DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Guide for mapping threatened species

For inclusion in the NSW regulatory framework

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Cover photo: Regent Honeyeater (*Anthochaera phrygia*). Stuart Cohen/DPIE

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Page 7: Swift Parrot (*Lathamus discolor*). Dave Watts/DPIE
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1. Purpose of the guide

Mapping a threatened species' distribution is challenging. Species can be difficult to locate because they occur in small or spatially dispersed populations that are variable on an annual or seasonal basis. Other species have cryptic habits (spending a large proportion of their life cycle underground or in inaccessible locations and habitats); whilst others are highly mobile or not visible for much of the year. For many threatened species, their distribution and ecology may not be well understood and there may be a reluctance to map a species because of the threat of illegal collection or removal.

Changes to the framework for managing biodiversity in New South Wales have required the inclusion of certain threatened species in statutory maps (the Native Vegetation Regulatory Map (NVR Map) and the Biodiversity Values Map (BV Map)) and/or to operationalise components of the Biodiversity Assessment Method (BAM). Maps of threatened entities should be dynamic, and the use of this guide will support continual improvement based on the growing body of knowledge of the species.

1.1 Native Vegetation Regulatory Map

The *Local Land Services Act 2013* requires the Environment Agency Head (or delegate) to map land that has separately been mapped by the Environment Agency Head as containing critically endangered species of plant listed under the *Biodiversity Conservation Act 2016* (BC Act) as Category 2 – Regulated Land in the NVR Map (section 60(I) (2) (I)).

Clause 112 of the Local Land Services Regulation 2017 (LLS Regulation) states that land may be mapped by the Environment Agency Head as Category 2 – sensitive regulated land because it contains critically endangered species of plants under the BC Act only if it is land around the location of particular plants of that species (being a location identified in the records of the Environment Agency Head) (clause 112 of the LLS Regulation).

The LLS Regulation then states the Environment Agency Head must designate land as Category 2 – sensitive regulated land if the Environment Agency Head reasonably believes the land is required to be categorised as Category 2-regulated land under section 60I (clause 108 (2)(b)).

This designation of land as Category 2 – sensitive regulated land on the NVR Map restricts the application of the Land Management (Native Vegetation) Code and provides a limited set of allowable clearing activities. Applications for clearing beyond the scope of the available allowable activities must assess the impacts on biodiversity values using the BAM and approval for clearing must be sought from the Native Vegetation Panel.

This document provides guidance on the legislative regime that applies to the mapping of critically endangered species of plant in accordance with the LLS Act and Regulations, for inclusion in the NVR Map.

For more information on the NVR map refer to the Native Vegetation Regulatory Map webpage.

1.2 Biodiversity Values Map

The Biodiversity Values Map (BV Map) identifies land with high biodiversity value at risk from impacts of development. Clause 7.3 of the Biodiversity Conservation Regulation 2017 (BC Regulation) lists the types of land that may be included on the BV Map. The BV Map is one of the triggers into the Biodiversity Offsets Scheme (BOS) for some local developments or

non-development related clearing under the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* (Vegetation SEPP) (BC Regulation clause 7.1 (1)(a)).

Clause 7.3 (3)(d) of the BC Regulation allows the Environment Agency Head (or delegate) to include land on the BV Map if the Environment Agency Head forms an opinion that land contains threatened species that are identified in a list of potential serious and irreversible impacts on biodiversity values under section 6.5(2) of the BC Act.

Under the BC Regulation, 'serious and irreversible impact' (SAII) principles are used to identify threatened entities that are at a very high risk of extinction from development. Species at risk of an SAII include all critically endangered species, as well as a number of endangered and vulnerable species that meet one or more principles of an SAII (see Guidance to assist a decision-maker to determine a serious and irreversible impact). A list of SAII species is on the Serious and irreversible impacts of development on biodiversity webpage.

Clause 7.3 (3)(k) of the BC Regulation allows the Environment Agency Head (or delegate) to form an opinion that any other land can be included on the BV Map where it has sufficient biodiversity value.

This document provides guidance on the legislative regime that applies to the mapping of land on the BV Map because the land contains SAII threatened species, or there is sufficient biodiversity value to be included on the map due to the presence of a SAII threatened species habitat.

For further information on the BOS and the BV Map see the Biodiversity Offsets Scheme entry requirements and the BV Map webpages.

1.3 Biodiversity Assessment Method

Under the BAM, threatened species are allocated to one of two biodiversity credit classes: ecosystem credits or species credits. Ecosystem credit species are those where the likelihood of occurrence of the species, or elements of its habitat, can be confidently predicted by vegetation surrogates and landscape features. Species credit species cannot be predicted to occur based on these surrogates/features and instead require a survey to determine presence at a site.

A small group of species are 'dual credit species', where part of their distribution is identified as a species credit (e.g. breeding habitat, winter foraging sites or specific habitat/locations required for persistence) and part of their distribution is an ecosystem credit (e.g. foraging habitat that has broad association with vegetation types).

For a small number of dual credit species for which we have extensive, long-term datasets that indicate the importance of parts of the landscape, the species credit components of their habitat will be mapped as 'important areas'. Mapping these areas seeks to address the criticism that survey rarely detects these highly mobile species, resulting in the ongoing loss of core habitat. Mapping means that if impacted by development, these important areas required for the species to persist in the wild will be offset within a mapped important area.

Very few dual credit species have mapped important areas.

Where a dual credit species with a mapped important area is also listed as a species at risk of a serious and irreversible impact (SAII) it will require mapping for the important area and the BV Map. It is anticipated that these maps will align.

See the Biodiversity Assessment Method webpage for further information.

2. Mapping process

Aim of this method

Maps are approved for inclusion into the regulatory framework by the Environment Agency Head (or delegate) who needs to be confident that the final product balances uncertainties when mapping species at a given location against ensuring a high likelihood that the species will be detected within the mapped area.

Maps of threatened entities should be dynamic and represent continual improvement based on the growing body of knowledge of the species.

The following steps outline the process undertaken to map a threatened species for inclusion in the NSW regulatory framework. The approach is broken into two broad sections:

2.1 Compiling the dataset of occurrence records

2.2 Generating the map.

Input from internal and external species experts must be sought at various steps in the process such as validating records (Steps 2 and 6) and the mapping approach (Step 9). Figures 1 and 4 provide a summary of each process.

2.1 Compiling the dataset of occurrence records

The process to develop a dataset of occurrence records has been adapted from Mackenzie and Auld (2018).

Step 1

To ensure the latest taxonomic information is applied and that all relevant records are captured, consultation of available sources for taxonomic synonyms of the target species is required. For example, sources such as PlantNet, Australian Plant Name Index, Australian Plant Census, Australian Faunal Directory and NSW Scientific Committee determinations should be reviewed.

Step 2

All available records for the species from relevant databases[1] must be sourced. These could include but are not limited to:

- BioNet – includes original incidental sighting records along with an incomplete list of records held by other institutions
- Atlas of Living Australia – includes some original sighting records along with an incomplete list of records held by other institutions
- NSW Scientific Committee determinations – may contain valuable information about the status of records
- local government and State Forests NSW – potential repository of sighting records (particularly in survey reports) often not provided to other institutions
- ecological consultants – often the repository of sighting records from various types of assessment work, whilst there is a requirement to lodge records with BioNet via licensing agreements, compliance is variable
- staff in the Environment, Energy and Science (EES) Group of the Department of Planning, Industry and Environment (DPIE) – a potential repository of sighting records (often embedded in unpublished reports and datasets and social media such as the Workplace '*Saving our Species*' group) yet to be provided to BioNet
- for flora specifically:
    - EMU (the NSW National Herbarium specimen database)
    - ANHSIR (Australia's National Herbarium specimen database)
    - Australia's Virtual Herbarium (AVH) specimen database
    - various regional, university, TAFE and interstate herbaria
- for fauna specifically:
    - Australian Museum specimen database
    - CSIRO Wildlife Collection
    - BirdLife Australia (Birdata is Birdlife Australia's data portal, some records are available in BioNet)
    - NSW Bird Atlassers
    - Australian Bird and Bat Banding Scheme
    - Australian National Insect Collection
    - eBird.

Advice regarding potential limitations of some of these different data sources is detailed in **Appendix A**.

Locality descriptions and georeferences of sensitive species are frequently denatured, removed entirely or inadvertently corrupted in the versions of databases available to the public. Any unique records identified in Step 4 below should be obtained directly from their original custodians to ensure accurate (as held) locality descriptions and geospatial information.

BioNet searches should be initially based on 'all records' to ensure flagged records (e.g. vagrants, quarantined, cultivated) are selected for investigation (and subsequent retention/deletion), in accordance with Step 6 below. Data should be accessed via an open source location to ensure transparency.

1 An internal Department process to align records from these data sources, thereby reducing double-handling of point location information, is under development by Biodiversity Information Systems but not yet finalised (June 2020).

Step 3

Each original downloaded file containing record information along with the date and details of the search terms used must be archived. Records are then compiled along with important information such as:

- the searched taxon name
- a unique identifier for each record (e.g. accession number for herbarium records, sighting key for BioNet records etc.)
- the date
- the observer/collector
- the locality or any other collection/sighting notes
- a georeference and its datum
- an estimate of georeference accuracy (if provided).

Step 4

Original records are assigned a unique identifier within the dataset for the mapped species and duplicate records that have occurred across various databases should be marked.

Step 5

Records known to represent cultivated or captive occurrences or individuals introduced from outside New South Wales should be excluded from further consideration and flagged accordingly. If these records are in BioNet the status code should be changed in accordance with **Appendix B**.

Step 6

BioNet records that have been quarantined due to suspect identification, etc. must be flagged and either: i) excluded from further consideration and supporting information justifying the decision to exclude the record provided; or ii) accepted and supporting information provided to justify the acceptance. Feedback on this process should be given to the manager/custodian of the original data source to ensure the appropriate change is made to the original data.

This step should be applied in consultation with internal and external species experts.

Step 7

The given georeferences for unique records must be plotted in GIS to assess for consistency with the location descriptions, notes and any other sighting information provided. The outcome of the assessment should be recorded. For records without georeferences, the location notes or other information provided with the record may be used to derive an appropriate georeference. Where it is only possible to include an indicative georeference (e.g. the location description is a bounded area such as a suburb, property name or lot and the approximate centroid of that area is taken as an indicative georeference), the point must be marked as ‘indicative only’ and consideration given to an appropriate georeference uncertainty buffer (i.e. the extent of the bounded area, see Step 8b). Any records for which a georeference cannot be derived (e.g. the location description is unidentifiable, excessively broad or contradictory) should be documented as such and excluded from further analysis. If an error is identified in a record, the original data custodian should be informed.

The reliability of georeferencing is often linked to the date of data collection. This context should be evaluated when assessing records with no location description (i.e. georeferences only). For example, GPS use by ecological professionals increased after 2000 with the removal of selective availability and the increased locational accuracy of handheld units. Many local agencies were using handheld GPS by 2005. By 2010, GPS location services in mobile phones had become so ubiquitous that most coordinates supplied with species records were derived using such devices.

Interaction between BAM and BioNet data

The BAM Credit Calculator (BAM-C), which operationalises the BAM, draws species locational information from BioNet. Therefore, efforts should be made to align the dataset with BioNet, which may require adding or amending records within BioNet (see Appendix B). It is particularly important where a record is the only representative for that species in an Interim Biogeographic Regionalisation for Australia (IBRA) subregion.

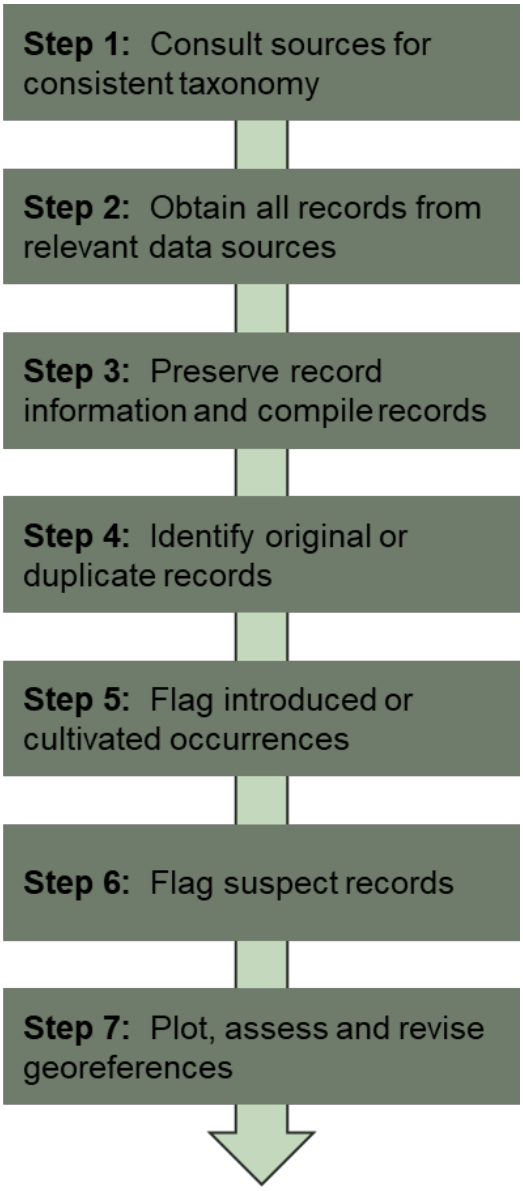

Figure 1 **Summary of the process for compiling the dataset of occurrence records for threatened species**

2.2 Generating the map

Different mapping approaches will be applied to mobile species versus sedentary species. Species experts should allocate species to the most suitable mapping approach based on the definitions provided.

2.2.1 Mobile species

High mobility fauna are those species that have large home ranges (e.g. 100 hectares per reproductive unit, migratory species).

Mapping areas used by these species is difficult and generally restricted to identifying important breeding or roosting sites (e.g. Queensland Department of Environment and Heritage Protection 2015).

For the purposes of this guide the concept has been expanded to include consideration of locations required to support the critical life stages of a species.

For example, mapping of important habitat for a species of bird could include: buffering known breeding locations; specific foraging locations where multiple sightings over multiple years indicate the significance of the location to the species; and/or criteria used by other organisations or programs (e.g. Important Bird Areas (PDF 6.7MB), significance criteria from the Wildlife Conservation Plan for Migratory Shorebirds).

Records identified in Steps 1–7 can be used in this process.

Example of the mobile species mapping process

The regent honeyeater is a species at risk of a serious and irreversible impact and therefore requires mapping to support the BV Map. It is also assessed as a 'dual credit' species where species credits would be assessed as mapped 'important areas' under the BAM.

Species experts allocated the regent honeyeater to the mobile species mapping approach. A considerable body of work had gone into identifying habitat critical to the survival of the species as part of the national recovery plan. Experts used this as the basis for mapping. The following steps were applied:

1. A dataset of occurrence records was generated in accordance with Steps 1–7.
2. The important bird areas identified in the *National Recovery Plan for the Regent Honeyeater* (Commonwealth of Australia 2016) formed the basis of mapped polygons; these were refined to include only areas of suitable habitat based on:
    a. expert opinion
    b. vegetation associated with the species
    c. all woodland vegetation within 200 metres of a record.
3. Radial buffers of one kilometre were applied to records of single breeding events located outside of the polygons mapped in no. 2 above and refined to include woodland vegetation.
4. Radial buffers of five kilometres were applied to records of multiple breeding events outside of the polygons mapped in no. 2 and refined to include only vegetation associated with the species.

The criteria, information, records and associated justifications for the mapping approach were documented in the metadata statement.

Step 8a (mobile species)

Experts must develop the criteria to identify important areas for the target species. These criteria will be species specific, evidence-based and must be documented.

Polygons are then mapped in accordance with the criteria. Mapping may involve a combination of approaches such as buffering particular point records like breeding or roosting records (consideration should be given to uncertainty buffers identified in Step 8b); mapping particular habitat features (e.g. plant community types) or landforms (e.g. rock outcrops); and/or based on existing mapping generated by other organisations or programs.

(Proceed to Step 9.)

2.2.2 Sedentary species

Sedentary species are likely to include all flora and those fauna species that do not meet the definition of 'mobile species' (e.g. some amphibians, invertebrates, small woodland birds, small mammals and some reptiles). Mapping for these species will rely on buffering records identified in Steps 1–7. Buffers serve several purposes, capturing:

1. Georeference uncertainty; each georeference/point location accepted in Step 7 must be buffered to reflect the uncertainty surrounding the true location of the georeferenced point. The magnitude of this uncertainty can vary from a lot boundary down to a 30 metre radius in the case of recent GPS usage. For records where GPS usage cannot be

confirmed or justifiably presumed from supporting information, the online tool developed by Wieczorek and Wieczorek (2015) can be used to calculate uncertainty according to the resolution of information contained in the location description and associated notes. The outputs from the tool can be used to inform the georeferenced uncertainty buffer. Every point location should have a georeference uncertainty buffer applied.

2. Population uncertainty, even with well-described and accurately georeferenced records, databased point locations represent populations of species dispersed across areas that are usually much greater than indicated by a dimensionless point. In some cases, the point location may represent one to a few individuals within tens of metres of each other, while in other cases individuals may be distributed over hundreds of metres or several kilometres. Population boundaries are seldom circular and rarely are species records made at the centre of the population.

   Furthermore, many species have life histories whereby the abundance and geographic distribution of aboveground individuals can fluctuate greatly in relation to season, rainfall and disturbance regimes (e.g. fire, flood, grazing and clearing). These life history characteristics create uncertainty around the extent of the population at any point location.

   Some sedentary species move 'locally' in using resources, predator refuges and thermoregulation (i.e. movement to ameliorate heat and cold) within home ranges that are smaller than the threshold used here to define mobile species (home range >100 hectares). Buffers accommodate these spatial processes that are essential to the persistence of a population.

   Hence, population buffers around point locations are required to adequately capture the on-ground distribution of the populations they represent, including undetected individuals in their vicinity.

Step 8b (sedentary species)

The cleaned point data and the georeference uncertainty buffers should be plotted in a GIS and merged into a single layer (see Figure 2). The merged layer forms the basis for deriving the population uncertainty buffer to account for spatial and temporal uncertainty in the extent of the population/s represented by the individual point locations. The population uncertainty buffer must be applied **in addition** to the polygons of the georeference uncertainty buffer.

Populations can vary greatly in size and extent; for example, Murray et al. (1999) found that 91–95% of sparsely occurring species were significantly more abundant in at least some locations throughout their range. The population uncertainty buffer should be large enough to capture adult individuals as well as recruitment. A **default radial buffer** value of 500 metres is recommended. Whilst a buffer of 500 metres is unlikely to incorporate every individual of the population, it is considered an appropriate and defensible balance between capturing the likely extent of the population while minimising the risk of over-mapping. In some cases (e.g. riparian species that extend along watercourses or connected tributaries), a non-circular buffer (e.g. linear, multi-shaped) will be more appropriate.

Where extensive survey effort has been used to delineate the population extent of a species, narrower buffers may be applied; for example, the population extent of long-lived plant species is often adequately delineated by appropriate survey, and a radial buffer of 200 metres may be sufficient to capture uncertainty relating to undetected seedbanks, seedlings and juveniles (see Figure 3).

Evidence justifying the population buffers applied must be documented in the metadata supporting the mapped layer. Evidence should be in the form of peer-reviewed, published or expert sources; for example, 'management buffers' recommended in conservation advices published by the Commonwealth Department of Agriculture, Water and the Environment that

make explicit recommendations on the buffer areas used to ensure individuals and habitat are not harmed by activities carried out beyond the area of occurrence could be considered.

Within the population buffer extent, mapping can be restricted to specific habitat features (e.g. plant community type) or land use classes that include suitable habitat and relevant landform types, or it may be that a combination of these is required. Mapping may also extend to incorporate remnant vegetation or to the limit of connected areas. Alternatively, if surveys have been conducted in suitable habitat at appropriate times (with respect to seasonal cycles, climatic cycles and disturbance cycles), using appropriate methods, and have been unable to locate individuals, these areas could justifiably be removed from the buffer extent. Any refinement of species extent using this process must be agreed by the species experts and documented with evidence-based justifications. Details of population buffers and filters must also be recorded in the metadata (and/or supporting documentation) for the species.

Whilst a single map is developed for each species using a common method, the specific approach to mapping each point location (e.g. buffers, removal of uninhabitable land within the buffered area, etc.) will vary between species, making it important to clearly document all decisions made throughout the mapping process.

Examples of different georeference uncertainty buffers are presented in Figure 2. Examples of georeference buffers used in combination with population uncertainty buffers are presented in Figure 3.

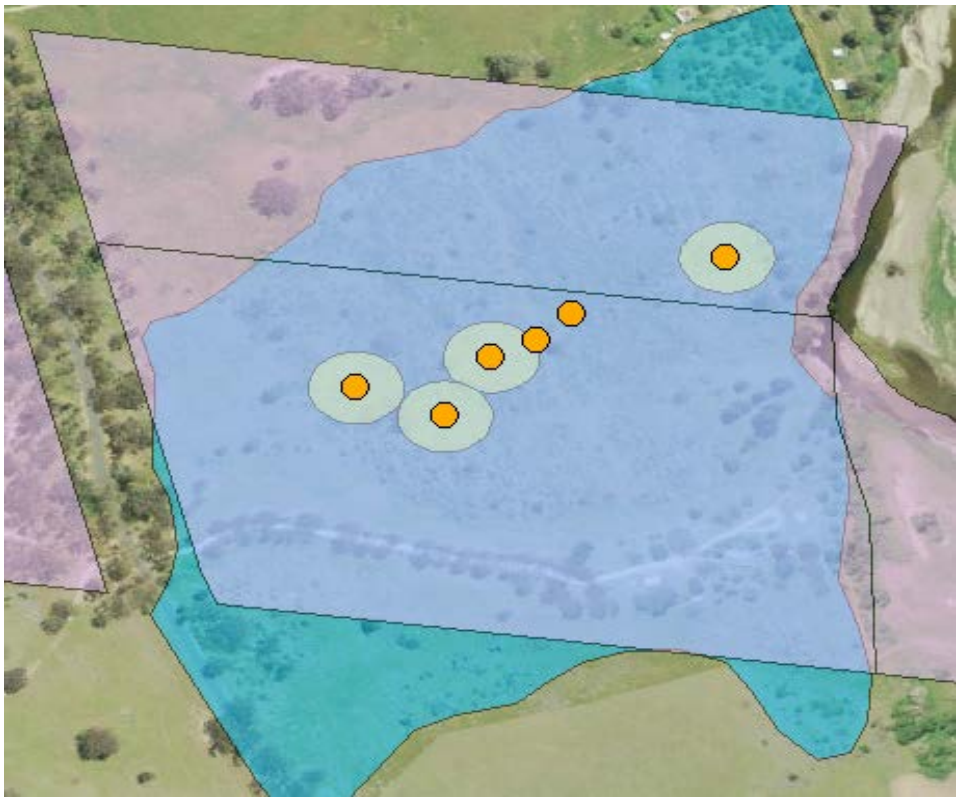

Figure 2 An example of point locations (orange circles) and associated georeference uncertainty buffers for a threatened shrub

The faint green circles around the points indicate records that were GPS georeferenced and have a georeferenced uncertainty buffer of 30 metres or less (i.e. their true locations could occur anywhere within the faint green circles). The remaining two points pre-date the use of GPS and the georeferences provided are less accurate. The location of the left-most point was described using a lot number (corresponding to the pink polygon) and that of the right-most point as a property name (corresponding to the blue polygon). The true location of the points could lie anywhere within the pink and blue polygons, respectively, highlighting potential accuracy limits when GPS has not been used to record the location of a record.

Figure 3 **An example of population uncertainty buffers (blue circles) around species records (orange points) with 30 metre georeference uncertainty buffers (pale green circles) based on contemporary GPS usage**

Step 9

Where mapping is to represent populations of sensitive species there may be a need to obfuscate the location of records to avoid loss through vexatious clearing or collection. The approach used to mask records should be based on ecologically relevant decisions and therefore is likely to be species specific; for example, intersection of the mapped area with remnant vegetation polygons or extension of mapping (e.g. vegetation associations, land use) to the limit of connected areas. The approach used must be documented and justified.

The step will not be relevant to all species or even all mapped polygons for a single species (e.g. in highly urbanised environments radial buffers may not appear circular, and facilitate identification of their centroids, due to severe fragmentation within the 500 metre radius of the record).

Step 10

Develop metadata that addresses, either within the text or as supporting documentation, a summary of information, data, and justifications for the application of the relevant steps undertaken to develop the map. A diagram of the GIS model developed to generate the map should be provided including screenshots to illustrate some steps in the mapping process. Information should also include an outline of how the mapping will be maintained and updated.

Step 11

Seek formal species expert review of the map and supporting metadata to check for accuracy and completeness. The review will:

- be undertaken by at least one independent species expert (i.e. not involved in the mapping process), preferably external to the Department
- produce a brief report that considers the application of Steps 1–9 in generating the map for the target entity
- make any recommendations to increase accuracy and completeness of the map.

The advice provided will be considered by the Department in consultation with species experts involved in generating the map. DPIE Science Division may also be consulted on issues relating to the application of this guide, if required. A response to recommendations must form part of the package provided to the Environment Agency Head (or delegate) in accordance with Step 12.

Step 12

Finalise the mapping and metadata by incorporating the responses to the external expert's recommendations.

Step 13

Seek approval from the Environment Agency Head (or delegate) to input into the relevant map product (e.g. the NVR and/or BV maps and/or important area maps to operationalise the BAM). Importantly, the Environment Agency Head or delegate retains their discretion to decide whether they 'reasonably believe' that the land should be mapped on the NVR Map, or form the opinion that the land should be mapped on the BV Map.

Step 14

Develop an Information Asset Register (IAR) record that includes:

- metadata with an outline of how the mapping was developed and how it is to be used
- data quality statement
- the spatial data.

Map generation must have repeatable factors in the production process and an IAR record such that version control can be appropriately managed. Figure 4 summarises the above steps.

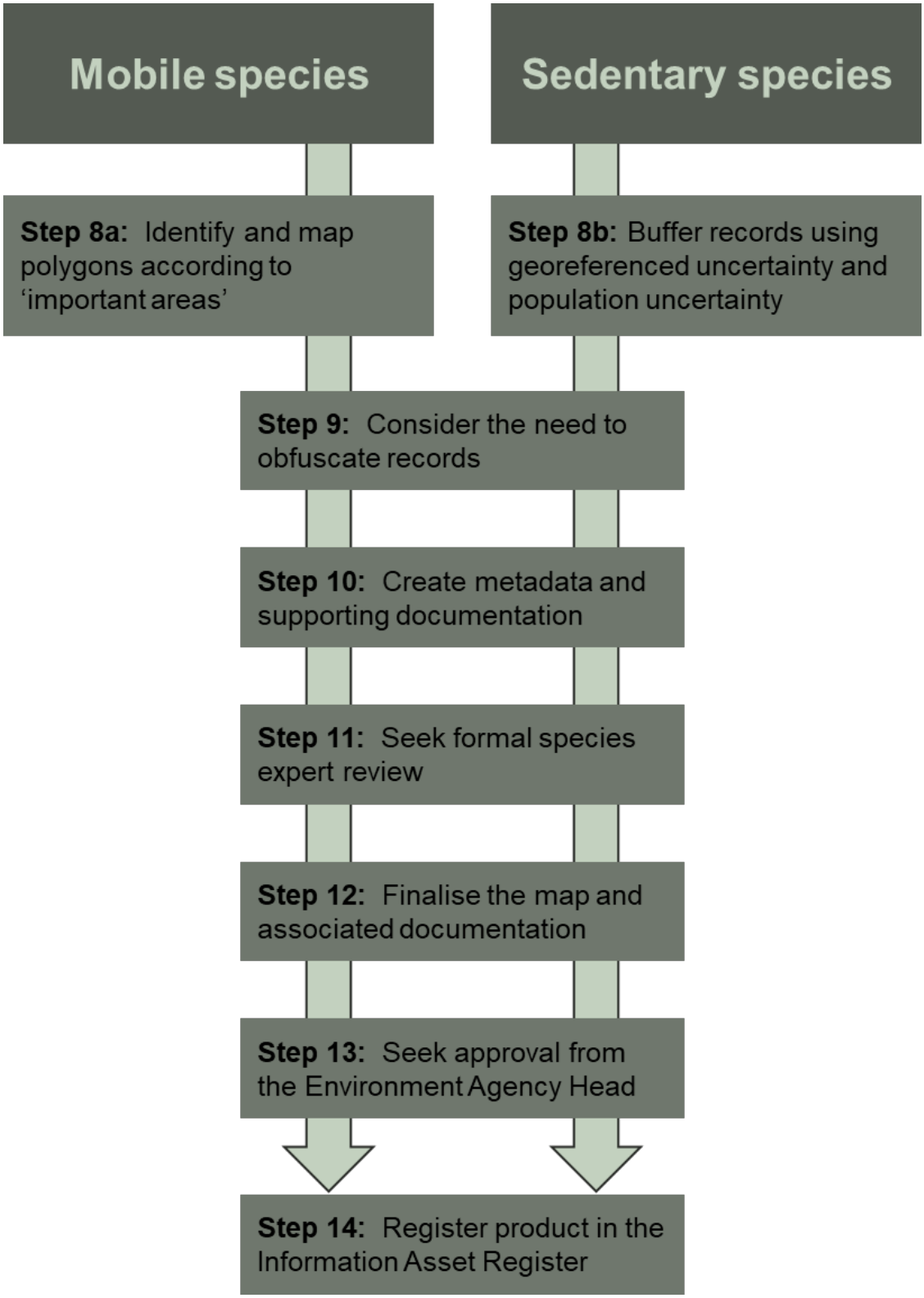

Figure 4 **Summary of the process for generating mapping products for threatened species**

3. Updating threatened species maps

The following scenarios would necessitate a change in the mapped layer and may require revision of a species' mapped occurrence:

- new species records are reported
- the habitat envelope of a species is expanded or reduced
- existing species records are identified as being incorrect (e.g. taxonomic changes)
- new/updated vegetation mapping and/or changes in vegetation associations
- new/updated land use mapping and/or changes in list of compatible land uses
- species are removed from the critically endangered listing (for the NVR Map) or are no longer considered at risk of an SAII (for the BV Map), hence will be removed from the relevant map products.

It is proposed that the Department will initiate an annual review of threatened species data that allows the maps to be reviewed and (where appropriate) updated with new records or changes to areas of habitat. Generally, changes to the mapped extent would be integrated as part of the annual updates of the NVR Map and BV Map to align with statutory requirements. Updates to important area maps used to operationalise the BAM can occur at any time but where the map is also required for the BV Map, attempts will be made to synchronise updates.

4. References

Commonwealth of Australia 2016, *National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*)*, Australian Department of the Environment, available from www.environment.gov.au/system/files/resources/286c0b52-815e-4a6c-9d55-8498c174a057/files/national-recovery-plan-regent-honeyeater.pdf (PDF 999KB).

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Appendix A – Details of data sources for threatened species records

To develop a comprehensive and up-to-date dataset of threatened species records, all relevant sources should be searched for the target species and associated synonyms identified in Steps 1 and 2 of this guide. It is also important to recognise the limitations of the different data sources and the sorts of records they can be relied upon to provide (and those they cannot). The reliability of a record should be assessed under Step 6 of the guide.

Sources for flora records are available from (this list is not exhaustive):

- **BioNet** – can be relied upon for original incidental sighting records and vegetation survey data only, but may also provide an incomplete guide to the existence of records held by other institutions, each of which must be contacted individually for accurate data.
- **ALA** (Atlas of Living Australia) – can be relied upon for occasional original sighting records only, but may also provide an incomplete guide to the existence of records held by other institutions, each of which must then be contacted individually for the original (undenatured) specimen records and validity of records should be considered before inclusion in the mapping process.
- **NSW Scientific Committee preliminary and final determinations** – sometimes the only source of records for poorly known taxa and may also contain important information about the status of particular records or sightings which have been independently reviewed by the NSW Scientific Committee.
- **EMU** (Royal Botanic Gardens specimen database) – can be relied upon for original specimen records.
- **ANHSIR** (Australia National Herbarium specimen database) – can be relied upon for original specimen records.
- **AVH** (Australia's Virtual Herbarium) – to be used only as a general guide to the existence of specimen records held by various state and regional Australian herbaria, each of which must then be contacted individually for the original (undenatured) specimen records – do not rely on AVH records or georeferences.
- **Local government and State Forests NSW.**
- **Ecological consultants** – often the repository of sighting records from various types of assessment work; whilst there is a requirement to lodge records with BioNet via licensing agreements, compliance is variable.
- **Staff in the Environment, Energy and Science (EES) Group** of the Department of Planning, Industry and Environment (DPIE) – a potential repository of sighting records (often embedded in unpublished reports and datasets, and social media such as the Workplace '*Saving our Species*' group) yet to be provided to BioNet. An assessment of the validity of records should be made before inclusion in the mapping process.
- **Regional, university, TAFE and interstate herbaria**.

Sources for fauna records are available from (this list is not exhaustive):

- **BioNet** – can be relied upon for original incidental sighting records and systematic fauna survey data only, but may also provide an incomplete guide to the existence of records held by other institutions, each of which must be contacted individually for accurate data.
- **ALA** (Atlas of Living Australia) – can be relied upon for occasional original sighting records only, but may also provide an incomplete guide to the existence of records held by other institutions, each of which must then be contacted individually for the original

(undenatured) specimen records and validity of records should be considered before inclusion in the mapping process.

- **ecological consultants** – often the repository of sighting records from various types of assessment work; whilst there is a requirement to lodge records with BioNet via licensing agreements, compliance is variable.
- **Australian Museum** (these usually also occur in the Atlas of Living Australia) – validity of records should be considered before inclusion in the mapping process.
- **CSIRO Wildlife Collection.**
- **Birdlife Australia** (some of these records are available for DPIE staff in BioNet) – validity of records should be considered before inclusion in the mapping process.
- **NSW Bird Atlassers** – validity of records should be considered before inclusion in the mapping process.
- **Australian Bird and Bat Banding Scheme** (bird and bat records, nesting records of birds) – validity of records should be considered before inclusion in the mapping process.
- **eBird database** – validity of records should be considered before inclusion in the mapping process.

Note that locality descriptions and georeferences of sensitive species are frequently denatured, removed entirely or inadvertently corrupted in the versions of databases readily available to the general public, and where records have been provided by their original custodians to databases such as BioNet, AVH and ALA. Given this, unique records identified in the search process above should always be obtained directly from their original custodians to ensure accurate locality descriptions and geospatial information.

In addition to spatial errors consideration should be given to identification accuracy. Different custodians manage the validity of records in different ways; it is important to consider their data quality statements and therefore the accuracy of records under Step 6 of this process. Scrutiny should be applied to records sourced from individuals (e.g. ecological consultants).

Appendix B – Editing records in the BioNet Atlas

The BioNet Atlas allows specific Department users to edit location records for species. To reduce the likelihood of incorrect records being added to the BioNet Atlas, the database checks against the accepted distribution layer and for potential duplicates. Each record is assigned a status, either valid or invalid. Where the status is invalid, the reason the record failed validation is stored in the 'Validation flags' field; either ACD (accepted distribution) or DUP (potential duplicate). All records with a status of 'invalid' should be reviewed and have their status updated as appropriate. The status of any record can be updated at any time.

After reviewing the record (e.g. sighting details, distribution maps, contacting observer) the Department will be able to update the status in the BioNet Atlas[2]:

- from the 'Species sightings' menu, select 'Open sighting'
- in the 'Sighting' tab folder, click on the 'Status' link
- in the 'Update status' pop-up, select the appropriate status from the drop-down list:
    - Accepted as valid from Quarantine
    - Suspect
    - Rejected as certainly incorrect
    - Vagrant or Escaped Animal or Plant Specimen
    - Valid record from population that is no longer extant.

Enter the reason for making the edit.

Invalid, suspect and rejected records are not released to external clients outside of the Department. Valid, accepted, vagrant and extant records are available for release externally. Similarly, the default reports extracted by Department staff do not include invalid, suspect or rejected records; however, staff can choose to include these records in their reports. Maps are approved for inclusion into the regulatory framework by the Environment Agency Head (or delegate).

2 Staff will only be able to edit records if they have been granted access to the dataset in which the record is stored. Most records are stored in the 'OEH Default Sightings' data source (see 'Datasource' tab of the sighting).