

Forest Protection Survey Program

Survey Design Summary October 2018



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Photo credit

Cover photo: Undertaking a fauna survey in the Central Highlands (photo Peter Baker)

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Forest Protection Survey Program Design Summary

Introduction

The focus for the Forest Protection Survey Program (FPSP) is on species that have timber harvesting prescriptions listed under the Code of Practice for Timber Production 2014 (the Code), where locating the species, using a survey approach that meets the trigger, would result in changes on the ground in the way the area is managed. Seventy-three faunal species – 20 mammals, 14 birds, six reptiles, seven amphibians, 16 fish, eight crustaceans, and two terrestrial invertebrates, and 312 plant species – have timber harvesting prescriptions listed under the Code.

Forest protection surveys which detect threatened species, may trigger the application of protection measures (e.g. prescriptions such as creation of buffers, retention of hollow-bearing trees, establishment of special protection zones) as required by the Management Standards and Procedures 2014.

The main reasons for conducting forest protection surveys are to:

- improve the management and protection of species impacted by timber harvesting, by increasing the chances that threatened species are detected
- decrease the likelihood of disruptions to timber harvesting within coupes by early detection of threatened species, where present
- improve the confidence of environmental stakeholders in DELWP's ability to meet the environmental objectives of the Code.

The survey design uses a risk-based framework to underpin the survey program. The framework for this decision-making process is based on the concepts of 'which', 'where', 'when', 'how', and 'how used'.

The design considers a wide range of complex inputs to inform decisions on which species require survey effort, on which coupes these surveys should be undertaken, the timing of surveys, the methods to be used, and how the data will be managed and used.

The survey locations are in the forest management areas (FMA) of East Gippsland, Tambo, Central Gippsland, Dandenong, Central, Benalla-Mansfield and North-East.

All coupes on VicForests' Rolling Operations Plan (ROP) that are planned to be harvested, undergo an initial desktop assessment to determine the priority for surveying for each coupe and for each target species. A detailed coupe survey schedule is then developed to guide the survey work for those species requiring field assessments. Site selection is targeted to ensure survey effort is commensurate with scientifically validated methods and able to be implemented within budget. All survey work is undertaken within either the general management zone or occasionally within special management zones if a prescription would impact on an adjacent coupe.

While species with prescriptions are the focus of the FPSP, taking a precautionary approach, other threatened species impacted by timber harvesting but without prescriptions, are also being considered. Such species have been prioritised for survey based on their threatened status, impact of timber harvesting, overlap with areas planned for harvesting and likelihood of being detected and their community profile.

As of October 2018 there are 353 coupes on the ROP, of which 337 (excluding the roading coupes) will be the focus for the first year of the FPSP. The target set for this program is to survey 80% of the coupes planned for harvest. As species' distributions and habitat requirements vary, not all coupes will provide suitable habitat for every species under consideration. Therefore, a prioritisation process is used to ensure that the highest priority coupes and species are selected for surveys. An optimisation approach is used which involves a desktop assessment of 100% of coupes and incorporates the habitat distribution models, detectability of species using the proposed sampling techniques and costs of surveys to select the most cost-effective set of coupes to sample. Seasonality, weather conditions, and access constraints are also considered.

Given the scale of the program, clear guidelines are being developed to establish how data are to be collected, standards of data required, and how these data will be organised, managed, stored and shared with other data systems within DELWP, such as the Victorian Biodiversity Atlas (VBA). Processes are being

developed to ensure timely transfer of data between DELWP and VicForests to allow new findings to be incorporated into their coupe planning and timber harvesting scheduling processes.

Species detections provide the basis for revisions to Habitat Distribution Models, which will lead to improved short and longer-term outcomes for threatened species, while minimising disruptions to harvesting operations. This survey program provides an opportunity to collect significant amounts of new data that will be highly beneficial in improving understanding of the distribution, habitat requirements, impact of disturbance and overall status of threatened species throughout the forest estate of eastern Victoria.

Overall Framework

The Code states that ‘The advice of relevant experts and relevant research in conservation biology and flora and fauna management must be considered when planning and conducting timber harvesting operations.’ Scientific experts from the Arthur Rylah Institute (ARI) have conducted the principle design of this program.

The overall framework for the survey design is outlined in Figure 1. Each of the components are further explained in subsequent chapters.

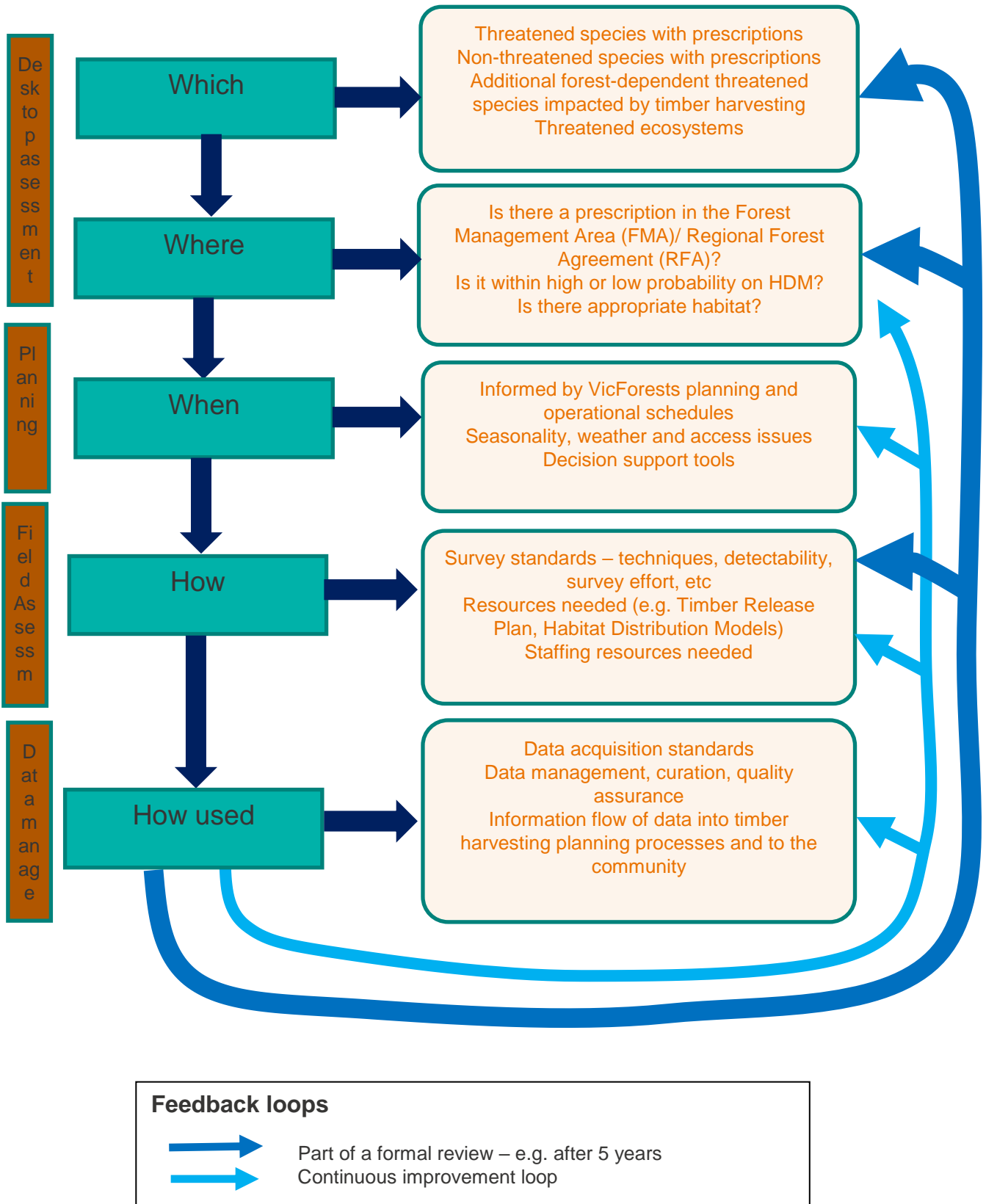


Figure 1: Forest Protection Survey Framework

Target Species

As noted previously, the key focus for the forest protection surveys is species which have timber harvesting prescriptions listed under the Code (DEPI 2014a,b,c), where locating the species, using an approach that meets the trigger, would result in changes on the ground in the way the area is managed. Most changes result in areas designated as SPZs where harvesting is excluded, or SMZs where harvesting practices are modified. Most of the species with prescriptions under the Code are species listed as threatened at either the state level (under the *Flora and Fauna Guarantee Act 1998* (FFG Act), or on the advisory lists of threatened species (DSE 2009, DSE 2013, DEPI 2014d, DELWP 2018). There are however, also some non-threatened species that have prescriptions, for example Yellow-Bellied Glider, for which if the triggers are met, protection measures are undertaken. Therefore, all non-threatened species with prescriptions have also been included for consideration in forest protection surveys. Appendix 1 (Threatened and non-threatened species with detection-based timber harvesting prescriptions in eastern Victoria) provides a full list of faunal species where prescriptions apply in eastern Victoria, with their triggers. This represents 73 species – 20 mammals, 14 birds, six reptiles, seven amphibians, 16 fish, six crustaceans, and two terrestrial invertebrates.

There are 312 plant species with prescriptions of which 75 have been identified as being potentially within coupes.

In addition to species listed under the Code, several threatened ecosystems (listed as vegetation communities) also have timber harvesting prescriptions. The following ecosystems occur in eastern Victoria. There is Ecological Vegetation Class (EVC) mapping for all eastern Victoria, which provides some guidance as to where these EVCs are likely to occur, however the mapping is only a guide and needs to be ground truthed. There are also other areas that are not mapped that may contain these EVCs.

Ecosystems that are included for survey are:

- Box Ironbark
- Heathland
- Montane Riparian Thicket
- Rainforest

It is important to know the prescription trigger for each species, as this will influence what survey technique is undertaken and to what level of intensity. For many species it is purely the presence of the species, which is relatively straightforward. However, for some species the trigger is a density estimate (e.g. for Greater Gliders it is >10 individuals/spotlight km, or >15 individuals/spotlight hour, or > 2 individuals/ha). For these species the technique used needs to enable assessment against these triggers, rather than purely detecting the species. For other species it is the location of a breeding or roosting record (e.g. Grey Goshawk, Eastern Bent-wing Bat) and so the technique needs to be appropriate to determine breeding or roosting status. For example, the most common techniques used to survey insectivorous bats are bat trapping and bat detectors. However, these would just document sites where individuals were foraging and would not provide information on roosting locations, as individuals can forage up to 40 km from their roost. The surveys therefore need to focus on finding roosts. The trigger for some species includes mapping of suitable habitat. As the triggers are critical for determining the correct sampling technique, these have been provided in the appendices.

DELWP has developed a prioritisation process to ensure that we are maximising the benefit of our survey effort as it is not possible to survey every coupe for every value. The following are considered in the survey prioritisation process:

- Target species list as determined by those that have prescriptions in the Code of Practice for Timber Production, and others of conservation significance
- Survey technique parameters e.g. time
- Detection probability of survey techniques
- Rated impact of timber harvesting
- Disturbance history including fire history and timber harvesting history
- Habitat distribution likelihood and nearby VBA records of target species

- Seasonal impacts on access, working conditions and detection probability
- Cost of survey technique and budget available

The priority aquatic species (fish and freshwater crayfish) are range restricted and in areas of stream catchments which received less previous sampling effort. Therefore, the process of coupe/site selection adopted for the aquatic fauna component of the FPSP is a qualitative and subjective approach, which relies on existing survey data and expert knowledge of species distributions, sampling issues (bias, detection issues), etc.

The following table lists the key target species of the surveys.

Survey Technique Abbreviation	Survey Technique Full name	Survey targets (bold) and other species for reporting	Comment
CHASS	Coupe Habitat and Sign Survey	Field observations of habit for and confirmed signs of: Habitat - Glossy Black Cockatoo Bats Spotted-tail Quoll signs Grey-headed Flying Fox roosts Trees >2.5m DBH	CHASS is conducted at coupes where no other survey technique is planned or where the proposed harvest date prevents other survey techniques being conducted in the time available
LBPTI	Leadbeater's Possum Thermal Imaging and Call Playback	Leadbeater's Possum Greater Glider Yellow-bellied Glider Koala Powerful Owl Sooty Owl Masked Owl	Conducted where the proposed harvest date prevents LBP camera trapping technique being conducted in the time available
LBPCT	Leadbeater's Possum Arboreal Camera Trapping	Leadbeater's Possum Greater Glider Yellow-bellied Glider Koala Eastern Pygmy-possum	
SLCP	Arboreal Spotlight and Owl Call Playback	Greater Glider Yellow-bellied Glider Common Brushtail Possum Koala Powerful Owl Sooty Owl Masked Owl Barking Owl Leadbeater's Possum Eastern Pygmy-possum	Combines spotlighting and call playback for cost effectiveness
TerCam	Terrestrial Camera Trapping	Spotted-tail Quoll Long-footed Potoroo Common Dunnart Smoky Mouse New Holland Mouse Eastern Pygmy-possum White-footed Dunnart Long-nosed Potoroo Swamp Antechinus Southern Brown Bandicoot Broad-toothed Rat Dingo	Quoll camera trapping conducted separately to herbivores to confirm identification. Detection of very small mammals may lead to Elliott trapping
OppObs	Opportunistic Observations	All species	

Survey Technique Abbreviation	Survey Technique Full name	Survey targets (bold) and other species for reporting	Comment
EllTrap	Small Mammal Elliott trapping	Common Dunnart New Holland Mouse Swamp Antechinus White-footed Dunnart Broad-toothed Rat	
Rept	Targeted Reptile search	Alpine Water Skink Alpine She-oak Skink Diamond Python Inland Carpet Python Bandy Bandy Woodland Blind Snake Swamp Skink Mountain Skink Alpine Bog Skink Eastern She-oak Skink Rosenberg's Goanna Tree Goanna (Lace Monitor)	Most reptiles listed in the Code are either not in harvest areas e.g. Alpine She-oak skink, or are of such low density and detection probability that targeted survey is most unlikely to detect them.
Frog	Frog Surveys	Giant Burrowing Frog Large Brown Tree Frog Spotted Tree Frog Blue Mountains Tree Frog Alpine Tree Frog Baw Baw Frog Southern Barred Frog Bibron's (Brown) Toadlet Dendy's Toadlet Southern Toadlet Martin's Toadlet/Tylers Toadlet Green and Golden Bell Frog Booroolong Tree Frog Keferstein's Tree Frog	Baw Baw Frog is entirely within protected areas and will not be surveyed initially. Southern Barred Frog is considered extinct. These species will receive further targeted survey if detected during other surveys
Flora	Targeted plant surveys	Plants - 76 species targeted	Most plant species in the Code do not occur in coupes planned for harvest
Fish Crust	Aquatic (Fish & Crustacean) surveys	Barred Galaxias Bluenose (Trout) Cod Mountain Galaxias Macquarie Perch Flat-headed Galaxias Murray Cod Dwarf Galaxias Orbost Spiny (Freshwater) Crayfish Mallacoota Burrowing Crayfish Narracan Burrowing Crayfish Warragul Burrowing Crayfish Strzelecki Burrowing Crayfish South Gippsland Spiny Crayfish Claytons Spiny Crayfish Variable Spiny Crayfish	

Survey Technique Abbreviation	Survey Technique Full name	Survey targets (bold) and other species for reporting	Comment
		Curve-tail Burrowing Crayfish Alpine Spiny Crayfish Murray Spiny Crayfish East Gippsland Spiny Crayfish	
LBPFA	Leadbeater's Possum Habitat Assessment		LBP habitat will be surveyed for where analysis of remote sensing data indicates high likelihood of presence. Design of a cost effective method of remote sensing analysis is being considered.
DiBird	Diurnal Bird surveys	Numerous species	Birds will be surveyed opportunistically as the cost effectiveness and triggers for management actions do not justify specific bird surveys. Tailored surveys may occur if threatened species listed in the Code are observed opportunistically
Invert	Invertebrate surveys		Alpine Stonefly and Giant Gippsland Earthworm are not predicted to occur in any current coupes planned for harvest
DiKoala	Diurnal koala searches	Koala	Targeted surveys are proposed where positive observations are recorded during other survey effort
BTPhasCT	Brush tailed Phascogale camera trapping	Brush tailed Phascogale	Not predicted to occur in any areas planned for harvest
Bats	Bat surveys	Eastern Horseshoe Bat Common Bent-wing Bat Large-footed Myotis Eastern Broad-nosed Bat Grey-headed Flying-fox	Specific surveys will be conducted where other sign is observed e.g. potential roost trees/caves etc

Survey scheduling

Following prioritisation, further analysis of a wide range of factors is conducted to develop a survey schedule.

Key factors considered in this process include:

- Proposed harvest date – this is a key influence in determining what dates the surveys have to be conducted by. Each technique takes time e.g. camera trapping takes a month, and the program is intending to be surveying months ahead of the planned harvest date.
- Location in relation to other coupes prioritised with the same technique. This analysis enables clustering of coupes into survey packages to economise on the logistics of survey. This also reduces safety issues of travel fatigue.
- Season of highest detection probability is considered to ensure we are surveying target species at the right time of year. See the table of seasonality below.
- Weather conditions at the time of survey can reduce or improve detectability. There are limited opportunities for some species
- Access can be a significant issue if a proposed coupe is hundreds of metres from a trafficable track. This creates additional time and cost as well as presenting a safety issue.
- Availability of contractors to conduct the surveys. Capacity is occasionally an issue due to competing demands in the market for the specialised skills.

The outcome of the scheduling processes is packages of achievable survey opportunities that can be conducted by the available resources at the right time of year.

Table x (give it a number and title) below provides a calendar of the seasonal timing of surveys for high or medium priority fauna species.

Shaded areas show the months of the year when surveys can be undertaken, including breeding season for species which have a prescription related to breeding. In addition, there are weather constraints influencing detectability, not all days (or nights) will be suitable for surveying within these time periods, and there are accessibility issues at some times of the year. Some species are lacking appropriate data to determine the best timing for surveys; these are indicated with an asterix. Information has been sourced based on expert opinion, the DELWP Approved Survey Standards (DSE 2011a,b,c,d), and from Frogwatch Field Guide to Victorian Frogs (Hero et al. 1991).

Species	Spring			Summer			Autumn			Winter		
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug
Spotted-tail Quoll												
Leadbeater's Possum												
Greater Glider												
Long-footed Potoroo												
Koala												
Smoky Mouse												
Common Dunnart												
Brush-tailed Phascogale												
Yellow-bellied Glider												
Grey-headed Flying-fox												
Eastern Horseshoe-bat												
Common Bent-wing Bat												
Large-footed Myotis												
Broad-toothed Rat												
White-footed Dunnart												
Swamp Antechinus												
Southern Brown Bandicoot												
Long-nosed Potoroo												
Powerful Owl												
Sooty Owl												
Masked Owl *												
Glossy Black Cockatoo												
Barking Owl												
Regent Honeyeater												
Spotted Quail-thrush												
Chestnut-rumped Heathwren												
Diamond Python												

Species	Spring			Summer			Autumn			Winter		
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug
Alpine Water Skink												
Alpine She-oak Skink												
Swamp Skink												
Eastern She-oak Skink												
Lace Monitor												
Rosenberg's Goanna												
Giant Burrowing Frog *	Survey adults Tadpole surveys					Survey adults			Tadpole surveys			
Large Brown Tree-Frog	Survey adults Tadpole surveys			Tadpole surveys		Survey adults					Survey adults	
Spotted Tree Frog			Survey adults									
Baw Baw Frog		Survey adults										
Southern Barred Frog				Survey adults								
Blue Mountains Tree Frog		Survey adults			Tadpole surveys							
Alpine Tree Frog		Survey adults			Tadpole surveys							
Bibron's Toadlet	Tadpole surveys					Survey adults						
Dendy's Toadlet						Survey adults						
Southern Toadlet						Survey adults		Survey adults Tadpole surveys				
Martin's Toadlet/Tylers Toadlet	Survey adults											
Green and Golden Bell Frog		Survey adults			Survey adults							
Booroolong Tree Frog		Survey adults										
Keferstein's Tree Frog		Survey adults										
Galaxiids (all species)												
Bluenose (Trout) Cod		#	#									
Macquarie Perch		#	#									
Murray Cod		#	#									
Spiny Crayfish		#	#									
Burrowing Crayfish												
Alpine Stonefly												
Giant Gippsland Earthworm												



Optimal survey timing

Breeding season (relevant for species where this relates to the prescription)

* indicates where detectability is not well quantified. The optimal survey timing for these species requires further data.

indicates surveys may be possible if stream flow conditions are suitable

Survey Guidelines

The following aspects have been considered when developing the survey guidelines for the forest protection surveys.

- The survey guidelines outline an approach that is applicable to the prescription triggers as outlined in the Code and associated documents (DEPI 2014a,b,c). For example, if the trigger is a breeding location, detecting just the presence of the species is not sufficient if breeding status cannot be determined.
- Requirement to show presence vs absence, i.e. the evidence needed to show presence and the amount of sampling effort required to infer absence.
- For species where the trigger is simply the detection of the species, there may be a range of potential techniques that could be suitable, however the technique that will be used in the Forest Protection Survey Program will be the one that is outlined.
- Detection probability (i.e. the likelihood of detecting the species if it is present) will vary depending on the technique used, the amount of survey effort, and in some instances the time of year, weather conditions at the time and the experience of the surveyor. To be able to infer absence it is necessary to know detection probabilities. This is available for some techniques (e.g. use of remote cameras in trees for Leadbeater's Possum) but not for all techniques for all species. Where this information is not available, the survey guidelines will discuss these uncertainties, and outline the proposed initial approach. In addition, information that could be collected during the forest protection surveys to improve knowledge of detection probabilities will be outlined, as well as how the guidelines will be updated using an adaptive approach when new learnings become available.
- Even with a good understanding of detection probabilities and undertaking surveys using the most appropriate techniques and the amount of survey effort needed to meet high standards, there is always a chance of not detecting a species where it is present. For example, there is a greater than 85% probability of detecting Leadbeater's Possum where they are present, when using remote cameras set in trees using the approach undertaken by ARI in recent surveys (i.e. three cameras set for 4 weeks in potential movement pathways) (Nelson et al. 2017). This is a high detection probability compared to many other species/technique combinations, however it still means that there is a 15% chance that they will be not detected at sites where they do actually occur. The tolerance of the risk of not detecting a species where it is in fact present varies depending on the focus of the risk. The risk to the species if it is not detected is that harvesting is undertaken without consideration of that species being present. The risk to the department may vary depending on how high-profile the species is and if third parties are also surveying for the species. Using the Leadbeater's Possum example again, there are times when third parties undertake a huge amount of survey effort in a single area, and eventually detect the species, which may not have been detected using just a standard survey. For cryptic species or those without external scrutiny, these 'false negatives' (i.e. not detecting them where they are present) are likely to go unnoticed.
- The amount of survey effort required needs to match the desired detection probability. For example, if it was considered that a 70% probability of detecting a species was sufficient, then a lower survey effort would be required than if a 90% detection probability was considered necessary to reduce the risk of not detecting the species where it is present. However, there also needs to be consideration of the overall effectiveness, with a given amount of resources, in balancing the sampling of fewer sites with a higher individual detection probability, with sampling more sites, each however with a lower detection probability.

In writing the survey guidelines, priority has been given to species, or species groups, in the following order:

- species that have a high profile in relation to timber harvesting (most of which already have survey standards from which information could be drawn).
- threatened species which are highly impacted by timber harvesting operations that have timber harvesting prescriptions.

- threatened species which may be impacted by timber harvesting operations to a lesser extent, that have prescriptions.
- threatened species without prescriptions which have been included due to the precautionary approach.
- non-threatened species that have prescriptions.
- threatened species with prescriptions but which do not occur in timber harvesting areas, or for which the prescription would never, or have only a very remote chance of being triggered, not warranting the development of timber harvesting related survey standards.

Survey guidelines have been developed based on the current DELWP survey standards and latest available expert experience to ensure the highest detection probability. Each survey guideline has been designed to maximise the probability of detection of the target species outlined in the table above. Individual survey guidelines are available in the DELWP FPSP website.

The survey guidelines:

- provide consistency for survey of target species using techniques identified
- provide clear guidance to contractors as to techniques and standards for survey
- provide specific fields of data to be collected for each technique
- ensure triggers for survey or prescription are considered in survey design and data collection
- ensure, where possible, a prescribed survey effort sufficient to meet a defined detection probability (where this is known)
- provide equipment lists and equipment standards
- provide guidance on specific considerations for survey site selection for that technique e.g. where to put cameras Survey Results.

Data management results

The aims of the Forest Protection Survey Program are to improve threatened species protection and reduce disruption and uncertainty to the timber industry. This means that data need to be of a high standard and obtained using consistent protocols. The following points have been considered with respect to standards for data acquisition.

A data management framework is being developed to address:

- user needs
- data management system options
- stakeholder reporting
- communications
- data quality assurance
- data efficiency.

standard operating procedures (SOPs) have been developed to outline a quality assurance program for the data and to document the survey guidelines for each type of surveys.

Contractors are required to demonstrate proficiency in sampling and identification prior to surveys commencing.

Survey results, reported on the FPSP website, provide a summary of what has been observed during surveys. Many other species that are not targets of the FPSP are also recorded and reported. These records provide valuable information about the broader range of species present in our forests.

If a target species is not found, then the result is also reported as “target not found” however all other observations are reported.

All results are subject to a quality assurance process to ensure data curation standards are met. Data is initially reported to the DELWP FPSP team. The results are then to VicForests as well as being uploaded to

the Victorian Biodiversity Atlas. More detailed information about the observations are available through the VBA through the portal <https://www.environment.vic.gov.au/biodiversity/victorian-biodiversity-atlas>

Program Management

The FPSP is managed by a team within the Monitoring Evaluation and Research Unit of Forest, Fire and Regions Group. The team consists of a Program Manager, a Data/Spatial Officer and a Contracts/Operations Officer.

The FPSP will:

- conduct desktop assessments on 100% of coupes planned for harvest each financial year.
- conduct in-field surveys on 80% of coupes planned for harvest each financial year.

Data on the harvest schedule is obtained from VicForests weekly to ensure that all coupes planned for harvest are considered in the survey design. As the harvest schedule changes frequently, the survey design is an iterative process and requires flexibility to adapt to these frequent changes.

Contractors are provided with target coupes and species to survey grouped by survey technique, and a time frame within which the surveys are to be conducted.

Quality Assurance

Quality assurance of the field survey effort is maintained by:

- Use of standard consistent systems and procedures.
- Adhering to the standards and procedures outlined in this SOP in relation to the survey guidelines and data management systems and processes.
- Reporting to the Contract Officer all situations where standards or procedures are unable to be maintained for any reason and alternatives are put in place to achieve the required outcome.

Contractors are required to ensure that all data collected and returned to DELWP is in the form required.

Continuous Improvement

The FPSP will implement a continuous improvement approach to enable learnings from the surveys to be incorporated into the future planning of the program. Some aspects will contribute to formal review processes, for example, reviews of prescriptions and their triggers, while other aspects can be continuously incorporated into the program, such as updating the habitat distribution models (HDMs) or improving understanding of detection probability and hence the optimal amount and type of survey effort required to ensure a high probability of detecting species where they are present.

The FPSP includes opportunities for participants in the program to recommend improvements to systems and processes. Suggestions for improvements can be forwarded to any of the FPSP management team by email or phone call. Suggestions for improvement should contain clear information about the issue encountered, the context of the issue and suggestions for improvement.

The FPSP team will consider the suggestions and make decisions as to whether to implement or reject the suggestion as is or as amended.

The FPSP team will maintain an issue register to record opportunities for improvement, and the outcome of consideration of the issues

Threatened and non-threatened species with detection-based timber harvesting prescriptions in eastern Victoria

Threat Listing: EPBC – listed under the Commonwealth *Environment Protection Biodiversity Conservation Act*; FFG – listed under the Victorian *Flora and Fauna Guarantee Act*; Adv – included in the advisory lists of threatened fauna and flora (DSE 2009, DSE 2013, DEPI 2014d, DELWP 2018) in any of the threat categories (including Near Threatened and Data Deficient). VEAC listing: B – Broad – forest-dependent threatened species. F – Focus – forest-dependent threatened species negatively impacted by native forest timber harvesting (VEAC 2017). RFA where prescriptions apply: CH – Central Highlands; EG – East Gippsland; G – Gippsland; NE – North East Regional Forest Agreement areas. Impact of timber harvesting is taken from Strategic Management Prospects (SMP). As not all threatened species have been assessed in SMP, for those species without this assessment a judgement has been made based on similar species: these are indicated with square brackets. HDM – Habitat Distribution Models. Where multiple common names have been used in the Management Standards and Procedures for a species, the alternative name is indicated in brackets.

a) Mammals

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Spot-tailed (Tiger) Quoll	<i>Dasyurus maculatus</i>	EPBC, FFG, Adv	B, F	CH, EG, G, NE	Detection of animal; detection of den or latrine site	[Med]	High	Yes
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	FFG, Adv	B	Statewide	Detection in area not previously known	High	High	Yes
Common Dunnart	<i>Sminthopsis murina</i>	Adv		CH	Detection of animal	[Med]	Low	Yes
Greater Glider	<i>Petauroides volans</i>	EPBC, FFG, Adv	B, F	EG	Density (>2/ha, >10/km, >15/spotlight hr)	High	Med	Yes
Squirrel Glider	<i>Petaurus norfolcensis</i>	FFG, Adv	B	NE	Detection of population	Med	Med	Yes
Leadbeater's Possum	<i>Gymnobelideus leadbeateri</i>	EPBC, FFG, Adv	B, F	CH	Detection of animal (= colony); detection of Zone 1A&B habitat	High	High	Yes

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Mountain Pygmy Possum	<i>Burramys parvus</i>	EPBC, FFG, Adv		NE	Detection of population	Med	High	Yes
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Adv		EG	Density (5 ind/pitfall line over 5 days)	High	Med	Yes
Long-footed Potoroo	<i>Potorous longipes</i>	EPBC, FFG, Adv	B, F	EG, G, NE	Detection of animal	High	High	Yes
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	EPBC, FFG, Adv	B	G	Detection of roost site with regular seasonal use	Med	High	Yes
Eastern (Southern) Horseshoe-bat	<i>Rhinolophus megaphyllus</i>	FFG, Adv	B	CH, EG, G, NE	Detection of roosting colony	High	Med	Yes
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	FFG, Adv	B	EG, G	EG - density (>10 ind in 1 trapping session); G - detection of roost sites	Med	High	Yes
Common (Eastern) Bent-wing Bat	<i>Miniopterus schreibersii oceanensis</i> (now <i>M. orianae oceanensis</i>)	FFG, Adv		CH, EG, G, NE	Detection of roosting colony	Med	Med	Yes
Large-footed (Southern) Myotis	<i>Myotis macropus</i>	Adv		CH, EG, G, NE	Detection of roosting colony	Med	Med	Yes
Smoky Mouse	<i>Pseudomys fumeus</i>	EPBC, FFG, Adv	B	CH, G, NE	Detection of animal	High	High	Yes
New Holland Mouse	<i>Pseudomys novaehollandiae</i>	EPBC, FFG, Adv		G	Detection of animal	Med	High	Yes

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Non-threatened species with detection based prescriptions in eastern Victoria								
Yellow-bellied Glider	<i>Petaurus australis</i>		F	EG	Density (>0.2/ha, >5/km, >7/spotlight hr)	High	Med	Yes
Common Brushtail Possum	<i>Trichosurus vulpecula</i>			EG	Density (>2/ha, >10/km, >15/spotlight hr)	Med	Med	Yes
Koala	<i>Phascolarctos cinereus</i>			EG	Detection of resident population	Med	Med	Yes
Eastern Broad-nosed Bat	<i>Scotorepens orion</i>			EG	Density (>10 ind. in 1 trapping session)	High	Med	Yes
Species on the VEAC list or listed as threatened and occur in timber harvesting areas, but do not have prescriptions								
White-footed Dunnart	<i>Sminthopsis leucopus</i>	FFG, Adv	B			[Med]	Med	Yes
Swamp Antechinus	<i>Antechinus minimus</i>	EPBC, FFG, Adv	B			Med	High	Yes
Southern Brown Bandicoot	<i>Isodon obesulus</i>	EPBC, FFG, Adv				High	High	Yes
Long-nosed Potoroo	<i>Potorous tridactylus tridactylus</i>	EPBC, FFG, Adv	B			High	High	Yes
Brush-tailed Rock Wallaby	<i>Petrogale penicillata</i>	EPBC, FFG, Adv	B			Med	High	Yes
Broad-toothed Rat	<i>Mastacomys fuscus</i>	EPBC, FFG, Adv	B			High	High	Yes
Dingo	<i>Canis lupus dingo</i>	FFG, Adv				[Low]	Low	No

b) Birds

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Grey Goshawk	<i>Accipiter novaehollandiae</i>	FFG, Adv	B	CH, EG, G, NE	Detection of nesting site	Med	Med	Yes
Square-tailed Kite	<i>Lophoictinia isura</i>	FFG, Adv	B	CH, EG, G, NE	Detection of nesting site	Med	Low	Yes
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	FFG, Adv	B	EG, G, NE	EG & G - Detection of nesting site; NE - Detection of resident population	Med	High	Yes
Glossy Black Cockatoo - eastern subsp.	<i>Calyptorhynchus lathami lathami</i>	FFG, Adv	B, F	EG, G	EG - Habitat (Black She-oak stands), detection of nesting site; G - Detection of nesting site	High	Med	Yes
Swift Parrot	<i>Lathamus discolor</i>	EPBC, FFG, Adv	B	NE	Detection of resident population	Low	High	Yes
Turquoise Parrot	<i>Neophema pulchella</i>	FFG, Adv	B	NE	Detection of nesting site (stumps)	Med	Low	Yes
Barking Owl	<i>Ninox connivens</i>	FFG, Adv	B	CH, EG, G, NE	Detection of nesting & roosting site with regular use (outside OMA)	Med	Med	Yes
Powerful Owl	<i>Ninox strenua</i>	FFG, Adv	B, F	CH, EG, G, NE	CH & EG - Detection of nesting & roosting site with regular use (outside OMA); G & NE - Detection of nesting & roosting sites	High	Low	Yes
Masked Owl	<i>Tyto novaehollandiae</i>	FFG, Adv	B, F	CH, EG, G, NE	Detection of nesting & roosting site with regular use (outside OMA)	High	Med	Yes

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Sooty Owl	<i>Tyto tenebricosa</i>	FFG, Adv	B, F	CH, EG, G, NE	Detection of nesting & roosting site with regular use (outside OMA)	High	Med	Yes
Apostlebird	<i>Struthidea cinerea</i>	FFG		NE	Detection of resident population	Low	Med	Yes
Regent Honeyeater	<i>Xanthomyza phrygia</i> (now <i>Anthochaera phrygia</i>)	EPBC, FFG, Adv	B	NE	Detection of a regularly used site; detection of an individual in an area not known to be a regularly used site	Med	Med	Yes
Non-threatened species with detection based prescriptions in eastern Victoria								
Little Falcon (Australian Hobby)	<i>Falco longipennis</i>			EG	Detection of nesting site	Med	Med	Yes
Peregrine Falcon	<i>Falco peregrinus</i>			EG	Detection of nesting site	Med	Med	Yes
Species on the VEAC list or listed as threatened and occur in timber harvesting areas, but do not have prescriptions								
Chestnut-rumped Heathwren	<i>Calamanthus pyrrhopygius pyrrhopygius</i>	FFG, Adv	B			Med	High	Yes
Speckled Warbler	<i>Chthonicola sagittata</i>	FFG, Adv	B			Med	Med	Yes
Spotted Quail-thrush	<i>Cinclosoma punctatum</i>	Adv	B			High	Med	Yes
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	Adv	B			Med	Med	Yes
Helmeted Honeyeater	<i>Lichenostomus melanops cassidix</i>	EPBC, FFG, Adv	B			[High]	High	Yes
Hooded Robin	<i>Melanodryas cucullate</i> (now <i>Melanodryas cucullata cucullata</i>)	FFG, Adv	B			Med	Med	Yes

c) Reptiles

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Alpine Water Skink	<i>Sphenomorphus kosciuskoi</i> (now <i>Eulamprus kosciuskoi</i>)	FFG, Adv		G, NE	Detection of animal	Med	High	Yes
Alpine She-oak Skink	<i>Cyclodomorphus praealtus</i>	FFG, EPBC, Adv		NE	Detection of animal	[Low]	High	Yes
Diamond Python	<i>Morelia spilota variegata</i> (now <i>Morelia spilota spilota</i>)	FFG, Adv		EG	Detection of animal	Med	Med	Yes
Inland Carpet Python	<i>Morelia spilota metcalfei</i>	FFG, Adv		NE	Detection of animal	Low	Med	Yes
Bandy Bandy	<i>Vermicella annulata</i>	FFG, Adv		NE	Detection of animal	Low	Med	Yes
Woodland Blind Snake	<i>Ramphotyphlops proximus</i>	Adv		NE	Detection of animal	Low	Med	Yes
Species on the VEAC list or listed as threatened and occur in timber harvesting areas, but do not have prescriptions								
Swamp Skink	<i>Egernia coventryi</i> (now <i>Lissolepis coventryi</i>)	FFG, Adv	B			Med		Yes
Mountain Skink	<i>Liopholis montana</i>	Adv				Med	Med	Yes
Alpine Bog Skink	<i>Pseudemoia cryodroma</i>	FFG, Adv	B			Med	High	Yes
Eastern She-oak Skink	<i>Cyclodomorphus michaeli</i>	FFG, Adv	B			Med	Med	Yes
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	FFG, Adv	B			[Med]	Med	Yes
Tree Goanna (Lace Monitor)	<i>Varanus varius</i>	Adv	B			Med	Med	Yes

d) Amphibians

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	EPBC, FFG, Adv	B	EG, G	Detection of animal	Med	Med	Yes
Southern Barred Frog	<i>Mixophyes balbus</i>	EPBC, FFG, Adv		EG	Detection of animal	Med	High	Yes
Baw Baw Frog	<i>Philoria frosti</i>	EPBC, FFG, Adv	B, F	CH	Potential habitat	High	High	Yes
Large Brown Tree-Frog	<i>Litoria littlejohni</i>	EPBC, FFG, Adv	B	EG	Detection of animal or egg mass	High	Med	Yes
Spotted Tree Frog	<i>Litoria spenceri</i>	EPBC, FFG, Adv	B	CH, NE, G	Detection of animal and mapping of suitable habitat	Med	High	Yes
Alpine Tree Frog	<i>Litoria verreauxii alpina</i>	EPBC, FFG, Adv		G, NE	Detection of animal (=population)	Med	High	Yes
Non-threatened species with detection based prescriptions in eastern Victoria								
Blue Mountains Tree Frog	<i>Litoria citropa</i>			EG	Density (sites with >50 indiv.)	Med	High	Yes
Species on the VEAC list or listed as threatened and occur in timber harvesting areas, but do not have prescriptions								
Bibron's Toadlet (Brown Toadlet)	<i>Pseudophryne bibronii</i>	FFG, Adv	B			Med	Low	Yes
Dendy's Toadlet	<i>Pseudophryne dendyi</i>	Adv				Med	Low	Yes
Southern Toadlet	<i>Pseudophryne semimarmorata</i>	Adv	B			Med	High	Yes
Martin's Toadlet/Tylers Toadlet	<i>Uperoleia martinii</i> <i>Uperoleia tyleri</i>	FFG, Adv	B			High	Med (Tylers)	Yes

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Green and Golden Bell Frog	<i>Litoria aurea</i>	EPBC, Adv	B			High	High	Yes
Booroolong Tree Frog (listed as Booroolong Frog)	<i>Litoria booroolongensis</i>	EPBC, FFG, Adv	B			Med	Med	Yes
Keferstein's Tree Frog	<i>Litoria dentata</i>	Adv				[Med]	Low	No

e) Fish

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Freshwater Herring	<i>Potamalosa richmondia</i>	FFG, Adv		EG	Detection of population	[Low]	High	No
Barred Galaxias	<i>Galaxias fuscus</i>	EPBC, FFG, Adv	B	CH, G, NE	Detection of population	[High]	Med	Yes
Mountain Galaxias	<i>Galaxias olidus</i>	FFG, Adv		EG, G, NE	Detection of population	[High]	Med	Yes
West Gippsland Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias longifundus</i>	FFG, Adv, being nominated for EPBC		G	Detection of population	[High]	Med	No
Tapered Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias lanceolatus</i>	FFG, Adv, being nominated for EPBC		G	Detection of population	[High]	Med	Yes

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Dargo Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias mungadhan</i>	FFG, Adv, being nominated for EPBC		G	Detection of population	[High]	Med	Yes
McDowalls Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias mcdowalli</i>	FFG, Adv, being nominated for EPBC		EG	Detection of population	[High]	Med	Yes
Shaw Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias gunaikurnai</i>	FFG, Adv, being nominated for EPBC		G	Detection of population	[High]	Med	Yes
East Gippsland Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias aequipinnis</i>	FFG, Adv, being nominated for EPBC		EG	Detection of population	[High]	Med	Yes
Roundsnout Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias terenasus</i>	FFG, Adv, being nominated for EPBC		EG	Detection of population	[High]	Low	Yes
Morwell Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias 'morwell'</i>	Not listed, being nominated under IUCN for EPBC		G	Detection of population	[High]	Med	No
Moroka Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias 'moroka'</i>	Not listed, being nominated under IUCN for EPBC		G	Detection of population	[High]	Med	No

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Yalmy Galaxias (until recently known as Mountain Galaxias)	<i>Galaxias 'yalmy'</i>	Not listed, being nominated under IUCN for EPBC		EG	Detection of population	[High]	Med	No
Cox's Gudgeon	<i>Gobiomorphus coxii</i>	FFG, Adv	B	EG	Detection of population	[Low]	Med	Yes
Australian Grayling	<i>Prototroctes maraena</i>	EPBC, FFG, Adv	B	EG	Detection of population	[Low]	Med	Yes
Bluenose (Trout) Cod	<i>Maccullochella macquariensis</i>	EPBC, FFG, Adv	B	NE	Detection of population	[Med]	High	Yes
Species on the VEAC list or listed as threatened and occur in timber harvesting areas, but do not have prescriptions								
Flat-headed Galaxias	<i>Galaxias rostratus</i>	EPBC, Adv	B			[Med]	Low	Yes
Dwarf Galaxias	<i>Galaxiella pusilla</i>	FFG, Adv	B			[Low]	Med	Yes
Murray Cod	<i>Maccullochella peelii</i>	EPBC, FFG, Adv	B			[Med]	High	Yes
Macquarie Perch	<i>Macquaria australasica</i>	EPBC, FFG, Adv	B			[Med]	Med	Yes
Silver Perch	<i>Bidyanus bidyanus</i>	FFG, Adv				[Low]	High	Yes
Empire Gudgeon	<i>Hypseleotris compressa</i>	FFG, Adv	B			[Low]	High	Yes
Non-threatened species that occur in timber harvesting areas, but do not have prescriptions								
South-east Victorian Blackfish	<i>Gadopsis 'SEV'</i>	Not listed as yet but considered threatened				[High]	Med	No

f) Crustaceans

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Orbost Spiny (Freshwater) Cray(fish)	<i>Euastacus diversus</i>	FFG, Adv	F	EG	Detection of animal	[High]	Med	No
Mallacoota Burrowing Crayfish	<i>Engaeus mallacoota</i>	FFG, Adv		EG	Detection of animal	[Med]	Low	No
Narracan Burrowing Crayfish	<i>Engaeus phyllocercus</i>	FFG, Adv		G	Detection of animal	[High]	Low	No
Warragul Burrowing Crayfish	<i>Engaeus sternalis</i>	FFG, Adv		G	Detection of population	[Med]	Low	No
Strzelecki Burrowing Crayfish	<i>Engaeus rostrigaleatus</i>	FFG, Adv		G	Detection of animal	[High]	Low	No
South Gippsland Spiny Crayfish	<i>Euastacus neodiversus</i>	FFG, Adv		G	Detection of animal	[Med]	Med	No
Species on the VEAC list or listed as threatened and occur in timber harvesting areas, but do not have prescriptions								
Eastern Freshwater Shrimp	<i>Australatya striolata</i>	FFG, Adv				[Low]	Low	No
Alpine Spiny Cray	<i>Euastacus crassus</i>	FFG, Adv				[Med]	Med	No
Murray Spiny Crayfish	<i>Euastacus armatus</i>	Adv				[Med]	High	No
East Gippsland Spiny Crayfish	<i>Euastacus bidawalus</i>	Adv				[Med]	Med	No
Claytons Spiny Crayfish	<i>Euastacus claytoni</i>	Adv				[High]	Low	No
Variable Spiny Crayfish	<i>Euastacus yanga</i>	Adv				[High]	Low	No
Curve-tail Burrowing Crayfish	<i>Engaeus curvisuturus</i>	FFG, Adv				[High]	Low	No

g) Terrestrial Invertebrates

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Alpine Stonefly	<i>Thaumatoperia flaveola</i>	FFG, Adv		G	Potential habitat			No
Giant Gippsland Earthworm	<i>Megascolides australis</i>	EPBC, FFG, Adv	B, F	G	Detection			No

h) Selected plant species (note: there are an additional 311 species with prescriptions that are not presented below)

The threatened plant species with detection-based prescriptions below were chosen as they are species that frequently get reported to DELWP Forest Reports (S. Colquitt, pers. comm.) or were categorised as being highly impacted by timber harvesting.

Common Name	Scientific Name	Threat listing	VEAC listing	RFA where prescriptions apply	Trigger for prescription	Impact of timber harvesting	Current knowledge of distribution	HDM available
Threatened species with detection based prescriptions in eastern Victoria								
Wallaby-bush	<i>Beyeria lasiocarpa</i>	Adv		G	Detection	Med	High	Yes
Blackfellow's Hemp	<i>Commersonia rossii</i> (now <i>Androcalva rossii</i>)	Adv	B, F	EG	Detection		Med	Yes
Slender Tree-fern	<i>Cyathea cunninghamii</i>	FFG, Adv		EG, G	Detection	Med	High	Yes
Bog Saw-sedge	<i>Gahnia subaequiglumis</i>	Adv		EG	Detection	High	High	Yes
Colquhoun Grevillea	<i>Grevillea celata</i>	EPBC, FFG, Adv	B, F	EG, G	Detection	Med	High	Yes
Tree Geebung	<i>Persoonia arborea</i>	Adv	B, F	CH	Detection	Med	High	Yes
Species on the VEAC list or listed as threatened and are highly impacted by timber harvesting, but do not have prescriptions								
Paperbark Tea-tree	<i>Leptospermum trinervium</i>	Adv				High	Med	Yes
Lilac Lily	<i>Schelhammera undulata</i>	Adv				High	Low	Yes

Priorities for inclusion of species in forest protection surveys and for revising or developing new survey guidelines

a) Mammals

Species	Priority for PHS	Rationale for inclusion in PHSs	Suggested survey techniques and approach
Spotted-tail Quoll	High	High profile species that occurs in timber harvesting areas, and although it occurs over large home ranges, requires sufficient high-quality habitat within range.	Remote cameras, searching for latrines and dens. Surveys could focus in higher probability areas rather than all potential coupes
Leadbeater's Possum	High	High profile and highly detectable	Remote cameras in trees, call playback with thermal camera. Sample all coupes in ash in CH and mixed species coupes nearby ash to help determine extent of usage of drier habitats
Greater Glider	High	High profile and highly impacted by timber harvesting	Spotlighting using mark-recapture distance-sampling method where appropriate or standard spotlight transects. Sample throughout range rather than just in East Gippsland where prescription applies, as VF may modify harvesting approach with knowledge of the species on the coupe
Long-footed Potoroo	High	High profile and highly detectable	Remote cameras – sample coupes throughout range and in areas on SDM in between Great Dividing Range and East Gippsland populations
Koala	High	High profile although not a threatened species, difficult to survey for in forested areas, so probability of detection likely to be low. Difficult to determine if the population is 'resident'.	Searching during day, listen for calls while spotlighting at night, incidental records followed up by targeted searches
Smoky Mouse	High/medium	Occurs within broad areas used for timber harvesting although specific habitats are not extensively harvested, threatened species that is detectable	Remote cameras
Common Dunnart	Medium	Occurs within some broad areas used for timber harvesting although specific habitats are not extensively harvested, listed as Vulnerable species	Remote cameras followed by trapping to confirm which species of dunnart
Brush-tailed Phascogale	Medium	High profile species that is impacted by timber harvesting however occurs in drier habitats than typically harvested, however may require surveys in limited areas	Remote cameras, nest boxes

Species	Priority for PHS	Rationale for inclusion in PHSs	Suggested survey techniques and approach
Yellow-bellied Glider	Medium	Medium profile, impacted by timber harvesting, prescriptions only in East Gippsland	Spotlighting – surveys can be undertaken in conjunction with Greater Glider (although investigate if any coupes in EGP need to be sampled specifically for YBG)
Grey-headed Flying-fox	Medium	Threatened species for which roosting camps (i.e. the trigger) are critically important and impacted by harvesting.	Searching for roosts – undertaken opportunistically during other surveys or from local knowledge
Eastern Horseshoe-bat	Medium	Occurs in timber harvesting areas although the habitat protected by the prescription is caves and mines, which have a moderate chance of being detected	Searching for cave/mine roosts – conduct desktop investigation first, and if mines or caves are reported undertake targeted investigations
Common Bent-wing Bat	Medium	Occurs in timber harvesting areas although the habitat protected by the prescription is caves and mines, which have a moderate chance of being detected	Searching for cave/mine roosts – conduct desktop investigation first, and if mines or caves are reported undertake targeted investigations
Large-footed Myotis	Medium	Occurs in timber harvesting areas although the habitat protected by the prescription is caves and mines, which have a moderate chance of being detected	Searching for cave/mine roosts – conduct desktop investigation first, and if mines or caves are reported undertake targeted investigations. Also roosts in tree hollows although very difficult to locate.
New Holland Mouse	Medium	Threatened species however little overlap in areas of suitable habitat timber harvesting as mostly in coastal heath, heathy woodlands and coastal scrub.	Trapping
Eastern Broad-nosed Bat	Low	Non-threatened species and unlikely to meet trigger of 10 individuals in one trapping session (depending on the definition of a trapping session)	Bat trapping
Common Brushtail Possum	Low	Non-threatened species common outside of forested areas.	Spotlighting – same technique as used for Greater Gliders, and so these surveys could detect high density populations if located in the same area.
Eastern Pygmy-possum	Low	Not listed as threatened (Near Threatened on Advisory List), while occurring in timber harvesting areas and is impacted by harvesting, the trigger for prescription is a high density in pitfall traps, so low likelihood that the prescription would be met	Pit trapping is a highly labour-intensive technique and so rarely used these days. If the species is detected during other surveys (e.g. remote cameras or spotlighting) targeted pitfall trapping could be undertaken to determine if high densities are present, sufficient to meet the trigger of 5 individuals/pitfall trapline in 5 days).
Squirrel Glider	Low	Surveys not required as no timber harvesting in suitable habitat in eastern Victoria. Only occurs in Chiltern and Reef Hills in this region.	Spotlighting

Species	Priority for PHS	Rationale for inclusion in PHSs	Suggested survey techniques and approach
Mountain Pygmy Possum	Low	Surveys not required as no timber harvesting in suitable habitat, as only occurs in alpine and subalpine areas.	Trapping
Yellow-bellied Sheathtail Bat	Low	Surveys not required as extremely unlikely trigger will ever be met as there are less than 50 records for Victoria with none being caught during bat trapping surveys, let alone 10 in a single trapping session	Bat trapping, searching for roosts
Broad-toothed Rat	High	Endangered species. Occurs within areas used for timber harvesting. No prescriptions.	Trapping
White-footed Dunnart	Medium	Occurs within some broad areas used for timber harvesting although specific habitats are not extensively harvested. Listed as Near Threatened. No timber harvesting prescriptions.	Remote cameras followed by trapping to confirm which species of dunnart
Swamp Antechinus	Medium	Occurs within some broad areas used for timber harvesting although specific habitats are not extensively harvested. Listed as Near Threatened.	Trapping
Southern Brown Bandicoot	Medium	Occurs within some broad areas used for timber harvesting although specific habitats are not extensively harvested. No prescriptions. Included due to the precautionary approach.	Remote cameras
Long-nosed Potoroo	Medium	Limited occurrence in areas used for timber harvesting. No prescriptions. Included due to the precautionary approach.	Remote cameras
Brush-tailed Rock Wallaby	Low	Does not occur in areas used for timber harvesting. No prescriptions.	Searching for colonies
Dingo	Low	Not included in PHS because no prescriptions	Remote cameras, with genetic samples required to determine purity

b) Birds

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Powerful Owl	High	High profile species impacted by timber harvesting, nest and roost sites (i.e. trigger) however not easy to detect	Incorporate into glider surveys by listening for owl calls (or potentially using call playback) plus opportunistic searches for nests and roosts, with more detailed followup surveying if a potential site found.
Sooty Owl	High	High profile species impacted by timber harvesting, nest and roost sites (i.e. trigger) however not easy to detect	Incorporate into glider surveys by listening for owl calls (or potentially using call playback) plus opportunistic searches for nests and roosts, with more detailed followup surveying if a potential site found.
Masked Owl	High	Part of the large forest owl group, impacted by timber harvesting, difficult to detect presence let alone nesting and roosting sites, so any new records will be informative	Incorporate into glider surveys by listening for owl calls (or potentially using call playback) plus opportunistic searches for nests and roosts, with more detailed followup surveying if a potential site found.
Glossy Black Cockatoo - eastern subsp.	High	Occurs in forested areas, feeding just on Casuarina, so localised distribution in far East Gippsland	Habitat mapping based on EVCs and Casuarina known distribution or HDM, followed by on ground habitat assessment and searches for nests in nearby eucalypt forests
Barking Owl	Medium	Low occurrence in areas planned for timber harvesting as mostly occurs in dry forests or woodlands, however if coupes planned in suitable habitat they should be considered.	Incorporate into glider surveys by listening for owl calls (or potentially using call playback) plus opportunistic searches for nests and roosts, with more detailed followup surveying if a potential site found.
Grey Goshawk	Low	Low probability of locating nests, medium impact of timber harvesting overall (although higher impact if nest tree was impacted)	Opportunistic nest search
Square-tailed Kite	Low	Low probability of locating nests, medium impact of timber harvesting overall (although higher impact if nest tree was impacted)	Opportunistic nest search
White-bellied Sea-Eagle	Low	Low probability of locating nests, medium impact of timber harvesting overall (although higher impact if nest tree was impacted). Nest trees always located next to large bodies of water.	Opportunistic nest search if near water, opportunistic observations of individuals in NE which may trigger resident population prescription.

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Regent Honeyeater	High	For most of the year occur in dry habitats (e.g. Chiltern) where harvesting does not occur, however from late summer to late autumn they disappear from these areas and likely go into forested areas in the ranges, which could be anywhere in NE, G or EG, and hence potentially in harvesting areas. Due to critically low population numbers, any locations where they occur are important.	Low probability of finding on any particular coupe, however high importance if found. Due to low probability may not warrant targeted diurnal bird survey, so might need to rely on incidental observations. Could use sound detection devices but may not be cost effective due to the amount of time required to go through all recordings.
Swift Parrot	Low	Does not typically occur in habitats planned for timber harvesting	Opportunistic observations
Peregrine Falcon	Low	Non-threatened species, trigger is nesting sites which has low chance of detection	Opportunistic nest search
Little Falcon (Australian Hobby)	Low	Non-threatened species, trigger is nesting sites which has low chance of detection	Opportunistic nest search
Turquoise Parrot	Low	Does not typically occur in habitats planned for timber harvesting	Opportunistic nest search
Apostlebird	Low	Does not occur in habitats planned for timber harvesting	Opportunistic observations
Helmeted Honeyeater	Low	No prescriptions, and no harvesting in occupied areas	Opportunistic observations
Spotted Quail-thrush	Medium	Occurs in forested areas used for timber harvesting. No prescriptions	Diurnal bird survey
Brown Treecreeper	Low	Tends to occur in dry forests and woodlands. No prescriptions	Opportunistic observations
Chestnut-rumped Heathwren	Medium	Occurs in forested areas used for timber harvesting. No prescriptions	Diurnal bird survey
Speckled Warbler	Low	Typically occurs in woodlands, not forests used for timber harvesting. No prescriptions	Opportunistic observations
Hooded Robin	Low	Typically occurs in woodlands, not forests used for timber harvesting. No prescriptions	Opportunistic observations

c) Reptiles

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Diamond Python	Medium	While occurring in areas used for timber harvesting, it is a cryptic species for which a huge amount of survey effort would be required to be able to infer absence	Spotlighting (warm nights), visual searches (day)
Alpine Water Skink	Medium	Occurs in alpine and subalpine habitats so habitat itself not harvested, however harvesting roads may go through suitable habitat so check if any nearby coupes	Visual surveys
Alpine She-oak Skink	Medium	Occurs in alpine and subalpine habitats so habitat itself not harvested, however harvesting roads may go through suitable habitat so check if any nearby coupes	Tile transects and grids
Inland Carpet Python	Low	Only occurs in dry habitats unlikely to be harvested in NE such as along Murray River and in Warby Ranges, however would need to reassess if coupes planned in these areas	Spotlighting (warm nights), visual searches (day)
Bandy Bandy	Low	Only occurs in dry habitats unlikely to be harvested in NE however would need to reassess if coupes planned in these areas	Spotlighting (warm nights)
Woodland Blind Snake	Low	Only occurs in dry habitats unlikely to be harvested in NE however would need to reassess if coupes planned in these areas	Spotlighting (warm nights)
Swamp Skink	Medium	Occurs within areas used for timber harvesting. No prescriptions.	Combination of methods (e.g. Elliott trapping, tile survey, visual searches, camera survey)
Mountain Skink	Medium	Occurs within areas used for timber harvesting. No prescriptions.	Visual searches
Eastern She-oak Skink	Medium	Occurs within areas used for timber harvesting. No prescriptions.	Visual searches
Alpine Bog Skink	Medium	Occurs within areas used for timber harvesting. No prescriptions.	Visual searches
Tree Goanna (Lace Monitor)	Medium	Occurs in timber harvesting areas and impacted by harvesting. No prescriptions.	Visual searches
Rosenberg's Goanna	Medium	Occurs in timber harvesting areas and impacted by harvesting. No prescriptions.	Visual searches from vehicle

d) Amphibians

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Species with prescriptions			
Giant Burrowing Frog	High	Potentially occurs in timber harvesting areas	Nocturnal call surveys, spotlighting, tadpole visual or netting surveys, call playback
Large Brown Tree-Frog	High	High profile, occurs in timber harvesting areas	Nocturnal call surveys, spotlighting, tadpole visual or netting surveys, call playback
Spotted Tree Frog	High	Well surveyed species with majority of potential habitat currently protected within parks or SPZs, however may occur in other areas impacted by harvesting	Spotlighting, tadpole visual surveys, mapping of suitable habitat
Baw Baw Frog	High	Majority of potential habitat currently protected within parks or SPZs – however there is the potential to occur outside this area so include due to precautionary approach	Mapping of suitable habitat; call surveys, call playback to confirm habitat assessment
Southern Barred Frog	Medium	Last record for Victoria in 1983, only known from two localities, inadequately surveyed so may still be present in timber harvesting areas	Nocturnal call surveys, spotlighting, tadpole visual or netting surveys
Blue Mountains Tree Frog	Medium	Non-threatened species but with prescriptions and occurs in timber harvesting areas	Nocturnal call surveys, spotlighting, tadpole visual or netting surveys, call playback
Alpine Tree Frog	Medium	Occurs in areas near to timber harvesting so could be affected by roading or downstream impacts	Nocturnal call surveys, spotlighting, tadpole visual or netting surveys
Bibron's (Brown) Toadlet	Medium	Occurs in timber harvesting areas and moderately impacted by timber harvesting. No prescription. Included due to precautionary approach.	Call surveys, active searching for frogs or nests
Dendy's Toadlet	Medium	Occurs in timber harvesting areas and moderately impacted by timber harvesting. Little know (listed as Data Deficient). No prescription. Included due to precautionary approach.	Call surveys, active searching for frogs or nests

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Southern Toadlet	Medium	Occurs in timber harvesting areas and moderately impacted by timber harvesting. No prescription. Included due to precautionary approach.	Call surveys, active searching for frogs or nests
Martin's Toadlet/Tylers Toadlet	Medium	Occurs in timber harvesting areas and highly impacted by timber harvesting. No prescription. Included due to precautionary approach.	Call surveys, active searching for frogs or nests
Green and Golden Bell Frog	Medium	Occurs in timber harvesting areas and highly impacted by timber harvesting. No prescription. Included due to precautionary approach.	Nocturnal call surveys, spotlighting, tadpole visual or netting surveys
Booroolong Tree Frog	Medium	Occurs in timber harvesting areas and may be impacted by timber harvesting. No prescription. Included due to precautionary approach.	Call surveys, active searching for frogs with expert guidance, tadpole surveys
Keferstein's Tree Frog	Medium	Occurs in timber harvesting areas and may be impacted by timber harvesting. No prescription. Included due to precautionary approach.	Call surveys, active searching for frogs or nests

e) Fish

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Species with prescriptions			
Barred Galaxias	High	Forest dependent, sedentary, highly impacted by timber harvesting operations	As for Mountain Galaxias
Bluenose (Trout) Cod	High	Forest dependent, relatively sedentary, potentially medium impacts from timber harvesting operations	Electrofishing; multiple sampling reaches within, upstream and downstream of target locations/coupes; digital images required to verify identification due to taxonomic issues, involvement of a taxonomic expert
Mountain Galaxias	High	Forest dependent, sedentary, highly impacted by timber harvesting operations	Intensive electrofishing; multiple sampling reaches within, upstream and downstream of target locations/coupes; collection of numerous voucher specimens due to taxonomic uncertainty; involvement of taxonomic expert.

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
West Gippsland Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range.	As for Mountain Galaxias
Tapered Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range.	As for Mountain Galaxias
Dargo Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range, and possibly extends into state forest.	As for Mountain Galaxias
McDowalls Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range, and possibly extends into state forest.	As for Mountain Galaxias
Shaw Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range, possibly extends into state forest.	As for Mountain Galaxias
East Gippsland Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range.	As for Mountain Galaxias
Roundsnout Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range.	As for Mountain Galaxias

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Morwell Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range, and possibly extends into state forest.	As for Mountain Galaxias
Moroka Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range, and possibly extends into state forest.	As for Mountain Galaxias
Yalmy Galaxias (until recently known as Mountain Galaxias)	High	As for Mountain Galaxias. A member of the Mountain Galaxias species complex, restricted, fragmented range, and possibly extends into state forest.	As for Mountain Galaxias
Australian Grayling	Low	Mobile species, recruitment from estuaries upstream; occupies larger to medium size rivers, potentially low impact from timber harvesting operations	
Cox's Gudgeon	Low	Mobile species, recruitment from estuaries upstream; potentially low impact from timber harvesting operations	
Freshwater Herring	Low	Threatened species with prescription, however presumed extinct in Victoria and previously known from a single location north of Mallacoota	
Macquarie Perch	High	Forest dependent, adults migrate further upstream, juveniles moderately to highly impacted by timber harvesting operations. Included due to precautionary approach.	Electrofishing, possibly fyke netting, targeting shallow to deeper water; multiple sampling reaches within, upstream and downstream of target locations/coupes; voucher specimen or images to verify identification of 0-1 year old fish
Flat-headed Galaxias	Medium	Occurs nearby or into areas of timber harvesting, highly mobile, moderately impacted by timber harvesting operations, poor detectability using standard techniques. Included due to precautionary approach.	Possibly a combination of electrofishing, seine netting and fyke netting; multiple sampling reaches within, upstream and downstream of target locations/coupes; voucher specimens and images to verify identification due to taxonomic issues, involvement of a taxonomic expert

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Murray Cod	Medium	Relatively sedentary, distribution can extend upstream into forested catchments, moderate impact from timber harvesting operations. Included due to precautionary approach.	Electrofishing, targeting shallow to deeper water; multiple sampling reaches within, upstream and downstream of target locations/coupes
Dwarf Galaxias	Low	Sedentary, small, found nearby to timber harvesting operations so potential for some impact	Dip netting in specific habitat, electrofishing; multiple sampling reaches within, upstream and downstream of target locations/coupes
Silver Perch	Low	Occurs in areas near to timber harvesting so could be affected by roading or downstream impacts, migratory species	
Empire Gudgeon	Low	Mobile species found in lower elevations in the east of the state, recruitment occurs from estuaries upstream into freshwater. Little overlap with timber harvesting areas	

f) Crustaceans

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Species with prescriptions			
Orbost Spiny (Freshwater) Cray(fish)	High	Threatened species, forest dependent, sedentary, highly impacted by timber harvesting operations	Electrofishing, and combination of bait traps and visual searches; multiple sampling reaches within, upstream and downstream of target locations/coupes; voucher specimens <u>and</u> images to verify identification due to taxonomic issues (difficult species identification, undescribed taxa), involvement of a taxonomic expert

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Mallacoota Burrowing Crayfish	High	Threatened species, forest dependent, sedentary, moderately impacted by timber harvesting operations	Searches of stream banks, riparian zones and within coupe for evidence of burrowing crayfish burrows; deployment overnight of burrow tube traps, including daytime electrofishing along stream edges in shallow water; multiple sampling reaches within, upstream and downstream of target locations/coupes, possibly multiple sampling events; images of specimens and voucher specimens retained for identification using a microscope and to verify identification due to taxonomic issues (difficult species identification, undescribed taxa), involvement of a taxonomic expert
Narracan Burrowing Crayfish	High	Threatened species, forest dependent, sedentary, highly impacted by timber harvesting operations	As for Mallacoota Burrowing Crayfish
Warragul Burrowing Crayfish	High	Threatened species, forest dependent, sedentary, moderately impacted by timber harvesting operations	As for Mallacoota Burrowing Crayfish
Strzelecki Burrowing Crayfish	High	Threatened species, forest dependent, sedentary, highly impacted by timber harvesting operations	As for Mallacoota Burrowing Crayfish
South Gippsland Spiny Crayfish	High	Threatened species, forest dependent, sedentary, moderately impacted by timber harvesting operations	As for Orbost Spiny Crayfish
Claytons Spiny Crayfish	High	Threatened species without prescription, forest dependent, sedentary, however highly impacted by timber harvesting operations. Included due to precautionary approach.	As for Orbost Spiny Crayfish
Variable Spiny Crayfish	High	Threatened species without prescription, forest dependent, sedentary, however highly impacted by timber harvesting operations. Included due to precautionary approach.	As for Orbost Spiny Crayfish
Curve-tail Burrowing Crayfish	High	Threatened species without prescription, forest dependent, sedentary, however highly impacted by timber harvesting operations. Included due to precautionary approach.	As for Mallacoota Burrowing Crayfish
Alpine Spiny Cray	Medium	Threatened species without prescription, forest dependent, sedentary, however moderately impacted by timber harvesting operations. Included due to precautionary approach.	As for Orbost Spiny Crayfish

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Murray Spiny Crayfish	Medium	Threatened species without prescription, forest dependent, sedentary, however moderately impacted by timber harvesting operations. Included due to precautionary approach.	As for Orbost Spiny Crayfish
East Gippsland Spiny Crayfish	Medium	Threatened species without prescription, forest dependent, sedentary, however moderately impacted by timber harvesting operations. Included due to precautionary approach.	As for Orbost Spiny Crayfish
Eastern Freshwater Shrimp	Low	Threatened species without prescription, migratory, does extend into timber harvesting areas	Electrofishing, fine mesh fyke netting for downstream migrants, eDNA

g) Terrestrial Invertebrates

Species	Priority for PHS	Rationale for inclusion in PHS	Suggested survey techniques and approach
Species with prescriptions			
Alpine Stonefly	Medium	Occurs in areas near to timber harvesting so species may be impacted by sedimentation, increased water temperature or removal of riparian vegetation.	Visual searching for nymphs which occur in streams, kick nets to catch nymphs
Giant Gippsland Earthworm	Medium	Restricted range and poor dispersal ability. Occurs in some forested regions (e.g. Mt Worth) close to timber harvesting areas, so may need to be considered in localised areas.	Excavating quadrats, banging the ground along transects and listening for gurgles