☐ Co-ordinates of the zero point of each sampling site; and ☐ Compass bearing along the transect at each sampling site.	3.4.1 Stratified sampling approach
Provide (if applicable): ☐ The size of the matter area (in hectares); ☐ Spatial representation of the regional ecosystem polygons that make up the matter area; ☐ The area (in hectares) of each regional ecosystem polygon comprising the matter area; ☐ The source of average stem density for each regional ecosystem (i.e. Regional Ecosystem Technical Description, advice from Queensland Herbarium, reference sites); ☐ The average number of large non-eucalypt trees per hectare determined for each regional ecosystem, and a copy of the source of this information (i.e. BioCondition Benchmark, Queensland Herbarium advice, reference site data); and	3.4.2 Average stem density approach

☐ State the scores assigned to each attribute at each sampling site.	
If applying the average stem density approach to estimate the number of non-juvenile koala habitat trees within an impact matter area:	
☐ Provide all calculations and results used to determine the number of non-juvenile koala habitat trees being impacted.	
If applying the average stem density approach to determine the number of non-juvenile koala habitat trees that can be established within an offset matter area – provide:	
☐ The number of trees already established in each regional ecosystem polygon that meet the size requirements for a non-juvenile koala habitat tree;	
☐ The method used to determine the above; and	
☐ All calculations and results used to determine the number of non-juvenile koala habitat trees that can be established within an offset matter area.	
Other requirements	
☐ Provide evidence that the assessor is suitably qualified to conduct the habitat quality assessment	