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1 INTRODUCTION

1. This chapter is intended to provide information and assistance to prospective applicants and decision makers who may be required to consider the effect of a proposed development, activity or action on threatened species, populations and endangered ecological communities, or their habitats.
2. This Chapter provides Council's guidelines for the preparation of flora and fauna impact assessment reports and accompanying Assessments of Significance (AoS), also known as 7 Part Tests, for threatened flora and fauna species and endangered ecological communities.
3. This Chapter takes into account the provisions of the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995*, the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and other relevant legislation, concerning the environmental impact assessment of threatened flora and fauna species of development upon endangered ecological communities and matters of national significance.

2 OBJECTIVES

- (a) To ensure that threatened species, populations and endangered ecological communities are protected from the impacts generated by development.
- (b) To ensure that developments that have the potential to impact upon threatened species, populations or endangered ecological communities are assessed in accordance with legislative requirements.

3 STATUTORY FRAMEWORK

1. The statutory framework for the regulation, protection and management of threatened species, populations or endangered ecological communities involves several State and Commonwealth Acts. It is the Applicant's responsibility to be familiar with this legislation however a brief summary of relevant key legislation is provided in this section.

3.1 Environmental Planning and Assessment Act 1979

1. The provisions of Section 5A(1) of the Environmental Planning and Assessment Act 1979 state that a consent authority must take into account whether a proposed development or activity is likely to have a significant effect upon any threatened species, endangered population or endangered ecological community or their habitats listed under the *Threatened Species Conservation Act 1995* or under the *Fisheries Management Act 1994*.
2. Council is required to assess relevant assessment guidelines and the factors (i.e. '7 Part Test') stated in Section 5A(2) of the EP&A Act in making a determination as to whether the proposed development is likely to have a significant effect upon any threatened species, endangered population or endangered ecological communities or their habitats.
3. The process for undertaking the '7 Part Test', also known as Assessment of Significance is outlined in Section 4.4. The '7 Part Test' will determine whether a Species Impact Statement (SIS) is required.



Figure 1: Photograph of a Green and Golden Bell Frog (*Litoria aurea*) (Courtesy of Martin Schulz)

3.2 Threatened Species Conservation Act 1995

1. The Threatened Species Conservation (TSC) Act 1995 provides for the consideration of measures for the conservation of all threatened flora and fauna native to NSW and their habitats (including populations and ecological communities). The TSC Act aims to ensure that all threatened flora and fauna which are native to NSW is protected.
2. The TSC Act places responsibilities on applicants, consent authorities and determining authorities and the NSW Department of Environment, Climate Change and Water for the protection and preservation of threatened species, populations and endangered ecological communities.
3. The TSC Act also introduces recovery and management strategies for the protection of and preservation of threatened species, populations and endangered ecological communities.
4. The TSC Act also requires licensing of any action which is likely to result in one or more of the following:
 - (a) Harm a threatened species, population or endangered ecological community,
 - (b) Pick a threatened species, population or ecological community,
 - (c) Damage a critical habitat, or
 - (d) Damage habitat of a threatened species, population or ecological community.

3.2.1 Schedules of the TSC Act

1. Endangered species, endangered populations, endangered ecological communities, species presumed extinct, vulnerable species and key threatening processes are listed in schedules attached to the TSC Act. A summary of these schedules is shown in Figure 1.

Table 1: Schedules 1A, 1, 2 and 3 of the TSC Act

Schedule 1	Schedule 1A	Schedule 2	Schedule 3
Part 1 – Endangered Species	Part 1– Critically Endangered Species	Part 1- Vulnerable Species	Key Threatening Processes
Part 2 – Endangered Populations			
Part 3 – Endangered Ecological	Part 2 – Critically Endangered Ecological	Part 2 - Vulnerable Ecological Communities	

Schedule 1	Schedule 1A	Schedule 2	Schedule 3
Communities	Communities		
Part 4 – Species Presumed Extinct			

3.2.2 Endangered & Vulnerable Flora and Fauna Species, Endangered Populations, Endangered Ecological Communities

1. The TSC Act provides for the listing of species, populations and ecological communities threatened in NSW, as determined by the NSW Scientific Committee. The Scientific Committee is an independent body responsible for reviewing nominations and determining which species, populations, ecological communities are to be listed. It is recommended that proponents and decision-makers reviewing preliminary and final determinations made by the NSW Scientific Committee to ensure all relevant matters are taken into account during the decision-making process. Preliminary and final determinations made by the NSW Scientific Committee can be viewed via the following web link:

[Hhttp://www.environment.nsw.gov.au/committee/ListOfScientificCommitteeDeterminations.htm](http://www.environment.nsw.gov.au/committee/ListOfScientificCommitteeDeterminations.htm)

2. Threatened species, populations and endangered ecological communities listed under both the TSC Act and the Commonwealth Environment Protection and Biodiversity Conservation Act are marked in the Schedules of the TSC Act with an asterisk(*).
3. The listing of vulnerable and endangered species, endangered populations and vulnerable and endangered ecological communities under Schedules 1, 1A and 3 of the TSC Act is an on-going and dynamic process. Therefore, it is recommended that proponents regularly review the Schedules contained in the TSC Act to ensure any impact assessment and 7 Part Test covers all relevant endangered and vulnerable species, populations and communities. Preliminarily listed species should also be considered.
4. The current up to date list of endangered and vulnerable species, populations and communities in Wollongong LGA may be obtained from the NSW Department of Environment, Climate Change and Water via the following website:

www.threatenedspecies.environment.nsw.gov.au/tsprofiles/home_species.aspx

3.2.3 Key Threatening Processes

1. The Threatened Species Conservation Act 1995 lists Key Threatening Processes in Schedule 3 of the Act. Key Threatening Processes are determined by the NSW Scientific Committee, an independent body. A requirement for the listing of Key Threatening Processes is that it adversely affects threatened species, populations or ecological communities, or that it may cause species, populations or ecological communities that are not threatened to become threatened. It is recommended that proponents and decision makers review preliminary and final determinations made by the NSW Scientific Committee via the following link:

www.environment.nsw.gov.au/committee/ListOfScientificCommitteeDeterminations.htm

2. The listing of additional Key Threatening Processes under Schedule 3 of the TSC Act is an on-going and dynamic process. Therefore, it is recommended that proponents regularly review the Key Threatening Processes under Schedule 3 of the TSC Act.
3. The current up to date list of Key Threatening Processes affecting threatened species, populations and endangered ecological communities in Wollongong LGA may be obtained from the NSW Department of Environment, Climate Change and Water via the following website:

www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_threats.aspx

3.2.4 Critical Habitat

1. Critical Habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities.
2. The listing of additional Critical Habitat under the TSC Act is an on-going and dynamic process. Therefore, it is recommended that proponents regularly review the Critical Habitat Register.
3. The current up to date list of Critical Habitat may be obtained from the NSW Department of Environment, Climate Change and Water via the following website:

<http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtection.htm>

3.2.5 Priorities Action Statement, Recovery Plans and Threat Abatement Plans

1. The TSC Act requires the Director – General of the NSW Department of Environment, Climate Change and Water (DECCW) to undertake the preparation of recovery plans and threat abatement plans for all threatened species, endangered populations and endangered ecological communities as listed under Schedules 1 and 2 of the TSC Act.



Figure 2: Photograph of a Powerful Owl (*Ninox strenua*) (Courtesy of Narawan Williams)

2. The Priorities Action Statement (PAS) lists strategies for promoting the recovery of each threatened species, population and ecological community and for managing each key threatening process. The PAS complements and integrates recovery and threat abatement plans by identifying actions required for implementation before a plan is scheduled to be prepared or by replacing a plan altogether when it is considered that the formal process of preparing a recovery plan or threat abatement plan is not required. Actions identified in a recovery plan or threat abatement plan are integrated within the PAS. The PAS identifies relative priorities for the implementation of the strategies and establishes performance measures to facilitate reporting on their achievements.

3. Recovery plans and threat abatement plans contain important biological and ecological information and should be utilised wherever available by proponents, applicants and decision makers.
4. The current up to date list of recovery plans and threat abatement plans may be obtained from the following NSW Department of Environment, Climate Change and Water websites:

http://threatenedspecies.environment.nsw.gov.au/tsprofile/home_recovery_new.aspx

<http://www.environment.nsw.gov.au/threatenedspecies/recoveryplans.htm>

<http://www.environment.nsw.gov.au/threatenedspecies/ThreatAbatementPlans.htm>
5. Council must have consideration to any recovery plan and/or threat abatement plan that applies to a threatened species, endangered ecological community or endangered population that may be affected by a proposed development. Where a recovery plan and/or threat abatement plan includes actions that are relevant to the carrying out of development on a site affected by the plan, the provisions of the plan may be implemented by Council through the development approval process.

3.2.6 Licensing provisions of Part 6 of the TSC Act

1. Any persons proposing to undertake an action that will, or is likely to, result in one or more of the following may require a licence under section 91 of the TSC Act:
 - (a) Harm to any animal that is of, or is part of, a threatened species, population or ecological community,
 - (b) The picking of any plant that is of, or is part of, a threatened species, population or ecological community,
 - (c) Damage to critical habitat,
 - (d) Damage to habitat of a threatened species, population or ecological community.
2. The TSC Act defines the terms ‘harm’ and ‘pick’.
3. DECCW is the licensing authority for a section 91 licence application and will assess the proposed action to determine whether it is likely to have a significant impact on a threatened species, population or ecological community. Further information can be found at:

www.environment.nsw.gov.au/threatenedspecies/S91TscLicenceForm.htm

3.2.7 Biodiversity Banking

1. Part 7A of the TSC Act provides a procedure under which a person may apply to the Director – General of the NSW Department of Environment, Climate Change and Water for a biobanking statement in respect to a development proposal.
2. Biobanking statements can be obtained for any development, other than the clearing of certain native vegetation that is dealt with under the *Native Vegetation Act 2003* or development excluded from the scheme by the regulations.
3. If a biobanking statement is obtained for developments assessed under Parts 4 and 5 of the *Environmental Planning and Assessment Act 1979*, these developments are taken to be development which is not likely to significantly affect any threatened species, populations or ecological communities.

4. Management actions carried out under a biobanking agreement are exempt from the requirement for development consent under the *Environmental Planning and Assessment Act 1979*, unless otherwise provided by the regulations.

3.3 Fisheries Management Act 1994

1. The provisions of Part 7A of the *Fisheries Management Act (FM Act) 1994* impose responsibilities on applicants, consent authorities, determining authorities and the NSW Department of Primary Industries (Fisheries) for the protection and preservation of threatened species, populations and ecological communities of fish and marine vegetation.
2. Schedules 4, 4A & 5 of the FM Act provide the lists of threatened fish species, populations and endangered ecological communities of fish and marine vegetation.
3. The listing of threatened fish and marine vegetation species, populations and ecological communities is an ongoing dynamic process. Therefore, it is recommended that proponents review the current list of threatened fish and marine species, populations and ecological communities on the Department of Primary Industries website via the following link:

<http://www.dpi.nsw.gov.au/fisheries/species-protection/species-conservation/what-current>

4. The FM Act also provides key threatening processes affecting threatened species, populations and ecological communities of fish and marine vegetation and also introduces the requirement for the preparation of recovery plans, threat abatement plans and management strategies for the recovery and preservation of threatened species, populations and ecological communities of fish and marine
5. Under Section 91 of the EP&A Act, the NSW Department of Primary Industries (Fisheries and Aquaculture) is required to assess Integrated Development Applications which require concurrence approval with respect to the sections 144, 201, 205 and 219 of the FM Act.

3.4 State Environmental Planning Policy No. 14 - Coastal Wetlands (SEPP 14)

1. State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14) aims to ensure that all coastal wetlands are preserved and protected in the environmental and economic interests of the state. This policy applies to certain coastal wetlands at Windang, Yallah and Haywards Bay.
2. Under SEPP 14, a proposal to carry out clearing of land, drainage works, land filling or the construction of levees within a classified SEPP 14 coastal wetland is designated development and hence, an Environmental Impact Statement (EIS) is required. The preparation of the EIS will require the formal consultation with the NSW Department of Planning in order to obtain the Director – General's requirements for the EIS. Consequently, a flora and fauna impact assessment study for any such proposal is likely to be required as part of the EIS.

3.5 State Environmental Planning Policy No. 44 – Koala Habitat Protection

1. State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas. The policy aims to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:
 - (a) By requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

- (b) By encouraging the identification of areas of core koala habitat, and
 - (c) By encouraging the inclusion of areas of core koala habitat in environment protection zones.
2. This policy applies when a Development Application has been made on land with a site area of more than 1 hectare or land is in the same ownership with an area of more than 1 hectare, whether or not the development applies to the whole or only part of the land.
 3. SEPP 44 requires a consent authority to satisfy itself as to whether or not the land is a potential koala habitat prior to the granting of consent to a Development Application. Schedule 2 of SEPP 44 contains the main koala feed tree species which may form potential koala habitat, namely: (i) *Eucalyptus teretocornis* (Forest Red Gum), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus punctata* (Grey Gum), *Eucalyptus viminalis* (Ribbon or manna gum), *Eucalyptus camaldulensis* (River Red Gum), *Eucalyptus haemastoma* (Broad leaved Scribbly Gum), *Eucalyptus signata* (Scribbly Gum), *Eucalyptus albens* (White box), *Eucalyptus populnea* (Bimble box or poplar box) and *Eucalyptus robusta* (Swamp Mahogany).
 4. If the land is potential koala habitat, the consent authority must satisfy itself as to whether or not the land is core koala habitat. In the event that the land is not core koala habitat, the consent authority may grant consent to the Development Application. However, if the site is classified as core koala habitat, a plan of management must be prepared for either the whole of the LGA or a part of the LGA (including the land to which the Development Application relates) prior to the granting of consent to the Development Application.
 5. The preparation of a koala plan of management is required to be undertaken in accordance with relevant guidelines and the requirements of the Director – General of the Department of Environment, Climate Change and Water. The plan of management must be formally approved by the Director – General of the Department of Environment, Climate Change and Water, prior to the granting of consent to the Development Application. Any such consent must be consistent with the approved plan of management.

3.6 National Parks and Wildlife Act 1974

1. The *National Parks and Wildlife (NP&W) Act 1974* established the functions and responsibilities of the NSW National Parks & Wildlife Service (now known as the Parks & Wildlife Division in the NSW Department of Environment, Climate Change and Water (DECCW)). The Parks & Wildlife Division has the responsibility for the management of national parks, conservation reserves; the protection and conservation of flora and fauna and the protection of aboriginal sites.
2. The provisions of the NP&W Act also make it an offence to harm, pick or damage a threatened species, endangered population, endangered ecological community or critical habitat. Where such action constitutes the carrying out of a development consent issued under Part 4 of the EP&A Act or an activity under Part 5 of the EP&A Act, it is possible that an offence may be defended.

3.7 Native Vegetation Act 2003

1. Under the Native Vegetation Act 2003, “*native vegetation*” means any of the following types of indigenous vegetation:
 - (a) trees (including any sapling or shrub or any scrub),
 - (b) understorey plants,
 - (c) groundcover (being any type of herbaceous vegetation),

- (d) plants occurring in a wetland.

Note: Vegetation is “*indigenous*” if it is of a species of vegetation or if it comprises species of vegetation that existed in NSW before European settlement. For the purposes of this Act, “*native vegetation*” does not include any mangroves, seagrasses or any other type of marine vegetation to which section 205 of the *Fisheries Management Act 1994* applies.

2. “*Clearing*” native vegetation means any one or more of the following:
 - (a) cutting down, felling, thinning, logging or removing native vegetation,
 - (b) killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation.
3. Under the Native Vegetation Act, “*broadscale clearing*” of native vegetation means the clearing of any remnant native vegetation or protected regrowth.
4. Under Section 12 of the *Native Vegetation Act 2003*, the clearing of native vegetation is not permitted, except where prior development consent has been granted under this Act or where the Minister has approved a property vegetation plan which permits the clearing of such native vegetation.
5. The clearing or removal of native trees and other native vegetation upon land to which Act applies requires consent to be obtained from the relevant Catchment Management Authority below:
 - (a) For lands north of Stanwell Park in Wollongong LGA (i.e. Otford, Helensburgh, Maddens Plain) - Sydney Metropolitan Catchment Management Authority.
 - (b) For lands south of Stanwell Park in Wollongong LGA - Southern Rivers Catchment Management Authority.
6. The *Native Vegetation Act 2003* applies to the following lands within the City of Wollongong LGA:
 - (a) Land zoned Non-urban, RU1 Primary Production, RU2 Rural Landscape or RU4 Rural Small Holdings.
 - (b) Land zoned R5 Large Lot Residential.
 - (c) Land zoned RE1 Public Recreation or RE2 Private Recreation.
 - (d) Land zoned Environmental Protection including land zoned E2 Environmental Conservation, E3 Environmental Management or E4 Environmental Living and all Environmental Protection zones in Wollongong Local Environmental Plan 1990.
 - (e) Land zoned W1 Natural Waterways. W2 Recreational Waterways or W3 Working Waterways.
7. The Act also states that any person who carries out or authorises the carrying out of clearing in contravention of this Act is guilty of an offence and is liable to the maximum penalty provided for under section 126 of the EP & A Act for a contravention of that Act.
8. The *Native Vegetation Act 2003* does not apply to the clearing of native vegetation associated with the construction of a single dwelling-house and ancillary infrastructure. However, any additional clearing of native vegetation around a dwelling-house may also require consent from the Local Catchment Management Authority (CMA) and also Council.

9. The Act also establishes that routine agricultural management activities (RAMAs) are exempt from the requirement to obtain either development consent or undertake land clearing works in accordance with an approved property management plan as is the continuation of existing farming activities as long as such activities do not occur in remnant vegetation areas.
10. Section 25 of the *Native Vegetation Act 2003* also excludes a range of activities / actions which do not require any formal approval from the Local CMA. However, these activities or actions may still require a separate tree management permit or development consent to be obtained from Council.
11. Any proponent considering the clearing of native vegetation is recommended to consult with both Council and the Local CMA to determine whether approval is required from the Local CMA and / or Council and what information must be provided in support of any such application..
12. Applicants may also wish to refer to Chapter E17: Preservation of Trees and Other Vegetation chapter in the DCP which provides more in depth explanation of the Native Vegetation Act 2003 and what activities / actions are exempt from requiring any approval from the Local Catchment Management Authority.

3.8 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

1. The Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC Act) came into effect on 16 July 2000. The EPBC Act requires approval from the Commonwealth Government for any actions that may have a significant effect on matters of national environmental significance and / or actions that have a significant effect on the environment of Commonwealth land.

3.8.1 Matters of National Environmental Significance

1. The provisions of the EPBC Act state that matters of national environmental significance are:
 - World heritage areas;
 - Wetlands protected by international treaty (the RAMSAR Convention);
 - Nationally listed threatened species and ecological communities;
 - Nationally listed migratory bird species such as JAMBA (Japan – Australia Migratory Bird Agreement) and CAMBA (China – Australia Migratory Bird Agreement);
 - All nuclear actions;
 - The environment of Commonwealth marine areas

The current up to date list of the matters of national environmental significance may be obtained from the Commonwealth Department of Environment, Water, Heritage and the Arts website via the following link:

<http://www.environment.gov.au/epbc/about/lists.html#species>

3.8.2 What is an Action?

1. The EPBC Act defines an “action” as either:-
 - A project;

- A development;
- An undertaking;
- An activity or series of activities or
- An alteration of any of the above.

An “action” does not include a decision to:

- Prepare a management plan, a masterplan or planning instrument,
 - Enter into an agreement, or
 - Issue an approval.
4. The legislation may relate to any Commonwealth, State, Council and private land as well as tidal and non-tidal waters (i.e. below mean high water mark).

3.8.3 Bilateral Agreement between the Commonwealth & the NSW State Government regarding the Administration of the Environment Protection and Biodiversity Conservation Act 1999

1. On 18 January 2007, the Commonwealth Government & the NSW State Government formally signed a Bilateral Agreement pursuant to Section 45 of the EPBC Act which allows the environmental impact assessment regimes under Part 3A, Part 4 and Part 5 of the EP & A Act to be automatically accredited under the EPBC Act. This means that separate assessment processes are not required under both the EPBC Act and the EP & A Act for the one development and a single assessment process (i.e. EP&A Act) may be followed subject to compliance with the requirements of the Bilateral Agreement.
2. The Bilateral Agreement is for a five (5) year period and will formally expire on 18 January 2012 (except where the agreement is renewed between the Commonwealth Government and the NSW State Government, prior to the expiry date).
3. Schedule 1 of the Agreement contains the public exhibition and assessment process required in order to comply with the Agreement and meet EP&A Act and EPBC Act requirements in respect to development proposals assessed under Part 4 and activities under Part 5 of the EP&A Act.
4. A copy of the Schedule can be obtained on the Commonwealth Department of Environment’s website at:

<http://www.environment.gov.au/epbc/assessments/bilateral/pubs/nsw-agreement-signed.pdf>

3.8.4 Referral Process under EPBC Act for Actions affecting Matters for National Environmental Significance

1. The process of referrals under the EPBC Act for actions affecting national environmental significance matters is summarised, as follows in Figure 3 below.

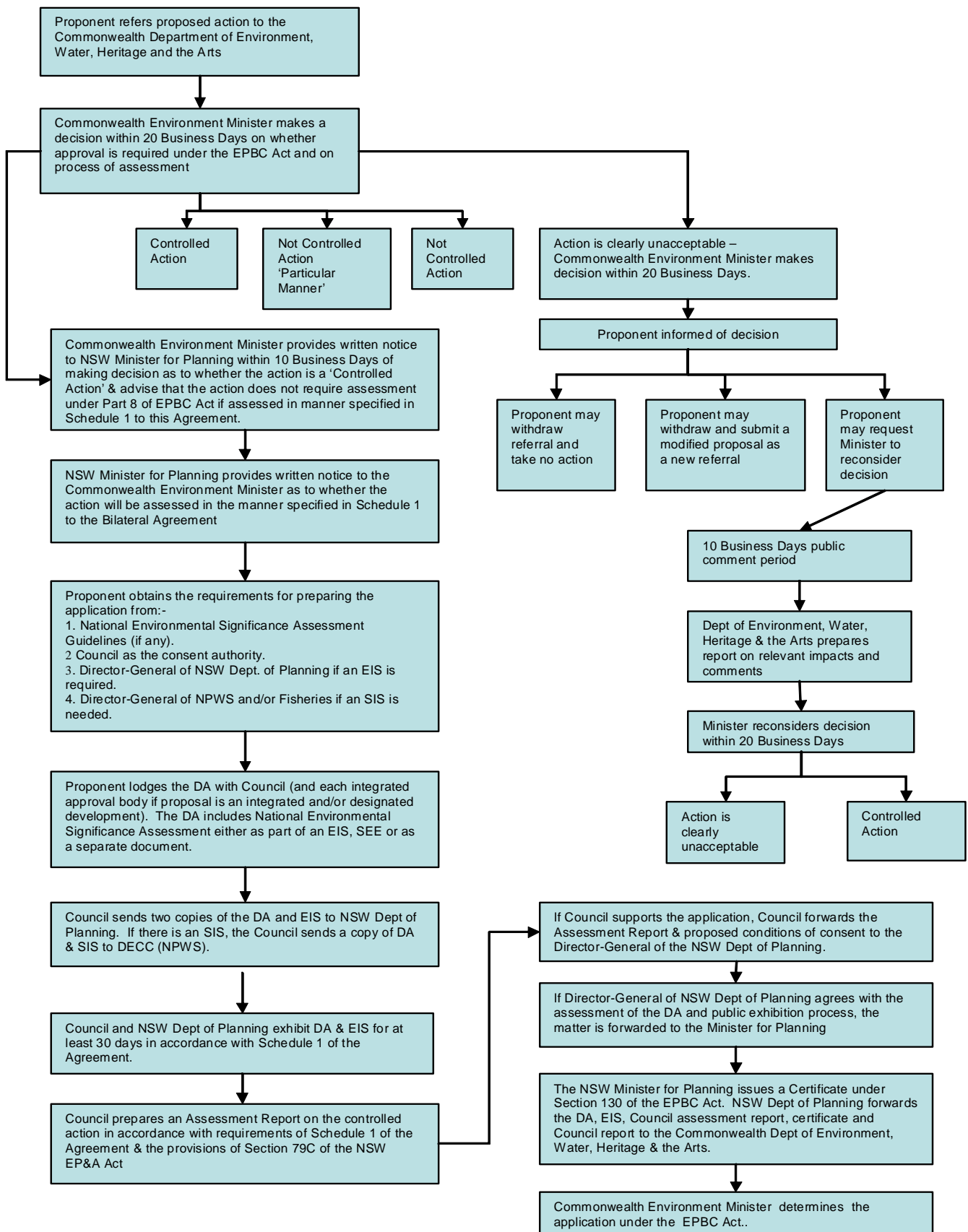


Figure 3: Assessment process for dealing with development applications involving the EPBC Act.

4 FLORA AND FAUNA IMPACT ASSESSMENT

4.1 When is a flora and fauna impact assessment report required?

1. A Flora and Fauna Impact Assessment Report is required to be lodged with a Development Application where:
 - (a) There is a potential impact on threatened species either directly or indirectly; or
 - (b) There is proposed direct or indirect impacts on native vegetation or fauna habitats such as water bodies, watercourses or dams or
 - (c) For any proposal which may have a significant effect on matters of national environmental significance and / or actions that have a significant effect on the environment of Commonwealth land, under the EPBC Act.
2. The flora and fauna impact assessment report must address the proposed subject site and study area. That is, the area directly affected by the proposal and any additional areas which are likely to be affected, either directly or indirectly.

4.2 When is an assessment of significance (7 part test) required?

1. An Assessment of Significance (AoS) or 7 part test is required to be conducted for each species, endangered ecological community or endangered population listed under the TSC Act or the FMA Act which is likely to be impacted, directly or indirectly, by the proposal. The aim of undertaking an Assessment of Significance is to improve the consideration and protection afforded to threatened species in planning and decision-making processes. The outcome of any threatened species assessment should be that developments, activities and actions are undertaken in an environmentally sensitive manner and that appropriate measures are adopted to avoid or minimise adverse effects on threatened species.
2. The Department of Environment and Climate Change's "Threatened Species Assessment Guidelines" (August 2007) are recommended as a basis to the preparation of an AoS. The guidelines can be accessed on the DECC website at:
<http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf>
3. The Assessment of Significance should be undertaken by specialist officers or suitably qualified ecologist/ consultant.
4. A Section 91 Licence is required to harm or pick a threatened species, population or ecological community or damage habitat under the TSC Act. When applying for a Section 91 licence under the TSC Act, the applicant provides the licensing authority with the Assessment of Significance.

4.3 What is required in a flora or fauna impact assessment report?

4.3.1 General

1. The content and survey methodology of a Flora and Fauna Impact Assessment Report is required to be consistent with the survey methodology requirements contained in this policy. However, Council may vary the survey requirements contained in this policy in cases where the appointed flora or fauna consultant is able to provide an alternative survey approach which, in the opinion of Council, is a best practice approach to enable the proper assessment of a proposal's impact upon a particular threatened species, population or endangered ecological community.

4.3.2 Desktop Research

1. Preliminary desktop research is recommended to be first step in order to identify all threatened species, populations or endangered ecological communities within a 10 kilometre radius of the site.
 - (a) Search the DECC Threatened Species website for threatened species, and ecological communities known from the Catchment Management Authority area.
 - (b) Search the ATLAS of NSW Wildlife / Bionet for threatened species, ecological communities in a 10km radius of the affected area.
 - (c) Consider habitat requirements and distribution of threatened species, populations and ecological communities to decide whether assessment of these are required.
2. The data source and date of searches should be stated clearly in the report.

4.3.3 Compile list of Threatened Species, Populations, EECs

1. Following a desktop review, a list of potentially threatened flora and fauna species, endangered populations and / or endangered ecological communities should be included in the flora and fauna impact assessment report.

4.3.4 Conduct flora and fauna surveys and habitat assessments.

1. Surveys should be conducted to assess habitats on the site and should be designed to target potential threatened species identified above in Section 4.3.3. Survey methods are to meet DECC (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Draft). Survey methods need to be stated clearly in the report.
2. Once surveys are conducted, refine the list of species and communities identified above and make a statement as to whether or not habitat exists to support the species or community.
3. A relevant literature review should also be undertaken for any identified potential threatened species, population or endangered ecological community. All data sources and their associated limitations should be stated.

4.3.5 Mapping Requirements (in support of any Flora & Fauna Report and 7 Part Tests)

1. A locality features map is required to be prepared which shows the study area in relation to any significant landform, other topographical features or existing remnant vegetation communities, creek lines or intermittent watercourses.
2. A vegetation communities map is required which shows the extent and location of all vegetation communities (especially any endangered ecological community) within the study area and the location of any identified threatened flora or fauna species or population.
3. A survey map is also required which shows the flora transects and quadrants and fauna trap sites and any incidental sightings of fauna species. This map should also be cross-referenced with the written survey results in the report.
4. Flora and fauna maps are required which identify the exact location (i.e. with GPS co-ordinates & datum) of each identified threatened flora and fauna species or population and / or endangered ecological community within the study area.
5. An aerial photograph of the study area and adjoining lands is also required.
6. A layout or building footprint map should be included in the Flora and / or Fauna Impact Assessment Report which clearly shows the proposed building layout or envelope as well as

drainage and road works and other ancillary works such as fencing, on-site sewage management systems utility service trenches etc, particularly in relation to any surrounding remnant vegetation.

7. The following mapping resources may be utilised.

DECCW (2002) *Illawarra Escarpment and Coastal Plain – Bioregional Assessment* available at: www.environment.nsw.gov.au/surveys/IllawarraEscarpmentBioregionalAssessment.htm

DECCW (2007) *Threatened and Pest animals of Greater Southern Sydney* available at: www.environment.nsw.gov.au/threatenedspeceis/faunasouthsydney.htm

4.3.6 General Requirements for Flora and Fauna Impact Assessment Reports

1. All preliminary flora or fauna impact assessment reports must include Assessment of Significance/ 7 Part Tests for all threatened species, populations or endangered ecological communities and their habitats that are likely to be impacted by the proposal. 7 Part tests are to be done individually for each species and their habitats and should be undertaken by suitably qualified and experienced ecologists or consultants. The Assessment of Significance / 7 Part tests must be accurate and based on current knowledge and information to allow for proper consideration of the likely impacts of the proposal on threatened species, populations and ecological communities and their habitats.
2. The preliminary flora and fauna impact assessment report shall identify and consider all direct, indirect and cumulative impacts for each relevant threatened flora and fauna species, populations and/ or endangered ecological communities and their habitats from the proposed development. This assessment is required to be included in all 7 Part Tests for all relevant flora and fauna species, populations and/ or endangered ecological communities.
3. Direct impacts should include all key threatening processes identified under the Threatened Species Conservation Act which are relevant to the specific species or populations as well as other readily identifiable impacts from the development.
4. Indirect impacts may include cumulative impacts of ongoing clearing and fragmentation of remnant vegetation communities, potential sedimentation or nutrient water pollution issues, noise and vibration disturbances during or post construction on roosting sites for bats or arboreal mammals etc.
5. Cumulative impacts generally occur from the accumulation of losses and depletions of individuals, populations and ecological communities and their habitats occurring at a local level from the proposed activity or development and from other activities or developments within the wider locality.
6. All preliminary flora and fauna impact assessment reports shall be presented in the following format:
 - (a) All reports, plans, aerial photographs and survey fieldwork notes shall be dated;
 - (b) All plans and / or aerial photography shall include the location and layout of the proposed development, current and proposed access arrangements, define existing landholding boundaries and the location of all watercourses and natural landform features and other topographical features;
 - (c) All plans or maps are required to be at an appropriate scale depending upon the size of the study area; e.g. 1:100, 1:200, 1:500 or 1:1000;
 - (d) All reports shall contain scaled maps showing the location of survey transects and plots;
 - (e) All plans shall contain all GPS co-ordinates (and associated datum) for locations where threatened species, population or ecological communities are identified;

- (f) All reports shall contain the full list of any identified threatened species, population or ecological community; and
- (g) All reports shall provide a comprehensive description of the survey methodologies including survey effort, survey dates, weather conditions etc.

4.3.7 Limitations of Survey Works to be recorded in Flora and Fauna Impact Assessment Reports

1. The Flora and Fauna Impact Assessment Report shall include details of all limitations associated with the survey work and findings in the report. The data collected for the purposes of the Flora and Fauna Impact Assessment Report shall include categories where the presence or absence of such species is recorded.
2. However, the failure to detect a species does not necessarily mean that the species is not present within the study area, especially if the study area falls within the distributional range of the species and the site contains suitable habitat. In this case, the precautionary principle is recommended to be applied and hence, the species should be assumed to be present within the study area. This may necessitate further survey work to be conducted during more favourable weather conditions or another season, particularly if the species is listed as critically endangered or endangered where the determination of the existence of the species within the study area is critical prior to decision-making on a proposed development.
3. If the species is not detected during the survey but the study area falls within the species normal distributional range, then an appropriate 7 Part Test will be required to be carried out.

4.4 Determination of a 7 Part Test findings

1. For proponents or applicants:
 - (a) The threatened species assessment of significance should not be considered a pass or fail test. Consideration of the factors will inform the decision making process of the likelihood of significant effect. Where necessary, the process will trigger further assessment in the form of a species impact statement.
 - (b) The assessment of significance should not be used as a substitute for a species impact statement. Application of the precautionary principle requires that a lack of scientific certainty about the potential impacts of an action does not itself justify a decision that the action is not likely to have a significant impact. If information is not available to conclusively determine that there will not be a significant impact on a threatened species, population or ecological community, or its habitat, then it should be assumed that a significant impact is likely and a species impact statement should be prepared.
 - (c) Proposed measures that mitigate, improve or compensate for the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been successfully for that species in a similar situation.
 - (d) In many cases where complex mitigating, ameliorative or compensatory measures are required, such as bush restoration or purchase of land, further assessment through the species impact statement process is likely to be required.
2. The courses of action Council may take, following the review and assessment of any 7 Part Test for threatened species, population and / or endangered ecological communities, include:
 - (a) If any of the 7 Part Test factors (individually or in combination) confirm that a development proposal or an activity is likely to have a significant effect upon a threatened species, population or endangered ecological community or their habitats, a Species Impact Statement (SIS) is required to be prepared.

A (SIS) must be prepared in accordance with the requirements of the Director – General of the NSW Department of Environment, Climate Change and Water (Parks & Wildlife Service Division) and must contain all relevant information as set out in the TSC Act; OR

- (b) If the development or activity can be modified such that a significant effect upon any threatened species, population or endangered ecological community or their habitats is unlikely, then a revised 7 Part Test is required to be undertaken in respect to the revised proposal; OR
- (c) If the development proposal or activity is likely to have a significant effect upon any threatened species, population or endangered ecological community or their habitats and the proponent is not prepared to modify the proposal or prepare the required SIS, then Council may proceed to determination of the application in which case refusal is likely; OR
- (d) If the 7 Part Test confirms that the development or activity is unlikely to have any significant effect on any threatened species, population or endangered ecological community or their habitats, Council may proceed with the determination.

- 2. The Assessment of Significance Guidelines (DECCW, 2007) will be taken into account when making a determination.
- 3. Council as the determining authority holds ultimate responsibility for the determination of a significant impact and hence is empowered to determine whether a 7 Part Test has satisfactory proven whether a Species Impact Statement (SIS) is necessary or not.

4.5 Independent review / assessment

- 1. Council may require an independent review of an preliminary flora and fauna impact assessment report and accompanying 7 Part Test. This review (if necessary) will be required to be undertaken, prior to the final assessment and determination of any Development Application.
- 2. The purpose of any independent review will be to:
 - (a) Assess the accuracy and / or adequacy of any preliminary flora and fauna report and accompanying 7 Part Test, particularly in respect to the survey work / methodology, findings and / or conclusions for specific threatened species, populations or endangered ecological communities.
 - (b) Identify any additional threatened species, populations or endangered ecological communities or their habitats which may require survey work and 7 Part Test assessment.
 - (c) Recommend any additional survey work program required to be undertaken to properly assess the proposal's potential impact upon any specific threatened species, population or ecological community.
 - (d) Confirm whether the proposal is likely to significantly affect any threatened species, population and / or endangered ecological community.
 - (e) Recommend any abatement or mitigation measures to any identified threatened species, population or ecological community.
- 3. The independent consultant is to be engaged by Council and shall report to Council, throughout the term of the review.
- 4. The full cost of the independent review will however be required to be funded by the applicant.
- 5. The engagement of the independent consultant will only take place, following communication with the applicant as to Council's short-list of independent consultants and the receipt of the written

quotation from the selected independent consultant and subsequent written acceptance of the quotation by the applicant.

6. In the event that the applicant does not provide written agreement for independent review of the flora and fauna study and accompanying 7 Part Test, then Council will determine the application on the basis of available information, in which case refusal of the application may be likely if Council considers that insufficient information has been provided to enable the proper determination of the application.

4.6 Requirements for the preparation of a Species Impact Statement (SIS)

1. The preparation of a Species Impact Statement (SIS) is required if any of the 7 Part Test factors either individually or in combination indicate that a proposed development or activity is likely to significantly affect any threatened species, population or endangered ecological community or their habitats (including critical habitat).
2. The SIS must be prepared in consultation with the Director General (DG) of the National Parks and Wildlife Service as to the form and content of the SIS (as per section 111 of the TSC Act). The request for the DG Requirements must be made by:
 - (a) The person applying for a Section 91 Licence under the TSC Act;
 - (b) The applicant seeking development consent under Part 4 of the EP&A Act; or
 - (c) The proponent of the activity proposed to be carried out under Part 5 of the EP&A Act.

Written details of the location, nature and scale of the proposal should be supplied to the DG when requesting the DG's requirements, along with all relevant information such as the Assessment of Significance, any Statement of Environmental Effects or Review of Environmental Factors.

3. The SIS must be prepared in accordance with section 109 and section 110 of the TSC Act and must comply with any requirements notified by the DG of DECCW. It is the responsibility of the determining or consent authority to ensure that a draft or final SIS complies with the requirements issued by the DG.
3. If Council ultimately considers that a development or activity is acceptable, following its assessment of the SIS, the formal concurrence from the Director – General of the National Parks and Wildlife Service is required, prior to final determination of the application.

4.7 Additional Resources

1. Threatened species profiles, identification guidelines and environmental impact assessment (EIA) guidelines for threatened species, populations and ecological communities can be accessed through DECCW Threatened Species website (below). The EIA guidelines in particular contain ecological information that will further assist in the survey and assessment of individual species, populations and ecological communities and can also be found through DECCW Threatened Species website.

www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_species.aspx

Appendix 1 - SURVEY METHODOLOGY - FLORA

SURVEY REQUIREMENTS FOR THREATENED FLORA SPECIES, POPULATIONS AND ECOLOGICAL COMMUNITIES

Survey Work Carried out in Optimal Times of the Year

Surveys must be undertaken at the most appropriate time of the year in order to guarantee the best sampling opportunity for the target species. Additionally, survey work should also include a review of any previous data over a number of previous seasons in order to ascertain any seasonal variation of the target species.

The carrying out of survey work at the most appropriate time of the year for the sampling of the target species is particularly important for a number of cryptic species (eg orchids), migratory species (being present at certain times of the year or sporadically present when suitable conditions exist) or are seasonal or active during particular periods of the year (eg amphibians, reptiles).

Seasonal & local climatic conditions

Local and regional climatic conditions can also influence the detectability of a target species.

If surveys are undertaken outside optimal survey periods, Council may require additional species – specific surveys to be undertaken at optimal times, in order to enable the proper assessment as to whether a proposed development or activity is likely to significantly affect the target threatened species, population or endangered ecological community.

STRATIFICATION AND SAMPLING

All surveys should be initially stratified on biophysical attributes (eg landform, geology elevation, slope, soil type, aspect) followed by vegetation structure (eg closed forest, open forest, woodland, heathland) and then floristics (eg species).

In a stratified random sampling design, the study area may be initially stratified using maps to provide information on the biophysical attributes with aerial photographs and existing vegetation maps used to identify vegetation structure and floristics. Additionally, soil maps and topographic maps may also further stratify sites.

The initial stratification map will reflect the initial stratification and guide the sampling intensity. However, distinct stratification units are rarely noticeable since transition zones tend to occur.

Each of the stratification units is required to be sampled. The minimum number of sampling sites within each of the units will be dependent upon the size of the unit. Sampling sites should be reflected on the survey map for further reference during the assessment process.

(Department of Environment & Conservation November 2004 page 5-67)

The Department of Environment & Conservation's Draft Threatened Species Biodiversity Survey and Assessment Guidelines for Developments and Activities November 2004 recommends that where only 1 sampling site is placed within a stratification unit, it must be located in an area which best represents the unit. Conversely, where there are multiple sampling sites within a stratification unit, the sampling sites should attempt to sample the geographic spread and heterogeneity of that unit. However, where the same stratification unit is fragmented or naturally patchy in structure and distribution, the calculation of the number of sampling sites required for that unit treats the area of each patch cumulatively.

In a stratified random sampling design, plots should be located randomly within each homogenous unit of vegetation identified by the stratification process. However, NPWS (1995) and Wilson (1997) recommend that plots be selected to avoid bias from edge effects and local disturbances such as roads and quarries.

To avoid edge effects, sampling plots should be selected according to the following criteria adapted from the NPWS (1995):

- Away from the boundaries of an environmental stratum;
- In homogeneous vegetation considered to be representative of the strata;
- Away from or free from local disturbances such as roads, mines, quarries and eroded areas; and
- The axis of the sampling plot should be aligned with the contour of hillsides or elongated vegetation communities (eg riparian areas) to avoid significant environmental gradients (eg soil moisture).

Survey effort is generally described in relation to stratification units. For areas of less than 1 hectare, the survey effort per stratification unit may be applied across the entire site where the site is relatively homogenous. However, any variations from the recommended survey effort must be justified within the flora and fauna report.

Transects (or traverses) are valuable for obtaining an understanding of the vegetation communities in the area, identifying community boundaries and recording species (Forest Animals Surveys *et al* 1997).

SAMPLING TECHNIQUES

1. Transects

Transects must be undertaken on foot for the recording of data. The number and length of transects will vary depending on the size, dimensions, topographic diversity and number of vegetation communities of the area being surveyed. However, a minimum of 2 walking transects (perpendicular to each other) is required.

Transect surveys should take into consideration the following matters:

- Transects should cross contours of land rather than following contour lines and should be orientated in such a direction that each transect samples the totality variability of the study area;
- Transects should also cross watercourses or water bodies rather than running parallel to such water courses or water bodies; and
- Transects should be established to ensure sampling variation between transects is minimised but precision of the sampling is maximised.

Information recorded while undertaking transects should include all plant species observed and other relevant information relating to the distribution of plant species such as aspect, topographic position, elevation and vegetation community boundaries.

2. Quadrant Surveys

A quadrant (or plot-based) survey is a quantitative examination of species distribution and abundance. Quadrant surveys are also more likely to detect inconspicuous or threatened species because a smaller area is sampled in a concentrated search. This survey technique also provides a basis for any subsequent monitoring requirement (Forest Animal Surveys *et al* 1997).

The plot size used widely and recommended by McDonald *et al* (1990), York *et al* (1991), NPWS (1995) and Forest Animal Surveys *et al* (1997) is a 400m² plot. The typical dimensions of a vegetation plot are 20 metres by 20 metres however where vegetation occupies a linear space, the plot shape can be changed to fit within the vegetation type as long as the total area remains the same (DECC *et al* 2004).

The following structural attributes of each quadrant location are required to be recorded:

- Primary structural layers present (for example tree / canopy layer, sub-canopy layer, emergents, tall shrub / small tree layer, shrub layer and ground cover);
- Height of structural layers;
- Relative cover abundance of each layer;
- Foliage (or canopy) cover for each layer (the percentage occupied by a vertical projection of the foliage and branches to the nearest 10%);
- The three most dominant species in each layer (recorded in order of dominance).

(Lower Hunter & Central Coast Region *et al* 2002)

3. *Random Meander Technique*

The random meander technique involves traversing areas of suitable habitat in no set pattern, but roughly back and forth whilst searching for a particular or several threatened plant species. This technique provides for greater coverage than a plot-based survey and is less time consuming (DECC *et al* 2004).

MINIMUM SURVEY REQUIREMENTS FOR THREATENED FLORA SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES

The minimum survey effort required per stratification unit is illustrated in Table 2 below.

Table 2: Minimum Survey Requirements for Flora Species

Survey Technique	Recommended Minimum Survey Effort	Recorded Information
Transect	<ul style="list-style-type: none"> • 1 x 100 metre traverse per stratification unit <2 hectares; • 2 x 100 metre traverses per 2 – 50 hectares of stratification unit; • 3 x 100 metre traverses per 51 – 250 hectares of stratification unit; • 5 x 100 metre traverses per 251 – 500 hectares of stratification unit; • 10 x 100 metre traverses per 501 – 1000 hectares of stratification unit, plus 1 additional 100 metre traverse for each extra 100 hectares thereof 	Floristics, structure, vegetation boundaries
Random meander	30 minutes for each quadrant sampled within the same stratification unit as the quadrant	Targeted for threatened species
Plot-based (Quadrant) Surveys	<ul style="list-style-type: none"> • 1 quadrant per stratification unit < 2 hectares; • 2 quadrants per 2 – 50 hectares of stratification unit; • 3 quadrants per 51 – 250 hectares of stratification unit; • 5 quadrants per 251 – 500 hectares of stratification unit; • 10 quadrants per 501 – 1000 hectares of stratification unit plus 1 additional quadrant for each extra 100 hectares thereof 	Floristics, structure, threatened species

Source: NSW Department of Environment & Conservation. November 2004. Threatened Species Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Draft)

GENERAL MATTERS FOR CONSIDERATION IN GATHERING SURVEY INFORMATION

1. *Plot Description*

A range of descriptive data is required to be recorded at each plot location on survey pro-forma, including the following:

- Date and time;
- Plot number or unique identifier number;
- Name of recorder(s);
- Plot size and dimensions;
- Location (using a Global Positioning System (GPS) reading, and specify datum);
- Locality description;
- Land tenure;
- Landform type;
- Soil type;
- Geology;
- Slope;
- Aspect; and
- Altitude.

2. *Floristic Data*

All plant species present within the plot are to be identified and recorded. If a plant cannot be identified in the field, a voucher specimen should be collected for identification using taxonomic keys such as Flora of New South Wales (Harden 1990, 1991, 1992, 1993) or other reference material.

A voucher specimen of any threatened or ROTAP species recorded is to be collected. Such specimens are to be sent to the National Herbarium of NSW (Royal Botanical Gardens) for confirmation. The Herbarium's confirmation of the species is also to be documented into the main body of the report. However, only Department of Environment, Climate Change and Water licensed investigators are legally permitted to take voucher specimens.

Dominant plant species should be identified in each stratum to aid in compiling a vegetation community description for inclusion into the main body of the report (whereas the full list of species recorded in the survey should be presented in the appendix to the report).

3. *Description of Sampling Sites*

The physical and biophysical characteristics of the site at each sampling site should be recorded through a pro-forma document.

4. *Habitat Assessment*

In cases where surveys are conducted outside of the appropriate season to detect threatened species, the likelihood of the vegetation community or other habitat components in the study area to support these species should be assessed.

EXISTENCE OF A THREATENED SPECIES, POPULATION OR ECOLOGICAL COMMUNITY

In the event that a threatened species, population and / or ecological community is identified through a plot or transect survey, a range of information should be recorded including:-

- Name and location of species, population or ecological community identified;
- Population area and size (extent) of the species, population or ecological community;
- Reproductive state;
- Age structure;
- Land conservation status;
- Fire response;
- Observers name;
- Date of survey; and
- Any known or potential threats.

This information is required to be sent to the NSW Department of Environment, Climate Change and Water's GIS Division for inclusion in the Atlas of NSW Wildlife, as part of the conditions of an investigator's scientific licence.

Appendix: 2 SURVEY METHODOLOGY - FAUNA

SURVEY REQUIREMENTS FOR THREATENED FAUNA SPECIES AND ENDANGERED FAUNA POPULATIONS

Survey Requirements for Amphibians (Frogs)

The majority of amphibians (frogs) are relatively inactive during the cooler months of the year and hence, are difficult to locate during the cooler months. Therefore, survey work for any threatened frog species (ie identified by the NPWS database within a 1 kilometre radius of the site) must be undertaken between September and March.

Survey sampling should involve a combination of diurnal (daytime) and nocturnal searches. Systematic diurnal searches for adult frogs and tadpoles must be conducted with a minimum survey effort of at least one hour within the relevant habitat of each stratification unit, according to the amount of habitat requiring survey. Systematic diurnal searches are to involve intensive searches within appropriate habitat such as reed beds, water soaks, ground litter along creek beds as well as logs and rocks and tufts of vegetation.

The majority of frogs are nocturnal and are most easily detected by their calls. Nocturnal frog surveys should involve the use of call playback as well as spotlighting, in order to detect any such threatened frog species. Different frog species have different seasonal peaks of activity and surveys should be conducted at the appropriate time of the year for those species, based on habitat characteristics. (NPWS 1997)

Playing the male advertisement call at a suitable volume is known to elicit responses from males in the area and is a useful method in areas where the habitat is appropriate for the particular species but there is no record of the species presence (Forest Animal; Surveys; EcoPro Pty Ltd and Fly by Night Bat Surveys Pty Ltd 2002).

However, surveys undertaken during sub-optimal periods such as during extended periods of dry weather or out of season may not result in the recording the presence of a particular frog species. Calling activity may also be reduced or cease completely but some individuals may be induced to call by use of playback of pre-recorded calls (Forest Animal; Surveys; EcoPro Pty Ltd and Fly by Night Bat Surveys Pty Ltd 2002).

Another major limitation of the call playback technique for frogs is that it cannot be used to confirm that a species is not present.



Figure 4: Photograph of a Stuttering Frog (*Mixophyes balbus*) (Courtesy of Narawan Williams)

Nocturnal searches should be conducted along all creeks or water soaks in the study area. The time, temperature, identity and number of frogs and other fauna are to be recorded during the survey census. (NPWS 1997). Fixed time searches should generally involve one person undertaking two hours of effort per 200 metres of watercourse.

Frogs may also be encountered opportunistically while spotlighting for mammals or undertaking diurnal surveys for reptiles.



Figure 5: Photograph of a Giant Burrowing Frog (*Heleioporus australiacus*) (Courtesy of E Magarey)

Survey Requirements for Reptiles

A range of sampling techniques is necessary for threatened reptile species since no one technique is able to capture all species (Schultz and de Oliveria 1995). The main techniques used for the effective sampling of threatened reptile species, include:- (i) pitfall trapping (ii) active searching and (iii) spotlighting on foot.

Reptile species are active during the warmer months of the year. Therefore, survey work for threatened reptile species shall be conducted between November to March only. The use of pitfall trapping techniques with drift fences is recommended to maximise the success of the survey work. It is noted that deep pits (>1.1m) capture many species (eg frogs, geckoes, legless lizards, snakes and dragons) which appear to escape from shallow pits (Woinarski et al 2000). However, deep pits may fill with water in heavy rain events and hence, floating timber must be placed in the pits to prevent trapped animals from drowning (Department of Environment & Conservation et al November 2004).

Active diurnal searches must be undertaken during warm, calm and dry weather periods only since windy, cold, overcast and / or rainy weather conditions will generally result in the hibernation of reptile species. Thirty minute searches on two (2) separate days per stratification unit are generally recommended to be undertaken before mid-morning when reptiles have not reached their optimal body temperature. Basking individuals can be identified by sight however cryptic species require the lifting and / or destruction of fallen logs, leaf litter, fallen bark etc to enable detection of such reptile species (Department of Environment & Conservation et al November 2004).

Nocturnal spotlighting of tree trunks and other habitat should be used to detect nocturnal snakes and geckoes. Thirty minute searches on two (2) separate nights should be undertaken per stratification unit.

Survey Requirements for Diurnal Birds

The location of census plots is recommended to correspond with the same habitat or vegetation community types where other vertebrate sampling is undertaken.

The main survey methods used for the surveying of diurnal birds include:-

- Sample plot counts – a minimum 20 minute search within a 1 hectare area (100 m x 100m, 50 m x 200m etc) with the sample plot configured according to the nature and configuration of the habitat being sampled; and
- Point count methods – where observation are made from a series of pre-determined points for pre-determined lengths of time. By recording the bird's distance from the point, density estimates can also be made (NPWS 1997).

All counts are to be conducted during periods of relatively high bird activity (such as early morning or late afternoon).

All bird species and individuals seen or heard are to be recorded, either as 'on-site' if detected within the plot or 'off-site' if recorded in adjacent vegetation types or flying overhead. (NPWS 1997).

Surveys for diurnal bird species are recommended to be undertaken for at least two seasons (including summer or winter depending upon the migratory nature of the particular species). The Regent Honeyeater (*Xanthomyza Phrygia*) and Swift Parrot (*Lathamus discolor*) for example occur in the coastal and near –coastal areas of the Illawarra Region, during the winter months. Therefore, it is critical that the main survey period for these species takes place in winter with the shoulder season being either the spring or autumn periods.

Walking through habitat is important for 'flushing' out cryptic species such as the Bush Stone-Curlew (*Burhinus grallarius*). (NPWS 2004).



Figure 6: Photograph of two Sooty Oystercatchers (*Haematopus fuliginosus*) (Courtesy of Martin Schultz)

Survey Requirements for Nocturnal Birds

Call playback combined with spotlighting is considered the most effective survey technique to detect nocturnal bird species, especially owls (Debus 1995; Kavanagh and Stanton 1998; Cessnock City Council 2002). Kavanagh and Peake (1993) also found that call playback more than doubled the detection rate for all species. This technique involves the listening for vocalisations, broadcasting using at least a 10W amplifier and spotlighting. A 10w amplifier may be heard by owls in an approximate 1 kilometre radius, although it is difficult to hear *Tyto* species beyond 800 metres (NSW Department of Environment & Conservation 2004).

At each playback site, an initial listening period of 15 minutes should be undertaken, followed by a spotlight search for 10 minutes to detect the particular nocturnal bird species within the immediate locality. The calls of each target species should then be played intermittently for 5 minutes, followed by a 10 minute listening period. After all the calls have been played, another 10 minutes of spotlighting and listening must be conducted in the vicinity to check for birds that are attracted by the calls but are not vocalising (NSW Department of Environment & Conservation 2004).

The recommended minimum power rating of broadcasting equipment is 8 -10 watts, allowing calls to be audible for a distance of 600 – 1000 metres. York *et al* (1991) states that 'boom 'box' style tape recorders are not as effective for owl calling as directional loud speakers.

Surveys for nocturnal bird species should be undertaken early in the evening or just before dawn since owls call most frequently during these periods of the night (NSW Department of Environment & Conservation 2004; Forest Animal; Surveys; EcoPro Pty Ltd and Fly by Night Bat Surveys Pty Ltd 2002).

A census for nocturnal birds should not be undertaken under very windy or rainy conditions as owls are most vocal on calm dry nights (York et al 1991; Kavanagh and Peake, 1993).

The call playback method may disrupt owls during their breeding session and hence, the alternative technique is observing and recording the type and number of roost trees. Roost trees also delineated by the evidence of white wash around the base of the tree or tree trunk. The collection of any owl pellets

from the base of trees will help to identify the particular owl species (Forest Animal; Surveys; EcoPro Pty Ltd and Fly by Night Bat Surveys Pty Ltd 2002).

Stag watching for 30 minutes prior to sunset and 1 hour following sunrise is recommended at key roosting sites (NSW Department of Environment & Conservation 2004).

Powerful Owls (*Ninox strenua*) and Masked Owls (*Tyto novae-hollandiae*) are particularly sensitive to disturbance during the breeding and nesting season and hence, any survey work undertaken during this period must be discreet to avoid any potential desertion of nests by the adult birds. Bush Stone-Curlews (*Burhinus grallarius*) are also particularly sensitive to disturbance when nesting and are known to abandon nests if continually disrupted (NSW Department of Environment & Conservation 2004).

Call playback for the Bush Stone-Curlews (*Burhinus grallarius*) should consist of playing calls for 30 seconds, followed by 4 ½ minutes of listening. This 5 minute cycle should be repeated up to three (3) times so there is a maximum of 15 minutes at each survey point. The same 30 seconds of calls should be used throughout the survey. If a bird responds to the call, approximately 10 minutes should be spent listening for other bird's responses. Survey points are recommended to be set 2 – 4 kilometres apart, depending upon weather conditions and topography of the locality (NSW Department of Environment & Conservation 2004).

Surveys for Mammals

The number of fauna survey sites should reflect the number of vegetation communities contained within the subject study area. The location of each fauna survey site should be determined from the assessment of vegetation community maps, topographical maps and aerial photographs, prior to the commencement of any such detailed survey work.

Several studies comparing different sampling techniques for terrestrial mammals have concluded that all methods are biased towards certain mammal species (Laurence 1992; Stanton and Anderson 1998; Lindenmayer 1999; NSW Department of Environment & Conservation 2004).

A range of different sampling techniques are recommended to be employed for the proper survey census of target mammal species, including (but not necessarily limited to) the following:-

- **Elliot trapping** – Elliot traps are typically 'shoe box' shaped and are folding aluminium traps which come in a range of sizes, depending on the target species to be trapped. Elliot traps have an opening at one end through which the animal is enticed by a bait placed at the other end of the trap. Once the animal takes the bait, the closing mechanism is triggered and the front door of the trap is closed.

The NSW Department of Environment & Conservation 2004 recommends that Elliot traps be numbered and tagged and established in a systematic manner, following a specified sampling regime for the study area. The sampling effort per stratification unit must equate to at least 100 trap nights. The recommended approach involves 25 traps placed for four (4) nights. If variation of this approach is proposed it should be noted that traps must be open for a minimum of three (3) nights and a maximum of four (4) nights. The trap lines should be spaced at 20 – 50 metre intervals. (NSW Department of Environment & Conservation 2004).

- **Wire Cage Traps** – Wire cage traps are for larger terrestrial mammals and entrap mammals in a similar fashion to Elliot traps. The sample effort per stratification unit is 24 trap nights, preferably using six (6) traps for a minimum four (4) consecutive nights. Wire cage traps are preferred for trapping target species such as the Spotted – tail Quoll (*Dasyurus maculatus*).
- **Hair Tubes** – Hair tubes vary in size and are typically cylindrical to funnel in shape with one end closed where the bait is placed. Double sided tape is attached to the inside of the tube near the bait and as the animal enters and leaves the tube, hair samples are attached to the tape. Hair tubes are recommended to be placed in ten (10) pairs (10 small tubes and 10 large tubes) in appropriate

habitat, along a transect in each stratification unit. The tubes are required to be checked regularly and not removed for at least 4 days and 4 nights if no hair samples are obtained (Suckling 1978).

- Pitfall Trapping – This involves the digging of a pit which is then artificially lined into which the target species is encouraged to fall and is subsequently unable to escape. Minimum dimensions for pits should be either 28 centimetres diameter and 40 centimetres depth or 15 centimetre diameter and 60 centimetre depth. The top of the artificial lining should be at or just below ground level and the bottom of the pit should be covered with a layer of leaf litter and floating timber / bark should be included, in case of heavy rainfall events. Sampling effort must involve 24 trap nights with pits being open for a minimum of 4 nights. The use of pitfall traps should be consistent with the NSW Agriculture *Guideline 6 Guidelines for the Use of Pitfall Traps* which may be obtained at www.agric.nsw.gov.au.
- Spotlighting – Spotlight searches are directed towards target flowering trees as these provide a source of blossom and nectar to *Petaurus* gliders. However, the Squirrel Glider (*Petaurus australis*) is often difficult to detect by spotlight as their eyes do not reflect brightly and often remain stationary when in the spotlight beam (Menkhorst et al 1988). Yellow – bellied Glider (*Petaurus norfolcensis*) are however more easily detected by spotlighting. (Forest Animal; Surveys; EcoPro Pty Ltd and Fly by Night Bat Surveys Pty Ltd 2002).
- Stag watching – Stag watching involves direct counts of nocturnal animals emerging from tree hollows at dusk. The technique involves observers stationed beneath hollow-bearing dead or living trees in a defined area and recording the identity and number of emergent animals following dusk for a period of approximately 40 minutes. This technique is useful as it provides an accurate measure of absolute abundance provided that all individuals emerge from the tree hollow after dusk and all individuals in a population or group den in tree hollows (Smith et al 1989).
- Arboreal trapping – The use of arboreal trapping is particularly useful for detecting target *Petaurus* glider species such as Yellow – bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*). Arboreal trapping is an effective sampling technique combined with spotlighting and stag watching (Forest Animal Surveys, EcoPro Pty Ltd, Fly By Night Bat Surveys Pty Ltd et al 2002). Trapping for *Petaurus* glider species should be undertaken with larger Elliot type B folding aluminium traps mounted on platforms. The recommended minimum trap density is six (6) to ten (10) traps per trapping grid. One trapping grid measuring a minimum of 0.5 hectares should be established in each vegetation type (Forest Animal Surveys, EcoPro Pty Ltd, Fly By Night Bat Surveys Pty Ltd et al 2002). Where Yellow – bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) are detected, the location of den trees should be recorded.
- Arboreal Hair Tubes – Arboreal hair tubes can also be used to detect the presence of arboreal mammals (Suckling 1978). However, a constraint with this technique is the difficulty of distinguishing the hair of the threatened Squirrel Glider (*Petaurus norfolcensis*) versus the hair of the common Sugar Glider (*Petaurus breviceps*). This is particularly problematic in areas where both species occur. (Forest Animal Surveys, EcoPro Pty Ltd, Fly By Night Bat Surveys Pty Ltd et al 2002).
- Call Playback – The use of call playback is particularly useful in detecting the presence of nocturnal arboreal mammals including the Squirrel Glider (*Petaurus norfolcensis*) and the Yellow – bellied Glider (*Petaurus australis*) as well as the Koala (*Phascolarctos cinereus*) (Wemmer et al 1996; NSW Department of Environment & Conservation et al 2004).
- Sand Plots – Sand plots involve creating a smooth sand surface across a track either using imported sand material or raking the surface of a dirt track. Any animals using the track will leave their footprints in the sand which can then be identified. Six plots are required for four nights per stratification unit (NSW Department of Environment & Conservation et al 2004).
- Tracks, scats and scratches – The searching of significant trees with tree hollows may reveal the existence of scats at the base of the tree trunk and visual signs of scratches may also be evident on the tree trunk which may help to identify the presence of a target species. For example, the Yellow –

bellied Glider (*Petaurus australis*) leaves a distinctive V- shaped feeding scar on tree trunks. The recommended minimum survey effort involves at least a 30 minute search performed in the appropriate habitat for the target species. (NSW Department of Environment & Conservation et al 2004).



Figure 7: Photograph of a colony of Grey headed Flying Foxes (*Pteropus poliocephalus*)

Survey Requirements for Microchiropteran Bats

The foraging strategies, dietary requirements and roosting site preferences for microchiropteran bats (insectivorous bats) are poorly known for most bat species and generalisations based on limited observations are commonly used (Parnaby 1998). The requirements of bats appear to vary widely within and between bat species, between sexes, age groups, seasons, years and on a regional basis (Parnaby 1998). Further the distribution and taxonomy of many bat species in NSW is poorly understood (Duncan 1999). Therefore, the conduct of surveys for threatened bat species is very problematic, given the limited scientific knowledge of such species.

Given the lack of knowledge pertaining to the distribution and taxonomy of bat species as well as their ecological requirements, it is very important that all survey work include detailed assessment of all existing records thorough assessment of suitable habitats for each target species be undertaken.

A number of microchiropteran bat species may be best identified through their ultrasonic echolocation calls while other bat species can only be reliably identified by trapping (Woodside and Taylor 1985; Helman and Churchill 1986). Therefore, a combination of both ultrasonic detection and trapping is essential as neither method can detect all species (Corben 1989; Parnaby 1992; Duffy 2000 Forest Animal Surveys, EcoPro Pty Ltd, Fly By Night Bat Surveys Pty Ltd et al 2002).

Roost sites are vital for the long-term viability of bat populations and hence, the location of such sites is an integral part of bat surveys (Forest Animal Surveys, EcoPro Pty Ltd, Fly By Night Bat Surveys Pty Ltd et al 2002).

Microchiropteran bats may be separated into those species which roost in trees (ie tree hollows, beneath bark or amongst vegetation) and those species which roost in artificial or subterranean roost sites such as caves, disused mines or under bridges etc.

The main survey techniques for detecting the presence of microchiropteran bat species, include:-

- Harp trapping - Harp trapping is considered the only current effective means of surveying many bat species simultaneously at a range of sites. Traps are recommended to be placed in bat 'flyways' such as across tracks, trails, creeks or in natural forest openings to maximise the likelihood of captures. Harp traps should be placed to sample all the vegetation communities within the study area and are recommended to be left in place for at least a minimum of 3 – 4 nights.
- Echolocation call surveys – The use of echolocation call surveys is particularly effective for recording those bat species that have strong calls. These species generally correspond with those that feed at or above the tree canopy and which are not readily captured in harp traps, including the Greater Broad-nosed Bat (*Scoteanax rueppellii*) and the Common Bent-wing Bat (*Miniopterus schreibersii*). Ultrasonic echolocation detectors are used to detect and record the high frequency echolocation calls used by bats to navigate and detect prey. Some studies have found that bats appear to modify their navigation calls according to the density of vegetation (Reinhold 2001). As part of this survey, it is recommended that temperature, humidity and atmospheric pressure data since these variables have a substantial effect on sampling results (Forest Animal Surveys, EcoPro Pty Ltd, Fly By Night Bat Surveys Pty Ltd *et al* 2002).
- Mist-netting & trip lines – Mist-netting & trip lines may be used for the capture of bat species not normally captured in harp traps. When installed over water bodies in warm weather, mist nets & trip lines can assist in capturing high flying species. Mist nets must be monitored continuously while in operation to remove any bats caught in the nets.
- Diurnal Roost Searches - Roost site requirements for most bat species also vary seasonally, in response to reproductive status and regional and localised climatic conditions. Specific microclimatic conditions are required during the winter season for bats to enter into a state of torpor and different conditions are required in summer within maternity sites. Food availability and social dynamics may also influence the selection of roosts. Some bat species are known to gather in large numbers at certain roost sites on an annual basis for breeding, preparing to breed or during torpor. The review of past records and data is vital in identifying the presence of these important sites, particularly since such sites may only be used at certain times of the year (NSW Department of Environment & Conservation *et al* 2004).

Roost sites may be readily identified by the accumulation of bat guano and evidence of foraging at or near potential sites such as caves, tunnel entrances, under bridges or at the base of trees with hollows. In addition, stag watching the entrance of potential roost sites at dusk will allow the observation of bats as they fly out of the roost to forage.

Bats are generally active from October to March and hence, sampling is required to be undertaken during this period. The prevailing climatic conditions should also be taken into consideration when planning microchiropteran bat surveys since cold temperatures, strong winds, heavy rain and / or full moon periods should be avoided when undertaking such surveys. (Law 1998).

The likelihood of identifying the majority of species present will be improved through increasing the number of trap sites per night. This will ensure greater coverage of the stratification unit. The number of nights at each site may not necessarily increase the number of individuals trapped but however may increase the species richness of captures (Duffy 2000).

Survey Requirements for Megachiropteran Bats (Fruit Bats, Flying – Foxes)

The presence of megachiropteran bats (fruit bats, flying foxes) is usually detected through the use of spotlighting of individuals while feeding on blossom or fruit. Territorial disputes between flying-foxes while feeding at food trees can also be easily heard. Mist netting of food trees is a method used to confirm identification of particular species. Mist nets require constant monitoring to remove any trapped from the net as soon as practicable.

The analysis of foraging resources is also an important consideration. In NSW, it is recognised that the primary food source for flying-foxes is the flowers of eucalypts, melaleucas and banksias. Flying-foxes preferentially feed on the pollen of native eucalypts however such eucalypts have irregular patterns of

flowering and hence, flying –foxes must migrate in response to the availability of food. The potential food resource of a study area must be properly assessed since it may contribute to the feeding resource of the target species at some times of the year.

Daytime roost site searches are also important in identifying the size and nature of a flying fox colony.

MINIMUM SURVEY REQUIREMENTS FOR THREATENED FAUNA SPECIES AND POPULATIONS

The minimum survey requirement for each fauna species group is contained in Table 3.

Table 3: Minimum Survey Requirements for Fauna Species

Fauna Group	Survey Technique /Method	Survey Period	Minimum Survey Requirements
Amphibians (Frogs)			
Diurnal search	Systematic day habitat search	September - March	One hour per stratification unit
Nocturnal searches	Night watercourse habitat search	September – March	Min. 2 hours per 200 metres of water body edge over a Min. of two (2) separate nights
	Night habitat search of damp and watery sites	September - March	30 minutes on two (2) separate nights per stratification unit
	Nocturnal call playback	September – March	Min. 1 hour for minimum two (2) separate nights
	Spotlight searches	September – March	Min. 30 minutes on two (2) separate nights
Reptiles			
Diurnal Search	Systematic day habitat search	November - March	Min. 30 minute search on two (2) separate days
Nocturnal searches	Pitfall traps with drift nets	November – March	24 trap nights (preferably using six (6) traps for a minimum of four (4) consecutive nights
	Spotlighting	November - March	Min. 30 minute search on two (2) separate nights targeting specific habitat
Diurnal Birds			
	Formal census	All year	1 hectare sample habitat plot per 20 minutes
	Wetland census	All year	1 hour census at dawn and dusk for each identified wetland on two (2) separate nights
	Water source census	All year	A 20 minute census at dawn and dusk for each identified water course on two (2) separate nights

Fauna Group	Survey Technique /Method	Survey Period	Minimum Survey Requirements
Nocturnal Birds			
	Day habitat search	All year	<p>Search habitat for pellets and likely tree hollows for Owl species – Min. two (2) separate days</p> <p>Flushing of Bush – Stone Curlews by walking through potential habitat – Min. two (2) separate days</p> <p>Observing potential roost hollows for Min. 30 minutes prior to sunset and Min. 1 hour following sunrise</p>
	Stag-watching	All year	Spotlighting for Bush Stone Curlew by foot or from a vehicle driven in 1 st gear
	Spotlighting	All year	<p>Sites should be separated by 800 metres – 1 kilometre and each site must have playback session repeated as follows:-</p> <ul style="list-style-type: none"> • at least 5 visits per site on different nights are required for the Powerful Owl and the Barking Owl; and • at least 6 visits per site for the Sooty Owl on different nights and at least 8 visits on different nights for the Masked Owl are required.
	Call Playback	All year	<p>Note: Powerful Owls and Masked Owls are particularly sensitive to disturbance during the breeding and nesting season and hence, all works during these times should be limited to avoid any potential desertion of nests by the adults.</p> <p>Sites for the Bush Stone-Curlew should be separated a minimum 2 – 4 kilometres apart (ie depending on weather conditions and topography) and conducted during the breeding season. Call playback for the Bush Stone-Curlew should consist of playing calls for 30 seconds followed by 4.5 minutes of listening. This 5 minute cycle should be repeated up to 3 times so there is a maximum of 15 minutes survey at each point. The same 30 seconds of calls should be</p>

Fauna Group	Survey Technique /Method	Survey Period	Minimum Survey Requirements
			used throughout the survey. Note: Bush Stone-Curlews are particularly sensitive to human activities when nesting and hence, all works during these times should be limited to avoid abandonment of nests by adult birds.
Mammals			
Small Terrestrial Mammals	Small mammal traps	All year	100 trap nights over 4 consecutive nights per site
	Hair tubes	All year	10 small tubes in pairs over 3 - 4 days and 4 nights per site
	Pitfall Traps with drift nets	All year	24 trap night nights over 3 – 4 consecutive nights
Medium Terrestrial Mammal	Cage / B Elliot traps	All year	100 trap nights over 4 consecutive nights per site
	Hair tubes	All year	10 large tubes in pairs over 3 – 4 days and 4 nights per site
Large Terrestrial Mammals	Wire cage traps	All year	24 trap nights over 3 - 4 consecutive nights per site
	Large Elliot traps	All year	24 trap nights over 3 - 4 consecutive nights
	Sand Plots	All year	6 Soil plots for 3 – 4 consecutive nights

Fauna Group	Survey Technique /Method	Survey Period	Minimum Survey Requirements
Koalas	Daytime habitat search	All year	Min. 1 day search - walking rate of 1 – 2 kilometres per hour – focussed on identifying preferred eucalypt feed trees & habitat through identifying scratch marks on trees and / or scats at base of trees.
	Spotlighting	All year	Walking rate of 1 kilometre per hour - Minimum 2 – 3 consecutive nights
	Call Playback	All year	Min. 2 sites per stratification unit up to 200 hectares plus an additional site per 100 hectares above 200 hectares – Min. 2 -3 consecutive nights
Arboreal Mammals	Arboreal Elliot traps	All year	24 trap nights over 3 -4 consecutive nights per site
	Spotlighting	All year	Walking rate of 1 kilometre hour per person on 3 – 4 separate nights
	Arboreal Hair Tubes	All year	3 hair tubes in each of 10 habitat trees up to 100 hectares of stratification unit for at least 4 days and 4 nights
	Call Playback (Gliders and Possums)	All year	2 sites per stratification unit up to 200 hectares plus an additional site per 100 hectares above 200 hectares. Each playback site must have the session conducted twice on 4 separate nights
	Stag-watching	All year	Observing potential roost hollows for 30 minutes prior to sunset and 1 hour following sunset on two (2) separate nights
Microchiropteran Bats	Harp trapping	October to March	2 harp trap nights per broad habitat type for minimum 3 – 4 separate nights
	Echolocation call recording	October to March	45 minute continuous recording plus call activated all night for minimum 3 - 4 separate nights
	Mist netting	October to March	1 trap set for at least 2 hours duration starting at dusk for minimum two (2) separate nights

Fauna Group	Survey Technique /Method	Survey Period	Minimum Survey Requirements
	Triplining	October to March	Targeted survey of water bodies for at least 2 hours duration, starting at dusk for a minimum of two (2) separate nights
	Spotlighting and transect walking	All year	Targeted survey near likely food resources for at least 2 hours duration for a minimum of two (2) separate nights
	Daytime habitat search	All year	Search for bat excreta at or near potential habitats
Megachiropteran Bats (Fruit Bats, Flying – Foxes)	Spotlighting	All year	Walking rate of 1 kilometre hour per person on 3 – 4 separate nights
	Mist netting	All year	1 trap set for at least 2 hours duration starting at dusk for minimum two (2) separate nights
	Daytime roost site search	All year	Walking rate of 1 kilometre hour per person

(Source: Department of Environment & Climate Change November 2004 Draft Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities and Cessnock City Council Flora and Fauna Survey Guidelines Lower Hunter Central Coast Region 2002)

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