NSW GOVERNMENT

# Private Native Forestry Field Guide for the **River Red Gum Forests**

Written by: PF Olsen (Aus) Pty Ltd in conjunction with EPA
Photographs: EPA unless otherwise acknowledged
Front cover: Image provided by EPA

Published by:
Environment Protection Authority
59 Goulburn Street, Sydney NSW 2000
PO Box A290, Sydney South NSW 1232
Phone: +61 2 9995 5000 (switchboard)
Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or info@environment.nsw.gov.au
See also www.epa.nsw.gov.au

ISBN 978 1 74232 540 8
EPA 2016/0336
June 2016

Printed on environmentally sustainable paper

# Contents

# Contents

# 1. Introduction

## 1.1 The Private Native Forestry Field Guide for the River Red Gum Forests

This Field Guide has been prepared as a supplement to the Private Native Forestry (PNF) Code of Practice for the River Red Gum Forests (the 'Code'). Its aim is to assist private native forestry practitioners to implement the Code.

The Field Guide does not replace the Code. Users should always refer to the Code in order to ensure its proper application. The Code can be found at the end of this guide. The Appendix to the Code is not included in this guide. A full version of the Code can be obtained from **www.lls.nsw.gov.au/sustainable-land-management/private-native-forestry/private-native-forestry-code-of-practice**.

## 1.2 The Private Native Forestry Code of Practice for the River Red Gum Forests

The *Native Vegetation Act 2003* and the Native Vegetation Regulation 2013 regulate the clearing of native vegetation on private land in NSW. The Regulation was amended on the 1st of August 2007 and now requires that Private Native Forestry Property Vegetation Plans (PNF PVPs) be developed, and approved, for forestry operations on private land. Private native forestry operations must now be conducted in accordance with the PNF Code of Practice. The Code for the River Red Gum Forests applies to all forests that are dominated by *Eucalyptus camaldulensis*.

## 1.3 What is private native forestry?

Private native forestry (for the purposes of the Code) is the management of native vegetation on privately-owned land for the purpose of obtaining, on a sustainable basis, forest products including sawlogs, veneer logs, girders, sleepers, pickets and landscape timbers.

## 1.4 Why are private native forests important?

Private native forests are important for timber production, biodiversity conservation, water quality and yield, enhanced greenhouse gas abatement and their contribution to local economies. Timber products are widely used in the building and housing industries, and by tradespeople, including furniture manufacturers and arts and craft suppliers.

## 1.5 What does the Field Guide include?

This Field Guide includes:

1. Information and guidance to help interpret and apply the Code
2. Tools to help identify, measure and apply Code requirements
3. References to additional information sources
4. A glossary of forestry terms

## 1.6 Using the Field Guide

The Field Guide incorporates a number of devices to help users to apply the Code found at the end of this guide.

**Ask an expert** **FOP note/Note**

**Steps to success** **How do I…**

➲ **The Code reference: 3.2(a)** refers to a specific section in the Code.

## 1.7 Additional legislation

By complying with the Code, users will be complying with the requirements of the *Native Vegetation Act 2003*. Approval under other legislation may still be required for parts of your forestry operation. Such legislation includes the *Environmental Planning and Assessment Act 1979*, the *Water Management Act 2000*, or Council's Local Environmental Plans. Other legislation that may be relevant to PNF operations is included in, but is not restricted to, the list below. **It is the responsibility of the user to ensure compliance with all additional legislation.**

Forestry operations on the floodplain may require additional approvals to undertake earthworks (such as importing or exporting soils and other materials). Contact the **Local Land Services** (**LLS**) or your local Council to discuss the relevant legislation.

The Code has been certified by the Minister that it meets the conditions of the *Threatened Species Conservation Act 1995*. This means that PNF operations carried out under a PNF **Plan** will not require a separate approval under that Act.

| Legislation |
|---|
| *Fisheries Management Act 1994* |
| *Heritage Act 1977* |
| *Local Environmental Plans* |
| *National Parks and Wildlife Act 1974* |
| *Occupational Health and Safety Act 2000* |
| *Pesticides Act 1999* |
| *Rural Fires Act 1997* |
| *Soil Conservation Act,1938* |
| *Water Management Act 2000* |

# 2. Planning for forestry operations

## 2.1 What is a forestry operation?

A forestry operation can include:

- Commercial timber harvesting
- Non-commercial silvicultural operations
- Regeneration and stocking activities
- Construction or maintenance of roads and tracks related to any of the above

**Clearing where the forest structure is not maintained over the long term is not a forestry operation.**

## 2.2 Gaining approval for a forestry operation

### 2.2.1 Private Native Forestry Plans

An approved PNF **Plan** must be obtained from the **Local Land services** (**LLS**) for any proposed native forestry operation on private land.

A PNF **Plan** is a legally binding agreement between a landholder and the **LLS**. A PNF **Plan** gives approval for forestry operations to occur on an area of land, and the landholder(s) agree to conduct forestry operations in accordance with the Code.

A PNF **Plan** can be granted for up to 15 years.

## 2.2.2 Obtaining a PNF Plan

Obtaining a PNF **Plan** is straightforward. The **LLS** will assist by providing information and helping you through the process.

### Steps to success

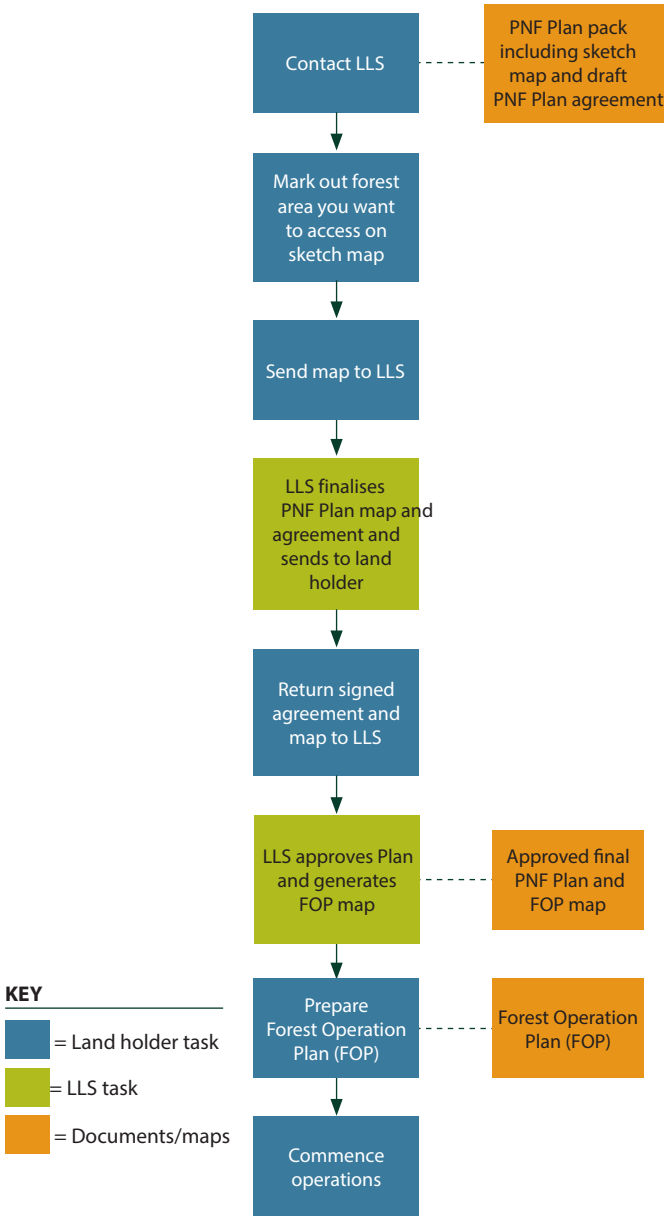
Step 1: **Contact the LLS** to obtain a PNF **Plan** pack including a draft **PNF Plan** Agreement and sketch map

Step 2: Landholder **completes sketch map** showing proposed forest area and returns to the **LLS**

Step 3: **The LLS prepares final PNF Plan** map and agreement and landholder signs agreement

Step 4: The **LLS** undertakes final checks, **approves PNF Plan** and forwards it to landholder

## PNF Plan approval process flow chart



### 2.2.3 What is included in a PNF Plan?

The PNF **Plan** consists of a formal agreement and a map of the property showing the area approved for PNF. The map uses a satellite image or aerial photograph of the property.

### 2.2.4 When the PNF Plan is approved

The Code requires that a Forest Operation Plan (FOP) be prepared prior to the commencement of any forestry operation.

**Note**

Further information on reviewing old growth forests is provided on PNF Fact Sheet 2 and PNF Guidelines 1 & 2.

## 2.3 Planning the forestry operation on private land

### 2.3.1 The Forest Operation Plan

**➲ The Code reference: 2.1**

The FOP consists of a map and a written component. The **LLS** will provide a base FOP map at the time of final PNF **Plan** approval. The **LLS** also supplies a template for the written component of the FOP, and a set of *Forest operations plan guidelines* in accordance with the Code.

The FOP provides details about the proposed activities, where operations can and can't occur, and what procedures are in place to ensure best operational practice and protection of the environment. The FOP is used by everybody involved with the operation so that they understand what is required and where it will occur.

### 2.3.2 What is included in the Forest Operation Plan

**➲ The Code reference: 2.1(5)**

In summary, the FOP requires a description of:

1. Property ownership and description (Lots/DPs)
2. PNF **Plan** approval area(s)
3. Forest type, species, condition, and past disturbance
4. Timber species and products to be harvested
5. Harvesting and silvicultural methods
6. Proposed regeneration activities (if any)
7. Protection of the environment including general habitat and biodiversity, and drainage feature management
8. Location, construction and maintenance of roads, log landings, portable mill sites and snig tracks
9. Any additional specific threatened species management
10. Any amendments to the FOP during forestry operations

**Ask an expert**

The planning requirements for PNF operations will vary depending on the complexity of the forest and the proposed operation. If you are in doubt about the planning process, or any specific component, then you should consider engaging expert assistance from a professional forester, ecologist, engineer or environmental scientist to assist you.

### 2.3.3 Communication of the Forest Operation Plan

**➲ The Code reference: 2.1(3&4)**

The FOP is the primary set of instructions for the proposed forestry operation. Communication of the FOP is therefore very important. The FOP will need to be used in association with the Code.

The Code requires that:

» A copy of the FOP must be available on-site when operations are being carried out

» The landowner and anyone else carrying out forestry operations must read, sign and date the FOP

## 2.4 Additional resources

Private Native Forestry Fact Sheet 1

Private Native Forestry Fact Sheet 2

Guideline 1 – Guidelines for assessing regeneration and stocking

Guideline 2 – Protocol for re-evaluating old growth forest on private property

Guideline 4 – Techniques for measuring stand height

Guideline 5 – Techniques for measuring stand basal area (in press)

Silvicultural guidelines – Private Native Forestry Code of Practice

Routine Agricultural Management Activities on Private Native Forestry Land Fact Sheet.

# 3. Undertaking forestry operations

## 3.1 Harvesting contractor selection

In most cases, the landowner(s) will need to employ the services of a harvesting contractor who has the skills and machinery needed to fell, load and transport logs and/or timber products. Although there is no requirement within the Code, many harvesting contractors have completed training to better understand the legislation. Suggested questions to ask of a harvesting contractor:

- Do you have current insurance, both Public Liability and Workers Compensation? (It may be worth asking for a copy of these certificates)
- Do you have a safety system in place? (This includes safe machinery and substances, safe systems of work, information, instruction, training and supervision, and a suitable working environment)
- Have you and your staff completed any recent training in forestry operations?

## 3.2 Silviculture

Silviculture is important because it allows commercial forestry to be undertaken in a way that ensures the maintenance of natural species patterns, forest health and vigour, and biodiversity values.

Because native eucalypt forests are complex systems, it is not practical or desirable to apply the same silvicultural management principles to all forest types and conditions when undertaking forestry operations.

**Steps to success**

Step 1: Accurately assess the **forest condition**

Step 2: Select the appropriate **silvicultural system**

Step 3: Specify the silvicultural system in the **FOP**

Step 4: Undertake **tree-marking** to define the silvicultural system in the field (highly recommended)

Step 5: **Apply** silvicultural system

Step 6: Ensure **regeneration**

## 3.3 What silvicultural systems can be used?

Choosing the right silvicultural system is important because it will underpin the future productivity of the forest by contributing to effective regeneration and allowing existing healthy trees to continue growing.

The Code adopts three silvicultural systems which suit a range of circumstances, and specifies prescriptions to be applied for each one.

### 3.3.1 Single tree selection

**➲ The Code reference: 3.1**

Single tree selection involves selecting and harvesting individual or small clumps of trees. Trees are selected on the basis of diameter and forest condition. Dominant and co-dominant trees are often retained with suppressed trees, which may be younger/smaller, targeted for harvest. In other cases smaller and younger trees may be retained to grow onto the next harvest. By removing competing trees, the retained trees have access to enough light, moisture and soil nutrients to respond and grow larger. Single tree selection is regulated by the Code through the application of retained basal area limits.

### 3.3.2 Thinning

**➲ The Code reference: 3.1**

Thinning is generally applied to even-aged stands where the retained trees have a strong ability to grow on once competing trees have been removed. Thinning does not aim to create canopy openings, or encourage regeneration. Rather it is intended to ensure that growing trees have the maximum opportunity to grow to a commercial size. Thinning is regulated through retained basal area limits.

### 3.3.3 Australian Group Selection

**➲ The Code reference: 3.2**

The Australian Group Selection silvicultural system is designed to encourage regeneration by creating canopy openings in the forest canopy which allows maximum light onto the forest floor. It is more appropriate for wetter or tablelands forest types that may have difficulty regenerating in smaller canopy openings. This practice aims to create smaller patches of even-aged regrowth distributed through the harvest area.

All trees greater than or equal to a 125 centimetre diameter at breast height over bark (DBHOB) must be retained as these large trees are considered to be roost, nest and food resource trees.

## 3.4 Identifying the right silvicultural option for your forestry operation

### 3.4.1 The River Red Gum Forests

The River Red Gum Forests are dominated by a single species, *Eucalyptus camaldulensis*. River Red Gum Forests not only depend on regular flooding throughout their life cycle but also on the frequency of flooding and depth to the water table. Only when conditions become less favourable for River Red Gum (i.e. less flooding or deeper water table) do other species (Black Box and Coolibah) appear within these forests. These forests can range from woodland trees of only 12 metres in height to tall forest trees 50 metres in height. Because River Red Gums regenerate from seed only (i.e. there is no lignotuber), these forests tend to be even-aged.

### 3.4.2 Forest condition categories

Although River Red Gum Forests tend to be even-aged, there are five broad forest condition categories that can apply to these forests. Each category requires a different approach to silviculture.

#### Broad forest condition categories

*Category 1:* Even-aged forests regenerated following a particular flood event, intense fire or harvesting

*Category 2:* Uneven-aged and well-stocked eucalypt forest in good productive condition. These stands generally arise from multiple flood events and/or past selective harvesting

*Category 3:* Essentially even-aged forest with some other age classes present, generally the result of an early clearing event with subsequent regeneration

*Category 4:* Well-stocked eucalypt forest, with few trees in good productive condition. This may be due to past management practice

*Category 5:* Eucalypt forest that is notably understocked

## 3.5 Silvicultural prescriptions

The Code specifies prescriptions to be applied for different silvicultural systems.

### 3.5.1 Single tree selection and thinning

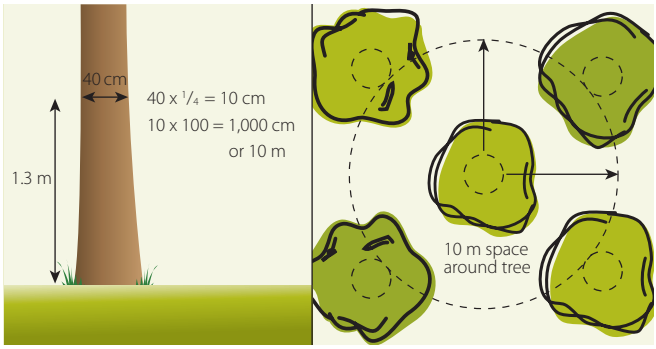
**➲ The Code reference: 3.1**

For thinning and single tree selection, the Code requires the retention of a minimum basal area (refer to Section 7 – Tools to help you) after harvesting of 12 square metres per hectare.

River Red Gum Forests may also be harvested to a spacing of a quarter of the diameter of a tree multiplied by 100 (expressed in meters). This equates to a minimum basal area of 12 square metres per hectare when done correctly.

For example, a tree with a 40 centimetre DBHOB would have a 10 metre spacing (Figure 3.1) from another tree with a 40 centimetre DBHOB.

*Figure 3.1: Example of calculating tree spacing*




**Ask an expert**

Seek expert advice from a professional forester if you are unsure about determining tree spacing.

**Note**

The techniques for measuring stand basal area are described in the document: *Private Native Forestry Code of Practice Guideline No. 5 – Guideline for Measuring Stand Basal Area*.

## 3.5.2 Australian Group Selection

**➲ The Code reference: 3.2**

For Australian Group Selection, the Code prescriptions are based on limiting the size and spacing of canopy openings in relation to stand height, and the total area of canopy openings as a proportion of the net harvestable area. In summary, the prescriptions are:

- The width of individual canopy openings cannot be more than twice the stand height (Figure 3.2)
- The distance between individual canopy openings must be at least twice the stand height (Figure 3.2)
- The total area of canopy openings cannot be more than 20% of the net harvestable area (Figure 3.3)

*Figure 3.2: Distribution of canopy openings in the net harvestable area*

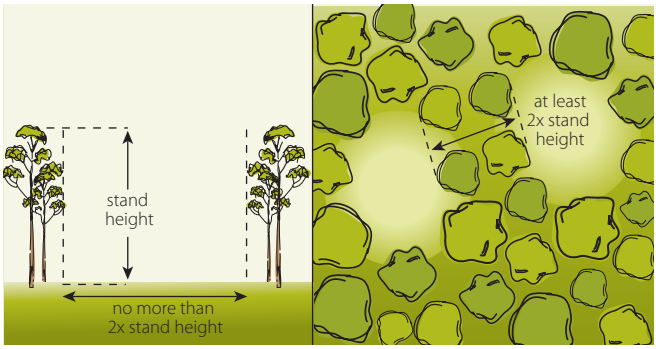
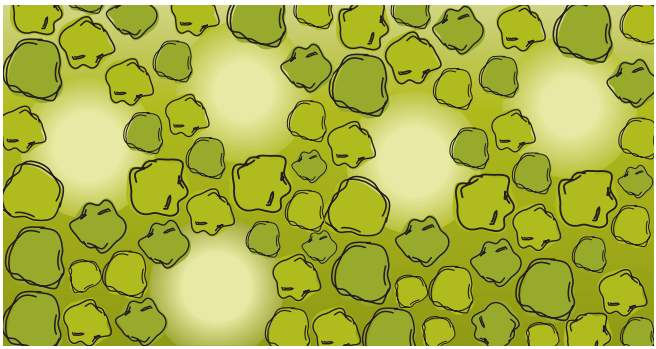



*Figure 3.3: The total area of canopy openings cannot be more than 20% of the net harvestable area*



## 3.6 Tree selection and marking

Tree marking prior to harvesting activities is highly recommended. Tree marking ensures that operators undertaking forestry operations know what trees need to be kept and removed. There are two approaches to tree marking – marking for retention (trees not to be removed) and marking for removal (trees to be harvested). The two approaches can be used individually or in combination. Trees can be marked with bright paint or tape.

Tree marking can be undertaken for a number of purposes. These include:

- Marking for wildlife purposes, e.g. retention of habitat trees
- Identifying exclusion and buffer zones (highly recommended to assist operators to quantify the basal area in riparian buffer zones)
- Marking trees with good productive potential to be retained for future harvest
- Marking trees for harvesting

**Note**

All threatened species exclusion and buffer zones, described in the Appendix to the Code, must be marked in the field and visible during forestry operations.

## 3.7 Assessing regeneration and stocking after harvesting

**➲ The Code reference: 3.3**

Forest regeneration is an on-going natural process and is necessary for the long-term maintenance of a forest in a healthy and vigorous condition.

The Code requires that a minimum level of regeneration and stocking (trees of any size) must be achieved within 36 months of a regeneration event. In the Code, a regeneration event is the second period of inundation following a harvesting or thinning operation. The minimum stocking levels for River Red Gum Forests are 60% within canopy openings and 70% elsewhere in the forest.

**Note**

Procedures on measurement of regeneration and stocking is available in the EPA document: *Private Native Forestry Code of Practice Guideline No. 1 – Guidelines for assessing regeneration and stocking.*

If the minimum stock levels are not achieved following a regeneration event, then another harvesting event cannot occur until they are. You may also be required to take supplementary actions to regenerate or re-establish the forest if sufficient tree stocking is not achieved within 36 months of a regeneration event. Examples of measures which may be taken to encourage regeneration include mechanical disturbance, fire, direct seeding or planting. The Silvicultural Guidelines for Private Native Forests in NSW is a good reference for more information.

**FOP note**

List supplementary actions, if likely to be necessary, to aid regeneration of the forest in the FOP.

## 3.8 Additional resources

Guideline No. 1 – Guidelines for assessing regeneration and stocking

Guideline No. 4 – Techniques for measuring stand height

Guideline No. 5 – Techniques for measuring stand basal area

Silvicultural guidelines – Private Native Forestry Code of Practice

Other silviculture related information:

Florence RG 1996, *Ecology and Siviculture of Eucalypt Forests*, CSIRO Publishing, Melbourne.

Baur G 1989, Siviculture Notes for New South Wales. Forestry Commission of NSW. A CD-ROM available from the Institute of Foresters of Australia.

Baur G 1965, *Forest Types in New South Wales*. Forestry Commission of NSW, Research Note No. 17. Reprinted and revised 1989.

# 4. Environmental management for forestry operations

## 4.1 Protecting and managing landscape features

**➲ The Code reference: 4.1, Table A**

Landscape features have special conservation value because of their unique characteristics, for example they have high numbers of threatened or rare species, provide critical habitat components, or have special heritage significance. It is the landholder's responsibility to determine if any of these landscape features occur in the area proposed for forestry operations.

### 4.1.1 Ecological communities and populations

The *Threatened Species Conservation Act 1995* identifies three categories for listing and special protection:

1. Endangered ecological communities (EECs)
2. Endangered populations
3. Vulnerable ecological communities

These require special protection measures to ensure that forestry operations do not result in further risk to the viability of the species and communities represented.

As part of the PNF **Plan** process, the **LLS** will provide a list of EECs that may occur on your property. If they are present, then specific approvals or prescriptions may be required (e.g. an ecological harvesting plan must be approved prior to harvesting in EECs) or harvesting may be excluded from the area.

**Ask an expert**

If you are unsure whether an EEC is on your property then you should seek further advice from the EPA.

### 4.1.2 Old growth forest

Old growth forests have special biodiversity value because they contain rare habitat elements. These unique elements are important for biodiversity conservation and management. Under the Code, forestry operations, apart from maintenance of existing roads, must not occur in old growth forest.

If old growth forest has been mapped on your property, it will be included on the PNF **Plan** map provided by the **LLS**. Where old growth forests have not been mapped by the **LLS**, they may still be present and must be identified and marked on the Forest Operation Plan.

**? How do I…**

**Review old growth forest on my property.**

Where old growth maps have been supplied by the **LLS**, the Code allows for landowners to request that the **LLS** reviews the maps if the landowner considers that they are inaccurate. The landowner must identify the area in dispute and provide evidence to the **LLS**, including photographs, logging records or other disturbance history. In this case, the **LLS** will undertake new mapping to identify old growth. The **LLS** may also identify old growth during site inspections. In both cases the **LLS** will identify old growth in accordance with the Code of Practice Guideline No. 2.

### 4.1.3 Geographic landscape features

A number of geographic features require specific protection under the Code. This is because they represent special habitat elements which can readily be damaged during forestry operations. The Code specifically excludes forestry operations from these areas, and from a buffer area around them, in order to maintain their special values. These include disused mineshafts (which require a 10-metre buffer) and wetlands.

## Wetlands

In accordance with the Code, a wetland includes any shallow body of water that is:

- Inundated cyclically, intermittently, or permanently with water
- Vegetated with wetland plant communities (Figure 4.1)

To assist with consistent on-ground identification, a wetland will generally have one or more of the following characteristics:

- Retains ponded water for extended periods after floodwaters recede
- Supports wetland plant species or communities whenever moisture is adequate (note: there may be deeper areas within a wetland where plants will initially grow then submerge, or cannot be easily observed at surface level)
- Does not support mature river red gum trees

*Figure 4.1: Typical wetland*

A wetland does not have to permanently contain visible water, or be permanently wet. It is normal for some wetlands to have a dry phase between cyclical or intermittent inundation, particularly in times of drought (Figure 4.2). During dry phases indicators of a wetland could include:

- Evidence of residual (alive, dying, or dead or decayed) wetland plant species across all, or the shallower parts of the wetland
- Bare, exposed, and sometimes cracking soil with the absence of any native groundcover species
- Regeneration of immature river red gum or other native tree or shrub species

*Figure 4.2: Wetland showing dead wetland plant species*

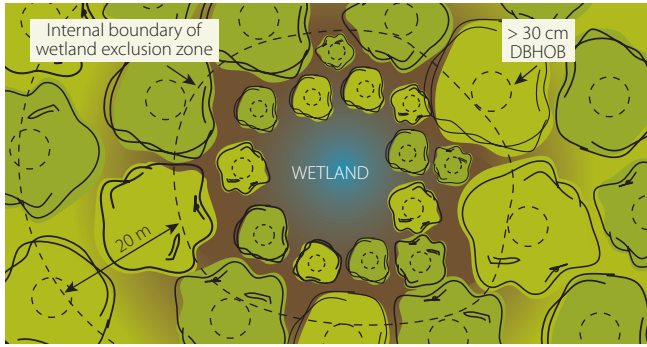
In River Red Gum Forest situations, the edge of a wetland is taken to be the first line of mature trees at the edge of the wetland. For ease of identification, mature trees are taken to be trees that are equal to, or greater than, 30-centimetre diameter at DBHOB.

## Wetland exclusion zones

Table A of the Code requires that forestry operations must not occur within 20 metres of any wetland. The 20-metre zone is to be measured from the first line of trees that are ≥30cm DBHOB (Figure 4.3 a & b).

*Figure 4.3 (a) (b): Exclusion zones*


*(a) Exclusion zone image*




*(b) Exclusion zone diagram*

## Permanent watercourses, water bodies, and major wetlands

**➲ The Code reference: 4.2, Table B**

The application of prescriptions from Table B of the Code requires the identification of permanent watercourses, water bodies, and major wetlands. These are explained below.

### Permanent watercourses

For the purposes of the Code, a permanent watercourse has the same meaning as prescribed streams. Prescribed streams are listed in the Major Rivers Database (Native Vegetation Regulation 2013: Environmental Outcomes Assessment Methodology) as a major river, or tributary or effluent of a major river. A list of prescribed streams can be found in Appendices A & B to this Guide. All permanent watercourses will be identified on the PNF Plan and FOP maps and referred to as prescribed streams.

### Water body

A water body is any permanent area, or containment, of water that does not meet the definition of a wetland. A water body can be natural or artificially made.

### Major wetland

A major wetland is a wetland listed in the Important Wetlands Database (Native Vegetation Regulation 2013: Environmental Outcomes Assessment Methodology) as wetlands of national and international importance in NSW.

A list of major wetlands for the River Red Gum area, can be found in Appendix C to this Guide. Current lists of major wetlands for the River Red Gum area can be obtained from the Forestry section of the LLS.

### 4.1.4 Cultural heritage

Forest landscapes can be rich in cultural heritage. This can be Aboriginal cultural heritage, in the form of objects or places of significance, or post-European settlement cultural heritage. Where objects or places of cultural heritage importance are identified, these must be protected by excluding forest operations within:

- 50 metres of a known burial site
- 20 metres of an Aboriginal scarred or carved tree
- 10 metres of a known Aboriginal object or place
- 10 metres of a listed heratige site

Heritage items are listed in Environmental Planning Instruments—check with your local council. The LLS will provide you with information about any known Aboriginal objects or places on your land. If you discover a heritage item or Aboriginal object on your land, do not disturb it, and contact the LLS.

## 4.2 Protecting habitat features

### 4.2.1 What is a protected tree?

**➲ The Code reference: 4.2, Table B**

A protected tree is any tree that needs to be retained by the Code because it provides habitat and/or food for native wildlife.

Protected trees include habitat trees (i.e. hollow bearing trees, roost and nest trees, feed trees, food resource trees) as well as well as grass trees, forest oaks, *Banksia*, Cooba (native willows), dwarf cherry and grey box. Habitat trees must be retained according to Table 1.

*Table 1: Minimum standards for tree retention*

**➲ The Code reference: 4.2, Table B**

| Trees that must be retained |
| --- |
| 5 hollow bearing trees per hectare, within 20–50 metres of any permanent watercourse, water bodies or major wetlands, must be retained. |
| 2 hollow bearing trees per hectare in all other areas must be retained. |
| One recruitment tree from the next cohort must be retained for every hollow bearing tree retained. |
| Where the total number of hollow bearing trees is less than 10 trees per hectare within 20–50 metres of any permanent watercourse, water bodies or major wetlands or 4 per hectare elsewhere, additional recruitment trees must be retained to bring the total number of trees retained up to 10 and 4 per hectare, respectively. |
| Additional recruitment trees above the number kept for the hollow bearing trees can be kept within the riparian buffer zone. |
| All roost, nest or food resource trees must be retained. |
| Clumps of habitat trees must be retained in River Red Gum broad forests where they constitute rookeries for water bird species such as herons, cormorants, spoonbills and egrets. |

## Hollow-bearing and recruitment trees

**➲ The Code reference: 4.2(6)**

*Hollow bearing trees:* Many forest-dwelling animals live in hollows in native trees. Hollows or cavities in trees are usually formed as a result of broken branches, lightning strike or fire and/or termite, insect or fungal attack (Figure 4.4). The occurrence of a natural range of hollow sizes, depths, volumes and positions helps to ensure that a diversity of hollows are available for hollow dependent animals.

*Figure 4.4 (a) (b) (c): Examples of different types of hollows*

*(a) Large (>125 cm) River Red Gum with hollows*

*(b) Branch hollow*

*(c) Branch hollow*

***Recruitment trees:*** Some large trees that are likely to develop hollows must be retained. These are called recruitment trees. Retention of recruitment trees is important for the long-term replacement of existing hollow-bearing trees as the older trees die and fall of natural causes.

## Roost and nest trees

**➲ The Code reference: 4.2(6)**

***Roost trees:*** Roost trees are used by many bird species and bats (Figure 4.5). They are often identified by the presence of faecal matter on branches where animals have been roosting and on the ground under the tree as well as by the smoothness of the hollow entry.

*Figure 4.5: Great egret roost trees*

PHOTO: Matt Herring (Murray Wildlife)

***Nest trees:*** Nest trees of any large raptor must be retained. Raptor (birds of prey, e.g. barking owl) nests are generally quite large and distinctive (Figure 4.6). Clumps of trees containing nests of colonial-nesting water birds (e.g. herons, cormorants, spoonbills and egrets) must also be retained.

*Figure 4.6: Nest tree*

PHOTO: Forests NSW

## Feed trees and food resource trees

### ➲ The Code reference: 4.2(6)

Trees with evidence of active sap feeding, specifically V-notch (Figure 4.7) or other incisions which have not healed over, must be retained. **River Red Gum broad forest type trees with a DBHOB of 125 centimetres or more must also be retained.**

*Figure 4.7: V-notch tree*

### Other trees to be retained as protected trees

**➲ The Code reference: 4.3(3)**

The following trees must be retained:

» All grass trees (any tree of *Xanthorrhoea*)

» Forest oaks (any tree of *Allocasuarina spp.*, except bull oak - *Allocasuarina luehmannii*)

» *Banksia*

» Cooba (*Acacia salicina*)

» Dwarf cherry (*Exocarpus strictus*)

» Grey box (*Eucalyptus microcarpa*)

## 4.2.2 Protection of retained trees

**➲ The Code reference: 4.3(1&2)**

As far as practicable, retained trees must not be damaged during forestry operations.

There are three specific actions that must be taken:

1. **Do not heap harvesting debris** such as branches, leaves, logs and bark, around protected trees. This increases the risk of the tree being killed or damaged during operations or a fire (Figure 4.8a).
2. **Do not damage trees with machinery.** Careless operation of heavy machinery can damage protected trees, especially during snigging operations.

3. **Use directional felling techniques.** Falling trees can cause significant damage to retained trees. Direct falling trees away from retained trees (Figure 4.8b).

*Figure 4.8 (a) (b): How trees can be damaged*

*(a) Milling debris stacked around trees*

*(b) Damage to retained trees*

## 4.3 Protecting threatened species

### 4.3.1 What are threatened species?

Threatened species are listed under the *Threatened Species Conservation Act 1995* as being considered in danger of extinction.

### 4.3.2 Identifying the presence of threatened species

**➲ The Code reference: Appendix**

The presence or potential presence of threatened species can be identified from:

#### Known records

Office Environment and Heritage (OEH) maintains the NSW Wildlife Atlas which is a store of all known records of threatened species in NSW. The LLS will advise you if there are any known listed species records within the property and within 10 kilometres of the property.

#### Site evidence

Many threatened fauna species leave evidence of their presence. This can include distinctive scats (faecal pellets, Figure 4.9a), chewed seed cones (Figure 4.9b), nests, roosts, active hollows, latrine sites (where animals defecate and mark scent), fur and bones. Confirmed sightings of a species can also be site evidence.

*Figure 4.9 (a) (b): Evidence of the presence of threatened fauna*

*(a) Koala scats*

*(b) Chewed seed cones*

**Ask an expert**

If in doubt about the identification or presence of threatened species you should seek advice from the LLS or other ecological expert.

### 4.3.3 What to do if threatened species are present

**➲ The Code reference: Appendix**

The Code Appendix lists threatened fauna (animals) and flora (plants) and their relevant prescriptions which must be applied to the forestry operation to ensure that the habitat requirements for those species are maintained.

The types of prescriptions which apply vary between species. They include, but are not limited to:

- Exclusion and buffer zones
- Additional tree retention
- Increases in width of stream exclusions

**Note**

Refer to the Code Appendix for specific threatened species prescriptions. The Code Appendix can be found at the back of the Code.

### Threatened species exclusion zones

Threatened species exclusion zones are established around known locations of threatened species. Forestry operations are not permitted within exclusion zones. This means that machinery must not enter the zone, new road construction cannot occur and trees must not be felled into or out of the zone. The exclusion zone must be clearly marked in the field. Operators must use directional felling to ensure that trees are felled away from all exclusion zones.

### Threatened species buffer zones

Threatened species buffer zones provide additional protection around threatened species exclusion zones. Forestry practices are modified in the buffer zone to ensure that the values of the exclusion zone are further protected. Buffer zones **must** be clearly marked in the field. Modifications to practices can include, but are not limited to:

- Additional retention of trees to meet food or habitat requirements
- Limitations on felling (for example directional felling) and machinery access
- Limitations on roadworks

### Additional tree retention

In some cases, threatened species require the retention of additional trees for food or habitat throughout the relevant part of the forestry operations area, to ensure the ongoing viability of the species in the area.

### General threatened species prescriptions

Three general conditions apply for threatened species protection.

- Retained trees can count as habitat trees if they meet the requirements
- Riparian exclusion zones can count as habitat exclusions if they overlap and meet the habitat needs

» Buffer and exclusion zones that form the edge of the forestry operation **must** be marked and the marking must remain visible throughout the operation

**FOP note**

The locations of all threatened species records must be recorded in the FOP. Buffer and exclusion zones related to these recorded locations are to be marked in the field (within the forestry operation area).

## 4.4 Protecting soil and water resources

The River Red Gum region is flat to slightly undulating, and the soils are mostly depositional (i.e. they have been deposited over many flood events for thousands of years). Soils contain nutrients, minerals and small organisms that contribute to forest growth and diversity. Although the River Red Gum Forests are on floodplains, careless forestry operations can result in major damage to or loss of soil. Soil erosion is the biggest cause of water pollution in forestry operations and can lead to increased stream sediment and nutrient loads with adverse effects on fish and other aquatic fauna and water quality.

### 4.4.1 Soil erosion

Forestry operations can contribute to land degradation if not undertaken appropriately.

Land degradation includes:

» Accelerated soil erosion

» Degradation to watercourses

Soil erosion is a natural process resulting from soil particles being dislodged by wind, rain, and frost. Forest operations can increase erosion by removing groundcover, loosening and exposing the soil. It is worse in highly erodible or unstable soil types, and where bare soil is exposed to flowing water.

Forms of soil erosion include:

- Sheet erosion: the removal of surface soil in a thin layer, or sheet. Soil particles are dislodged by raindrop splash and water flowing in a sheet across the soil surface.
- Rill erosion: the removal of soil in small channels (<30 cm deep) caused by the concentration of water flow (Figure 4.10).
- Gully erosion: the removal of soil in deep channels (>30 cm deep) caused by the continued concentration of water flow over a longer distance.

*Figure 4.10: Rill erosion*

Operational factors which can influence soil erosion include:

- **Timing** of activities
- **Machinery** type
- **Groundcover** and soil disturbance
- Extraction **track and road** patterns

## 4.4.2 Drainage features

**➲ The Code reference: 4.4 Table C**

A **drainage feature** is any part of the landscape that naturally conveys or holds concentrated water flow. Drainage features include flood runners, natural drainage depressions (Figure 4.11a) and drainage lines (Figure 4.11b), which occasionally carry water, through to rivers and lakes which permanently carry water. Drainage features must be protected to:

- Minimise bank erosion
- Minimise pollution
- Provide refuge for aquatic and terrestrial biodiversity

*Figure 4.11 (a) (b): Types of drainage features*

*(a) Drainage depression*


*(b) Drainage line*

## Prescribed stream

Prescribed streams are listed in Appendices A & B of this guide, and will be identified on the PNF **Plan** map and FOP map.

## Drainage feature with an incised channel

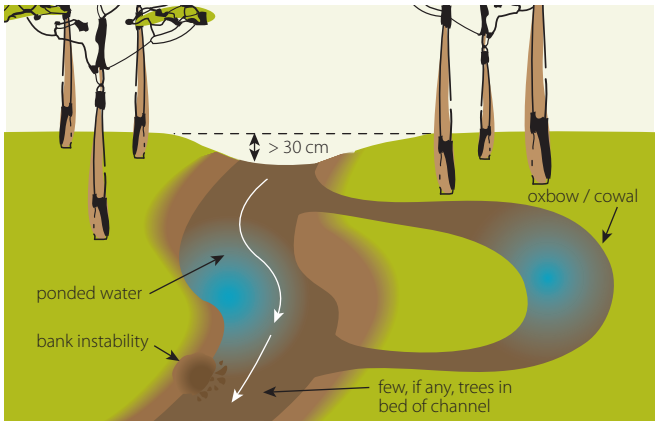
A drainage feature with an incised channel is taken to be any drainage feature:

- With clearly identifiable bed and banks
- Capable of containing and conveying a channelised flow of water at least 30 centimetres deep

These drainage features will generally have one or more of the following characteristics (Figure 4.12):

- Steep, or sharply defined, banks
- Evidence of bank instability, failure or slumpage due to the periodic action of flowing water
- Clearly provides a concentrated flow path
- Few, if any, mature trees within the bed of the channel
- May retain sections of residual ponded water for extended periods; this may include features such as oxbows and cowals that do not meet the definition of a wetland

*Figure 4.12: Drainage feature with an incised channel*



## 4.4.3 Managing soil and water

### Prevention of soil erosion and water pollution

Soil erosion and water pollution resulting from forestry operations can be limited by:

- **Minimising** disturbance of groundcover and soil
- **Protecting** drainage features
- No streambed and bank disturbance during crossing

### Protection of drainage features

The Code ensures drainage features are protected from soil erosion and water pollution by:

- Listing prescriptions for the construction, maintenance and use of forest infrastructure (see section 5.3 Forest Infrastructure)
- Limiting forest operations within and around drainage features by applying riparian exclusion and buffer zones.

The intent of these exclusion and buffer zones is to protect habitat features along waterways, and to prevent soil erosion and water pollution from forestry operations.

### Riparian exclusion zones

**➲ The Code reference: 4.4(1,3,6,7,9&11, Table C)**

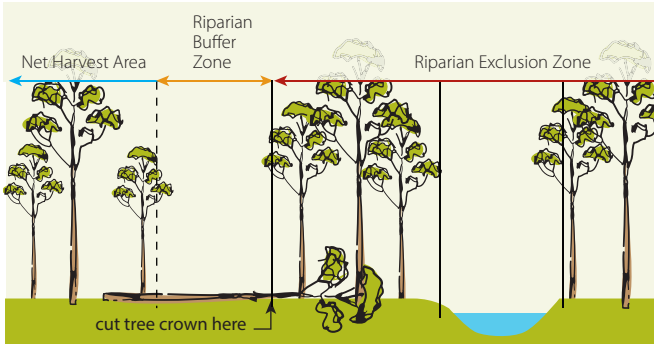
Riparian exclusion zones extend from the top edge of the incised channel for drainage features with an incised channel, and from the mean water level of the prescribed stream. The distance of the riparian exclusion zone is specified in Table 2 (also see Figure 4.13 b & c). All forestry operations are excluded from riparian exclusion zones, except where specifically permitted for drainage feature crossings and road construction or maintenance. This means that machinery must not enter riparian exclusion zones, and trees cannot be felled into or out of the zones. Debris from tree harvesting must not be allowed to enter riparian exclusion zones. If a tree is accidentally felled into an exclusion zone, the tree crown must be cut off at the boundary of the exclusion zone and left where it fell, before any merchantable timber can be removed (Figure 4.13).

**Machinery must not operate in the exclusion zone at any stage.** The pushing of debris into riparian exclusion zones is **not** permitted.

**Note**

It is recommended that exclusion zones be marked in the field and operators **must** use techniques such as directional felling to ensure that harvested trees do not enter the zone.

*Figure 4.13: Accidental falling into exclusion zone*




## Riparian buffer zones

**➲ The Code reference: 4.4(2,4,5,6,9&11)**

Riparian buffer zones extend for 25 metres on the outside of riparian exclusion zones for prescribed streams. Forestry operations are limited in these zones as follows:

- Machinery to operate using walkover techniques only
- Retain all hollow bearing trees
- Only 30% of the pre-harvest basal area can be removed in any 10-year period, whilst retaining the minimum basal area limit of 12 square metres per hectare
- Trees must be felled away from the drainage line
- If a furrow is created from the removal of logs, it must be treated to ensure that concentrated water flow does not occur
- Clearing and disturbance is minimised

Where there is no other alternative trees can be felled into riparian buffer zones, as long as no more than six trees are felled in a 200-metre-long section of the boundary and the tree crown is not removed from the buffer zone.

## Unmapped drainage depressions

**➲ The Code reference: 4.4(8,10)**

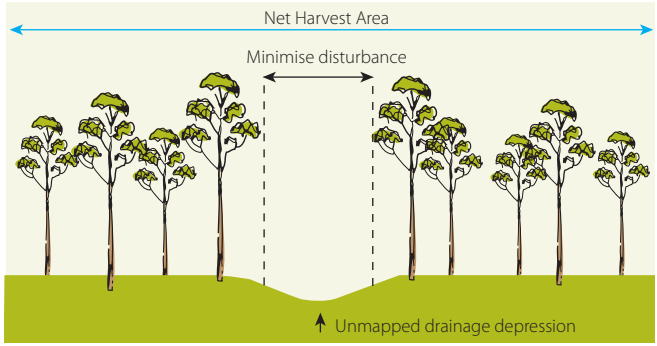
Not all drainage features appear on maps. Machinery can operate in unmapped drainage depressions; however, disturbance must be minimised by using walkover techniques, minimising skewing the machinery tracks, operating with the blade up, and not snigging along the depression (Figure 4.14).

*Table 2: Riparian exclusion and riparian buffer zones*

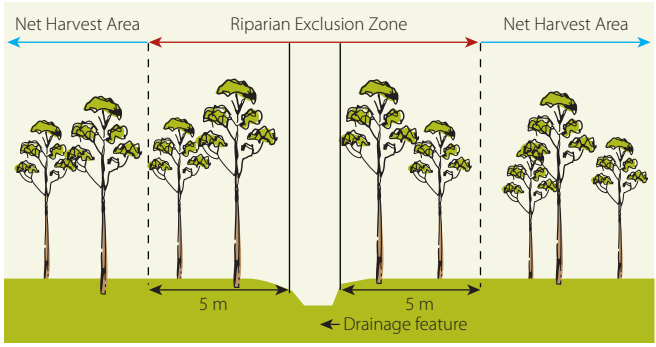
**➲ The Code reference: 4.4(1), Table C**

| Drainage feature | Riparian exclusion zone distance from drainage feature | Riparian buffer zone distance beyond exclusion zone |
|---|---|---|
| Any drainage feature with an incised channel | 5 metres | Nil |
| Prescribed streams | 20 metres | 25 metres |

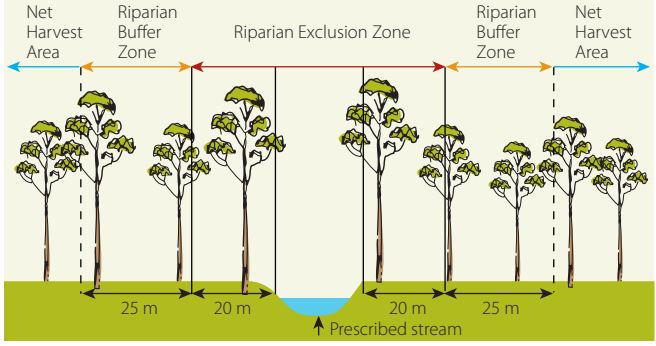
*Figure 4.14 (a) (b) (c): Examples of how to protect drainage features*




*(a) Unmapped drainage depression*




*(b) Any drainage feature with an incised channel*

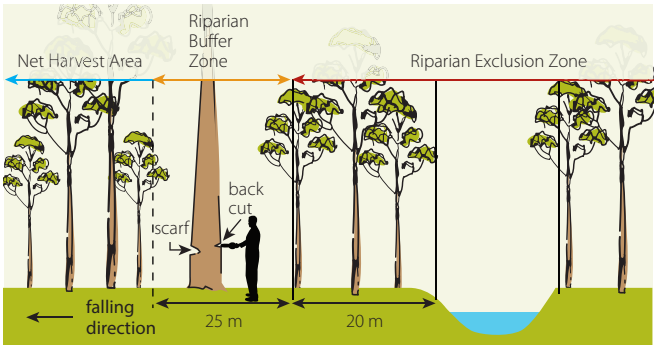



*(c) Prescribed stream*

### Directional felling

Directional felling is a harvesting technique where an experienced operator is able to guide the falling direction of a tree away from an exclusion zone or similar, by careful placement of the scarf and backcut (Figure 4.15).

*Figure 4.15: Directional felling out of a Riparian Buffer Zone*




## 4.5 Additional resources

Private Native Forestry advisory notes 1 to 15

Identification guidelines for endangered ecological communities.

# 5. Forest infrastructure

It is likely that there is existing forest infrastructure (roads, drainage feature crossings, snig tracks, log landings and mill sites) within your forestry operation area. This section outlines what the Code requires to ensure that existing and new forest infrastructure are fit to be used for forestry activities.

**Note**

A PNF **Plan** approval does not remove the requirement of the landholder from obtaining approval under other legislation such as the *Environmental Planning and Assessment Act 1979*, the *Water Management Act 2000*, or Council Local Environment Plans. Contact the **LLS** or your local council to discuss the relevant legislation where earthworks are required to be undertaken on your property (such as importing or exporting soils and other materials) on the floodplain.

**Steps to success**

Step 1: Identify suitable **existing infrastructure**. Map on FOP.

Step 2: Identify any **new infrastructure** required. Specify location and design in FOP.

Step 3: Undertake **road maintenance and construction**.

Step 4: Ensure ongoing maintenance throughout the operation and keep a **record** in your FOP.

Step 5: When the operation is finished, make sure roads, tracks and landings are **closed or maintained** as required for ongoing property management and record this in your FOP.

## 5.1 Constructing and maintaining roads

➲ **The Code reference: 5.1**

### 5.1.1 Road maintenance

➲ **The Code reference: 5.1(7)**

Properly maintained roads reduce soil erosion and water pollution because the road surface is stable and drainage structures divert water to stable areas. Maintenance is also cheaper than rehabilitation of degraded roads or new construction. When roads are regularly used in dry weather, the surface becomes powdery and breaks down into bulldust. If there is no rain to bed down this bulldust, it is recommended that the roads are periodically sprayed with water as part of the maintenance program. This will help to reduce the chance of soil entering drainage features.

#### Key principles

1. **Plan your road needs** to minimise disturbance and cost, and to maximise usefulness and longevity
2. **Use existing roads** rather than building new ones, where possible
3. **Maintain** as much **vegetation and topsoil cover** as possible
4. Keep roads as far **away from drainage features** as practicable
5. **Choose** the most appropriate **drainage structures** to ensure that water leaves the road with minimal erosion
6. **Maintain** road surfaces to avoid the risk of soil erosion and water pollution
7. **Seek expert advice** if you are unsure

**Note**

Time and effort spent on initial good design and construction will provide major benefits for many years to come.

## 5.1.2 Road design

The characteristics of your property will affect road design. Because the soils in the River Red Gum region are depositional, road design needs to consider minimising the adverse affects of over-use. Stable soils are better to work with than erodible or dispersible soils.

Important considerations when planning the road network are:

- The location of timber resources
- The location and condition of existing roads
- Where new roads should be constructed
- The amount of traffic that will use the roads
- Environmental factors such as highly erodible soils, drainage features and environmental exclusions

**Ask an expert**

Road design can be challenging. If you are unsure about your obligations or how to design your road network, then you should seek the services of an experienced professional forester or engineer.

### Road location

**➲ The Code reference: 5.1(3)**

Roads are best constructed with outfall drainage (Figure 5.2b). This means that less construction effort is required and drainage will be easier to achieve.

## 5.1.3 Road construction

**➲ The Code reference: 5.1**

It is better that **construction of new roads is minimised** but sometimes it is necessary. This is particularly relevant where construction of a new road will have less environmental impact than use of an existing road. When roads are located in flat or undulating conditions, minimal earthworks may be all that is required.

### Clearing of vegetation

**➲ The Code reference: 5.1(1,4&5)**

The Code requires that clearing of shrubs and trees for road construction and maintenance is minimised. Cleared trees and debris must not be stacked in any landscape feature (defined in the Code 4.1(1), Table A) or any riparian buffer or exclusion zone.

### Maintaining groundcover

**➲ The Code reference: 5.1.1(1)a**

Groundcover can stabilise soils and prevent erosion and water pollution. Groundcover can be vegetation such as grass and herbs, but can include litter, rock and other material that protects the ground surface. The reintroduction of topsoil is critical for establishing ground cover.

### Opening existing roads

**➲ The Code reference: 5.1(12)**

Existing roads may have overgrown. Established vegetative groundcover and stable road surfaces are good for preventing soil erosion and water pollution. When re-opening roads, clearing width and disturbance to drainage structures must be minimised to retain the benefits of the established vegetation.

## 5.1.4 When you've finished

**➲ The Code reference: 5.1(7&9)**

At the end of the operation roads must be assessed for their ongoing use.

If not needed for ongoing property management, roads must be stabilised, have effective drainage structures put in place and be allowed to revegetate.

If needed for ongoing property management, roads must be maintained to remain stable with functional drainage structures and sediment controls.

## 5.2 Draining roads

**➲ The Code reference: 5.1.1**

Forest roads, if not adequately drained, can erode and lead to land degradation and water pollution. Appropriate drainage structures and outlets built into new roads in the right locations, ensure that water can leave the road surface without causing damage or pollution.

### 5.2.1 Types of road drains

The type of drainage structures will depend on the type of road you have.

#### Crossfall drainage

**➲ The Code reference: 5.1.1(1)(c&d)**

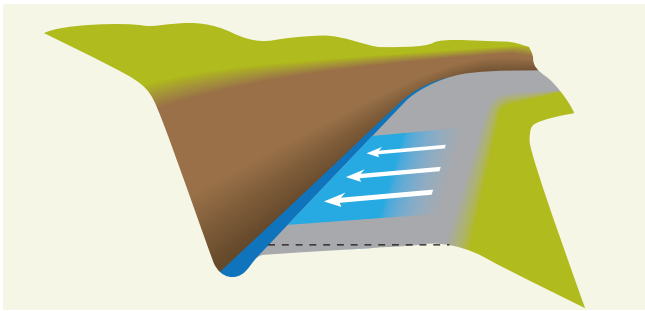
Crossfall drainage uses the slope across the road surface to direct water off the road surface. There are two types of crossfall drainage.

» **Infall drainage** directs water to a table drain and is generally appropriate for roads in hilly and steep land, or where safe road design requires it (Figure 5.1a)

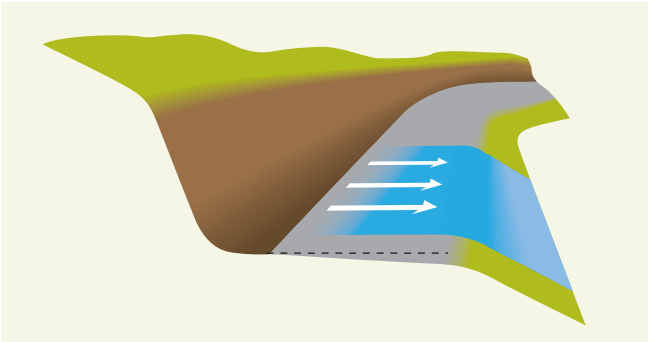
» **Outfall drainage** directs water from the road surface to a stable road verge or shoulder (Figure 5.1b)

For effective crossfall, the slope of the road surface (from one side to the other) will be between 3 to 4 degrees (4–6%). This equals a 20 to 30 centimetre fall across a road 5 metres wide.

*Figure 5.1 (a) (b): Examples of crossfall drainage*



*(a) Infall drainage*

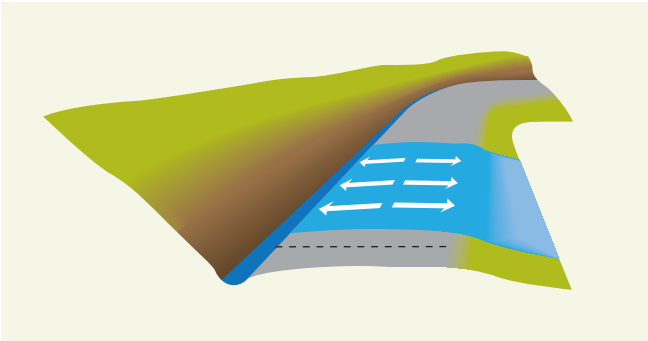


*(b) Outfall drainage*

## Crowned roads

Wider roads and roads on level surfaces are often crowned. A crowned road is higher in the centre than on the sides. The road surface can then shed water in both directions, either to a stable road verge, or to a table drain (Figure 5.2). Generally crowning of roads requires a grader for construction, and requires regular maintenance in very dry or wet conditions unless the road has been sealed with a good quality gravel material.

*Figure 5.2: Crowned road*



## Table drains

A table drain runs parallel with the road and captures crossfall water flow from the road surface. The water is then diverted out of the table drain and across the road at regular intervals using either a relief pipe, a rollover crossbank or a spoon drain. The maximum allowable distance of water flow in between table drains is specified in the Code 5.1, Table D.

## Mitre drains

A mitre drain is constructed as a water exit point for crowned roads (Figure 5.3). Mitre drains must divert water onto a stable surface and should be spaced according to the Code 5.1, Table D.

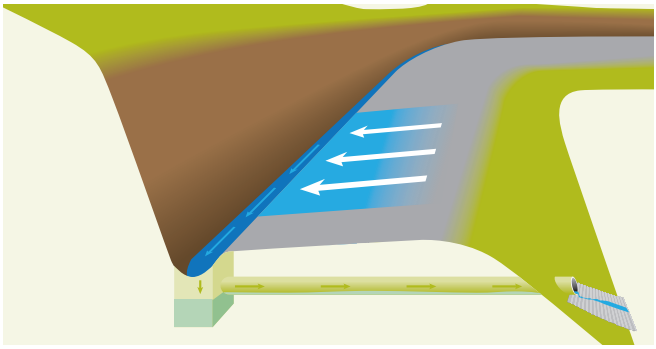
*Figure 5.3: Mitre drain*

## Relief culverts

**➲ The Code reference: 5.1.1(6)**

Relief culverts divert water from table drains under the road surface to a safe exit point on the other side of the road (Figure 5.4). Relief culverts should not discharge onto fill batters unless the batter is protected from scouring. Pipes can be made from a variety of materials, including concrete, plastic and steel.

*Figure 5.4: Relief culverts*

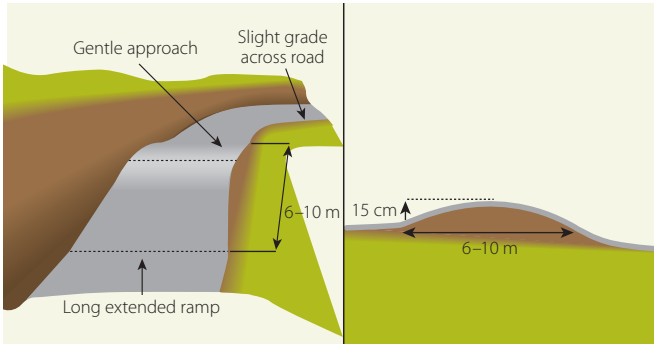


## Rollover banks

**➲ The Code reference: 5.1.1(5)**

Rollover banks are a type of cross drain. They are a low mound constructed across the road surface, which diverts runoff from the road (Figure 5.5). They are a good way of draining roads with a low grade (less than 5 degrees) during timber haulage but can be difficult for trucks to negotiate on steeper grade roads. They are useful structures to build on completion of operations where use of the road in the future is planned. Rollover banks can be used with infall or outfall drainage and must have an effective height of 15 centimetres.

*Figure 5.5: Rollover bank*

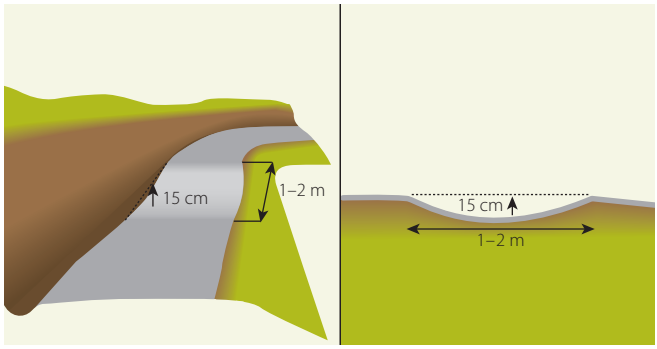


## Spoon drains

**➲ The Code reference: 5.1.1(5)**

Spoon drains are another type of cross drain. They are a shallow ditch in the surface of the road which works in a similar way to rollover banks (Figure 5.6). They are generally not as effective as rollover banks, and so are better used on flatter ground. Spoon drains can be used together with infall or outfall drainage and must have an effective depth of 15 centimetres.

*Figure 5.6: Spoon drain*

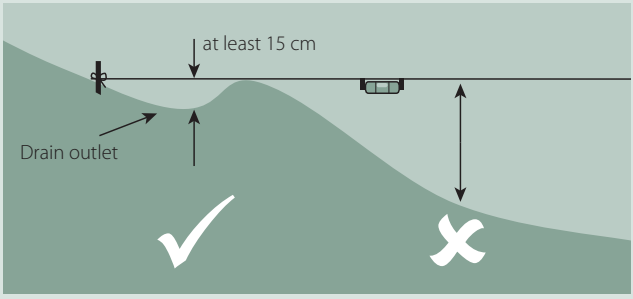


## ? How do I…

### Measure effective bank height or depth for a rollover bank or spoon drain?

Put the end of a tape measure into the lowest part of the drain outlet (Figure 5.7). Hold the tape vertically and, using a string line held level with the top of the bank, measure from the string line to the lowest part of the drain. Where this line hits the tape is the effective height.

*Figure 5.7: Measuring effective bank height*




## 5.2.2 Where should drains be located?

**➲ The Code reference: 5.1.1(2&6)**

The Code specifies the maximum allowable distance of water flow along roads according to the grade of the road (Table 3). The steeper the grade of the road, the more often runoff needs to be diverted from the road surface. Runoff must be diverted onto a stable surface, which will not erode. Runoff should not be diverted onto other roads snigtracks, log landings and portable mill sites or other disturbed areas.

*Table 3: Maximum distance that water may travel along road surfaces, table drains and snig tracks*

**➲ The Code reference: 5.1 (Table D)**

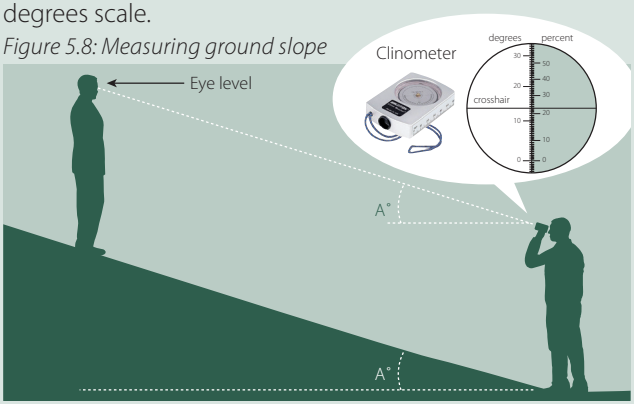
| Road or snig track grade (degrees) | Maximum distance (metres) |
|---|---|
| 0 to ≤ 1 | 250 |
| > 1 to ≤ 2 | 200 |
| > 2 to ≤ 3 | 150 |
| > 3 to ≤ 4 | 125 |
| > 4 to ≤ 5 | 100 |
| > 5 to ≤ 6 | 90 |
| > 6 to ≤ 7 | 80 |
| > 7 to ≤ 8 | 70 |
| > 8 to ≤ 9 | 65 |
| > 9 to ≤ 10 | 60 |

## ? How do I…

### Measure road grade or ground slope?

Slope is measured using a clinometer or angle-measuring device (Figure 5.8). A clinometer has a sighting hole with a suspended circular scale within a metal case. Bring the device close to one eye and look into the sighting hole. With both eyes open, tilt the clinometer so that the line in the sighting hole is aligned with a point in the distance that is at the same height as your eye (this can be another person or a mark on a tree). Read off the slope on the degrees scale.

*Figure 5.8: Measuring ground slope*




## Earth windrows

**➲ The Code reference: 5.1.1(3&4)**

Earth windrows along the road shoulder often result from road construction, maintenance activities and high traffic flow in very dry or wet conditions (Figure 5.9). In some instances windrows are effective in channelling water flow along the road shoulder above high fill batters, to prevent erosion from concentrated water flow. The water flow can be diverted from the road surface at a point where the fill batter is not as high. However earth windrows must be cut through at regular intervals related to the grade of the road (Table 3) or removed from the road shoulder.

*Figure 5.9: Earth windrow*

## 5.2.3 Sediment and erosion control

**➲ The Code reference: 5.1.1(6)**

Drainage structures concentrate water. Therefore the exit point of the drainage structure must:

» Slow the water down – slowing water flow helps to prevent erosion

» Disperse water via silt traps or ground cover – this allows sediment and nutrients to be filtered out of the water and reduces pollution (Figures 5.10 a & b)

### What is a stable surface?

A stable surface is able to withstand erosion and damage from concentrated waterflow. Stable surfaces at a drainage structure outlet include:

» Good ground cover (established grass and vegetation)

» Natural rock or artificially rocked surfaces

» Concrete

Poor outlet protection can result in severe erosion (Figure 5.11).

*Figure 5.10 (a) (b): Examples of good outlet protection*

*(a) Establishing groundcover*

*(b) Artificially rocked surface*

*Figure 5.11: Example of poor outlet protection*

### Protection of cut batters

Cut batters are a risk area for soil erosion. To protect cut batters:

» Ensure the grade of the cut batter is appropriate for the soil type to avoid erosion or slumping

» Minimise disturbance above the cut batter (this will reduce water flow down the batter)

## 5.2.4 When you've finished

**➲ The Code reference: 5.1(7&8)**

At the end of the operation roads must be assessed for their ongoing use.

If not needed for ongoing property management, roads must be stabilised, have effective drainage structures put in place and be allowed to revegetate.

If needed for ongoing property management, roads must be maintained to remain stable with functional drainage structures and sediment controls.

# 5.3 Drainage feature crossings

**➲ The Code reference: 5.1.2**

Crossings are where roads and snig tracks cross drainage features. Crossings increase the potential for erosion and water pollution. It is important that extra care is taken when dealing with drainage feature crossings.

**Note**

New gully stuffers are **not** to be constructed under any circumstances. For more information on gully stuffers see Section 5.3.2.

### Key principles

1. **Minimise construction of** new drainage feature crossings
2. **Choose the right crossing type** and design it to suit the circumstances. New gully stuffers are not to be constructed

3. **Minimise** disturbance to the banks and bed of watercourses to avoid **changing** the natural flow of the watercourse
4. Use **construction materials** that will not cause water pollution and will stay in place during storms
5. **Stabilise** any disturbed areas after construction and maintenance

**Ask an expert**

Seek expert advice if you are unsure about drainage feature crossings.

## 5.3.1 Crossing design and location

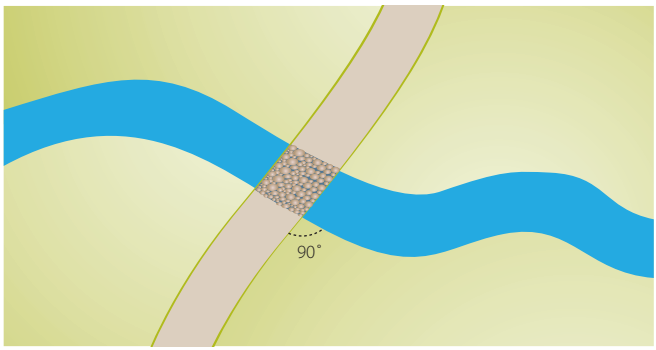
### Design requirements

**Crossing design**

**➲ The Code reference: 5.1.2(3)**

Crossings must be constructed at right-angles to the flow of water in the drainage feature wherever possible (Figure 5.12). In some circumstances using an angled approach may improve environmental outcomes, but this should be avoided.

*Figure 5.12: Crossing approach at right angles*



Crossing design must:

- Take account of the requirements of fish and other aquatic animals
- Minimise disturbance to the stream banks and stream beds by ensuring no soil deposits enter the stream/ drainage feature and stream banks are not cut
- Limit changes to the natural flow of the stream

**Design capacity**

**➲ The Code reference: 5.1.2(6)**

The design capacity of the crossing is a measure of its ability to convey and withstand the water flow from storm events/ inundation of a particular size.

If the crossing is permanent it must be designed so that it can carry the water that results from a one-in-five-year storm event (i.e. the heaviest storm that can normally be expected in any five-year period). It must also be able to stay in place in the event of a one-in-ten-year storm event. Bridges must be designed and constructed so the natural stream flow is not restricted and erosion is minimised.

**Crossing location**

**➲ The Code reference: 5.1.2(2)**

Crossings should be located where construction will cause minimal disturbance to stream banks, stream beds and natural flows. Drainage feature crossings should be minimised.

**FOP note**

Drainage feature crossings should be recorded in the FOP.

## 5.3.2 What types of crossings can be used?

**➲ The Code reference: 5.1.2(1)**

Crossings must be stable causeways, culverts or bridges. Gully stuffers may be used if stable but **must not** be constructed.

## Gully stuffers

**New gully stuffers are not to be constructed under any circumstances**. A gully stuffer is where logs, debris or soil material have been placed to fill a gully at the crossing point (Figure 5.13). There is limited capacity for water to exit along the natural stream course. **Existing gully stuffers can be used if they are stable and require no additional maintenance work.**

*Figure 5.13 (a) (b): Gully stuffers*

*(a) Soil-based gully stuffer*

*(b) Log-based gully stuffer*

PHOTO: PF Olsen Australia

## Causeways

**➲ The Code reference: 5.1.2(8)**

Causeways are a natural or constructed crossing that enables vehicles to cross a drainage feature with minimal disruption to the stream bed (Figure 5.14). The water flows over a causeway. Causeways must be constructed of non-soil material to minimise soil turbidity. For example crushed gravel, rock, bitumen, concrete or logs.

*Figure 5.14: Causeway*

## Culverts

Culverts are constructed crossings that allow water to pass under the road formation (Figure 5.15). They are commonly constructed using round pipes with a layer of fill over the top of the pipe. This fill is compacted and leveled to form the road surface.

*Figure 5.15: Culvert crossing*

### Bridges

Bridges are constructed over a watercourse, and allow the streamflow to pass under the structure (Figure 5.16). Generally, bridge timber (logs) can be accessed on-site. Bridges can be constructed with limited or no disturbance to the drainage feature banks or bed.

*Figure 5.16: Bridge*

## 5.3.3 Crossing construction and maintenance

When constructing or maintaining crossings you must:

- **Prevent** erosion and water pollution
- Ensure fish and other aquatic animals can continue to **travel up and down** the watercourse
- **Minimise changes** to the natural flow of the stream and the shape and condition of the stream banks and stream beds
- **Minimise disturbance** to soil and streamside vegetation
- **Not place** fill material **into** the **watercourse**
- **Store surplus fill material outside** the **exclusion zone** for the watercourse

### Crossing and approach material

**➲ The Code reference: 5.1.2(2 & 7)**

The material that is used on the crossing surface and on the approaches to the crossing must be stable so that it won't be displaced during normal use of the crossing.

The base of the crossing must be made of erosion-resistant material.

### Disturbed areas

**➲ The Code reference: 5.1.2(4)**

If the bed and banks are disturbed during construction and maintenance, they must be reshaped and stabilised as soon as possible. Reshaping and stabilisation is usually achieved by replacing the soil from the disturbed site with the same soil material. Other stabilisation techniques can include the use of rock, pebbles/blue stone, geotextile and revegetation.

### Road drainage approaching crossings

**➲ The Code reference: 5.1.2(5)**

Drainage feature crossings are critical sites for preventing sediment pollution of streams/drainage features because roads can be a major contributor of sediment. Approaches to crossings should be stabilised using rock or pebbles.

### When you've finished

Crossings must be able to continue to withstand storm events/inundation and carry water without polluting after the operation is completed. It is important to decide whether the crossing will be removed (if it can be done safely), stabilised and put out of service or maintained for ongoing property management.

## 5.4 Snig tracks

**➲ The Code reference: 5.2.1**

**Snig tracks** are used to transport logs from the harvest site to the log landing or portable sawmill site.

Extra care must be taken because snig tracks are subject to heavy machinery traffic, which results in increased ground and soil disturbance, and therefore a greater risk of soil erosion and water pollution.

### Key principles

1. **Use existing** snig tracks and log landings wherever possible (except when located in riparian exclusion or buffer zones)
2. **Use walkover techniques**
3. **Maintain** as much **ground cover** as possible
4. **Minimise** damage to other trees and vegetation
5. **Retain logging slash** including bark on snig tracks
6. **Avoid drainage feature crossings** if possible
7. **Maintain drainage structures**

### 5.4.1 Snig track design, location and layout

The location of snig tracks should reflect the location and distribution of log landings or portable sawmill sites in relation to the location of timber resources.

- **Consider the number** of snig tracks needed:
  - **Too few**: higher machine costs (have to travel further for logs) and more potential for concentrated soil damage and compaction
  - **Too many**: higher construction costs and greater widespread disturbance
- **Locate tracks** where the groundslope allows them to **drain naturally**
- **Avoid drainage feature crossings** wherever possible
- Locate tracks away from exclusion zones and riparian buffer zones.

## 5.4.2 Construction and maintenance of snig tracks

### Environmental protection

**➲ The Code reference: 5.2.1(2&5)**

Avoid groundcover and soil disturbance and soil exposure when constructing, maintaining and using snig tracks.

Snig tracks must not be constructed or used within exclusion zones or riparian buffer zones except where explicitly permitted by the Code.

### Walkover extraction

**➲ The Code reference: 5.2.1(1)**

Walkover extraction is where harvesting machinery extract logs without the need for earthworks, and without removal of underlying soil and vegetation (Figure 5.17). This is the preferred technique, as it reduces the need for snig track construction.

*Figure 5.17: Slash retention for walkover extraction*

### Re-opening old snig tracks

**➲ The Code reference: 5.2.1(3&4)**

Minimise soil and vegetation disturbance. Old snig tracks must not be re-opened and used if they are incised and cannot be drained properly.

**Note**

During all forestry operations, the use of bulldozer and skidder blades should be restricted to the minimal removal of obstructions (which include logs, tree heads and rocks) and the construction or maintenance of drainage.

## 5.4.3 Draining snig tracks and log landings

### Size and types of snig track drainage structures

#### Snig track drainage techniques

**➲ The Code reference: 5.2.1(7)**

Snig tracks can be drained using any of the following techniques:

» Retain the existing groundcover using **walkover** techniques

» **Retain or install slash** and harvesting debris on snig tracks

» Construct or maintain **outfall drainage** on the snig track

» Construct **crossbanks**

#### Crossbanks

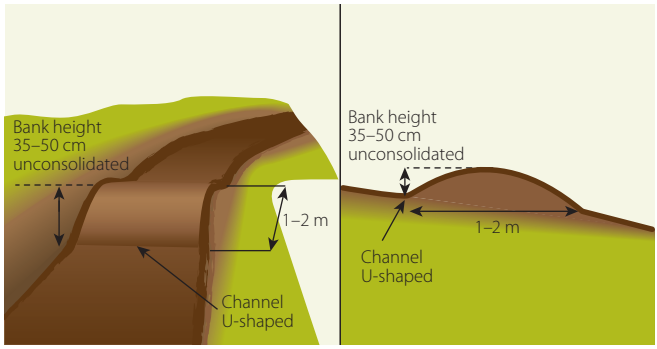
**➲ The Code reference: 5.2.1(9&10), 5.2.2(5)**

Crossbanks must have an effective height of at least 35 centimetres if the soil has not been compacted, or 25 centimetres if the soil has been compacted (Figure 5.18). As a guide, crossbanks should not be higher than 50 centimetres.

A crossbank must be constructed between 5 and 20 metres of a drainage feature crossing.

They must be constructed from earth, rock or gravel, without any bark or organic material, although bark and other forest debris can be retained on snig tracks between drainage structures.

*Figure 5.18: Snig track cross bank*




## 5.4.4 Snig track crossings

**➲ The Code reference: 5.2.2**

When planning the location of snig tracks, the number of crossings must be minimised.

**Machinery must not cross a drainage feature which has running water or when the soil is saturated, except by means of a stable crossing.**

The types of snig track crossings that can be used include stable causeways, culverts or bridges. Existing, stable gully stuffers can be used; however, **no new gully stuffers can be constructed.**

The snig track approach must be as close as possible to right angles to the flow of water.

### When you've finished

**➲ The Code reference: 5.2.1(8), 5.2.2(7)**

On completion you must reshape the snig track to remove all wheel ruts and log furrows. Recoverable topsoil must be spread back over the surface of the track to assist revegetation.

The snig track approaching crossings must be reshaped to match the original natural ground surface. If vegetation groundcover will not grow back naturally, a suitable sterile seed or native seed with fertiliser must be sown to establish effective groundcover.

## 5.5 Log landings and portable mill sites

**➲ The Code reference: 5.2**

Log landings and portable sawmill sites are used to sort, process and load logs or sawn wood onto trucks for transport.

Extra care must be taken in these areas because they are subject to heavy traffic. This results in increased ground disturbance and therefore a greater risk of soil erosion and degradation.

### 5.5.1 Design and location

#### Size

**➲ The Code reference: 5.2(2)**

Log landings and portable sawmill sites must be no larger than the minimum size necessary for efficient operations.

The size of log landings and portable mill sites should cater for:

- **Safe operation** of harvesting and loading machinery and trucks
- The amount of **truck traffic** using the site
- The **volume of logs** and/or timber which is expected to be serviced, processed and loaded on the site
- Any relevant **environmental requirements**

#### Location

**➲ The Code reference: 5.2(1&4)**

Wherever practicable, log landings and portable mill sites must **not** be located in flood runners or drainage depressions. Consider the location of existing roads, snig tracks and timber resources.

Log landings and portable sawmill sites must be located at least 10 metres away from any exclusion or riparian buffer zone.

## Managing water flow

**➲ The Code reference: 5.2(3&5)**

Log landing and portable mill sites must be located and constructed to ensure that they drain naturally. Runoff must be diverted to a safe point where it can discharge onto established vegetation away from any drainage feature.

## Debris management

**➲ The Code reference: 5.2(6,7&8)**

Large volumes of tree waste and sawdust are generated at log landings and portable sawmill sites. This waste can:

- Create a fire risk
- Affect soil quality
- Lead to water pollution
- Damage retained trees (protected vegetation)

This tree waste and sawdust must be removed as harvesting operations progress, and be distributed through the harvest area in small volumes (Figure 5.19). **The waste must not be stacked against any retained trees because this not only creates a fire risk and can result in the tree being damaged and/or destroyed.**

*Figure 5.19: Manage debris as operation progresses*

Vegetation and debris from these sites must not be deposited in a riparian exclusion zone, riparian buffer zone or flood runner.

### When you've finished

**➲ The Code reference: 5.2(9)**

Mill sites and log landing sites must be drained and reshaped so that water runoff can safely disperse from the site into surrounding undisturbed vegetation.

## 5.6 Using forest infrastructure

Forest infrastructure is subject to heavy use by trucks and harvesting equipment which can result in rapid deterioration, particularly in wet conditions. The Code addresses this by identifying circumstances when forest infrastructure cannot be used.

### Key principles

1. **Avoid** operating in **wet weather**
2. **Maintain** stable and effective **drainage structures** and surfaces
3. **Choose** the right machinery
4. **Remedy damage** to infrastructure as soon as possible

### 5.6.1 Wet weather limitations for forestry operations

**➲ The Code reference: 5.2.3**

Harvesting on wet and saturated soils is likely to cause environmental harm and damage to forest infrastructure (Figure 5.20). The Code includes specific limitations for operations.

### General harvesting limitations

**➲ The Code reference: 5.2.3(1)**

Harvesting operations must not occur when:

» There is runoff from the snig track surface

» Soils are saturated

» Soil is rutted to a depth of more than 200 millimetres below the track surface over a 20-metre section or longer

*Figure 5.20: Consequences of using roads in wet weather*

## 5.6.2 Maintaining stable surfaces

### Blading off

**➲ The Code reference: 5.1(14) & 5.2.1(6)**

**Blading off must not be undertaken under any circumstances.** It is a technique where the wet, soft, top layer of a road, snig track, log landing or portable sawmill site is removed, using a grader or bulldozer, to reveal a firm surface underneath. Blading off results in greater water concentration, soil compaction, progressive degradation and environmental harm and can mean that the road is impossible to effectively drain.

### Impacts of log trucks on roads

**➲ The Code reference: 5.1(10) & 5.2.3(2&3)**

Log trucks are heavy and can easily damage poor road surfaces.

Trucks cannot use forest roads where the surface of the road has broken down. Road surface breakdown is defined as rutting of more than 150 millimetres deep for a distance of more than 20 metres.

Trucks cannot use natural surface roads where there is water runoff from the road surface, as there is an increased risk of soil erosion. If the truck is already loaded or partially loaded, it can travel to its destination using the road.

**Note**

If there is any water runoff from the log landing, all machines must remain stationary. You can still use forwarders, excavators and truck-mounted loaders to load trucks, but these machines must remain stationary. The only exception to this is if the log landing is constructed of gravel or other stable material.

# 6. Ensuring outcomes

## 6.1 Auditing of forestry operations

An audit is a planned activity involving staff from the EPA and the landholder or their representative. The landowner can request an audit from the EPA at any stage. The EPA may undertake audits at any time during, post or pre forestry operations, with or without the landholder's or contractor's consent.

The EPA will contact the landholder or their representative and arrange a suitable time for the audit. Audits will be conducted by trained and experienced EPA officers, who will discuss the landholder's operations and inspect the property to examine aspects of the forestry operations being conducted.

Aspects to be examined may include the protection of environmental values (including wetlands, drainage features and Aboriginal artifacts), retention of residual basal area, regeneration and the FOP.

The aim of the audit is to:

- Ensure the landholder and operator comply with the Code
- Gather information to support any audit findings
- Discuss audit outcomes and any follow-up actions with the landholder, and contractor where necessary
- Improve operational best practice

## 6.2 Reporting requirements

**➲ The Code reference: 2.2**

The Code requires landholders to report to the LLS if they have carried out PNF operations in the previous year, or if they plan to undertake PNF operations in the current year.

Landholders do not need to provide a report if they have not carried out any PNF operations in the previous year, and have not carried out (or intend to carry out) PNF operations in the current year.

A sample report is available at **www.lls.nsw.gov.au/sustainable-land-management/private-native-forestry/annual-reporting.**

Reports may be submitted by post, via email or online to the **LLS**, and are **due at the end of March each year**.

## 6.3 Forest management certification

Many markets for forest products are increasingly demanding timber that has been produced under a forest management system which has been certified to either the **Australian Forestry Standard** (AFS) or the **Forest Stewardship Council** (FSC). Forest management certification offers landowners the opportunity to access a wider range of markets by implementing and having certified a system of operations. This ensures that operations are undertaken legally, to the highest standards and under a regime of continuous improvement.

It is possible for smaller owners to participate in Group Certification schemes (for AFS or FSC or both), which reduce certification costs while still offering the additional environmental management and product marketing advantages.

## 6.4 Additional resources

Sample 'Annual Reporting Template'

Certification:

Australian Forestry Standard – www.forestrystandard.org.au

Forest Stewardship Council – www.fscaustralia.org

# 7. Tools to help you

## 7.1 Equipment

There is a range of equipment which is recommended or useful to assist you to plan, undertake and monitor native forestry operations.

### 7.1.1 Basic equipment

Equipment that you should have:

- 30 metre tape for measuring distance and tree height
- A compass
- Clinometer for measuring ground slope, road grade and tree height
- Dendrometer/relaskope or basal area prism for measuring basal area
- Diameter tape for measuring trees
- Global Positioning System (GPS) for locating mapped features in the field
- String line and string line level
- Binoculars (for locating nesting sites in trees)
- Field note book
- Tree marking tape or paint

## 7.2 Mapping skills

Running a native forestry operation requires skills in map reading and interpretation. Maps assist the reader to locate themselves, features and details of the forest operation.

## 7.2.1 Map reading

### The Forest Operation Plan map

The main map you will use during the PNF operation is the FOP map (Figure 7.1). The base FOP map is provided by the LLS and will include the following features:

- Property boundary
- Boundary of the approved PNF area
- Areas excluded from operations
- Contours
- Drainage features
- North arrow
- Map scale
- Legend

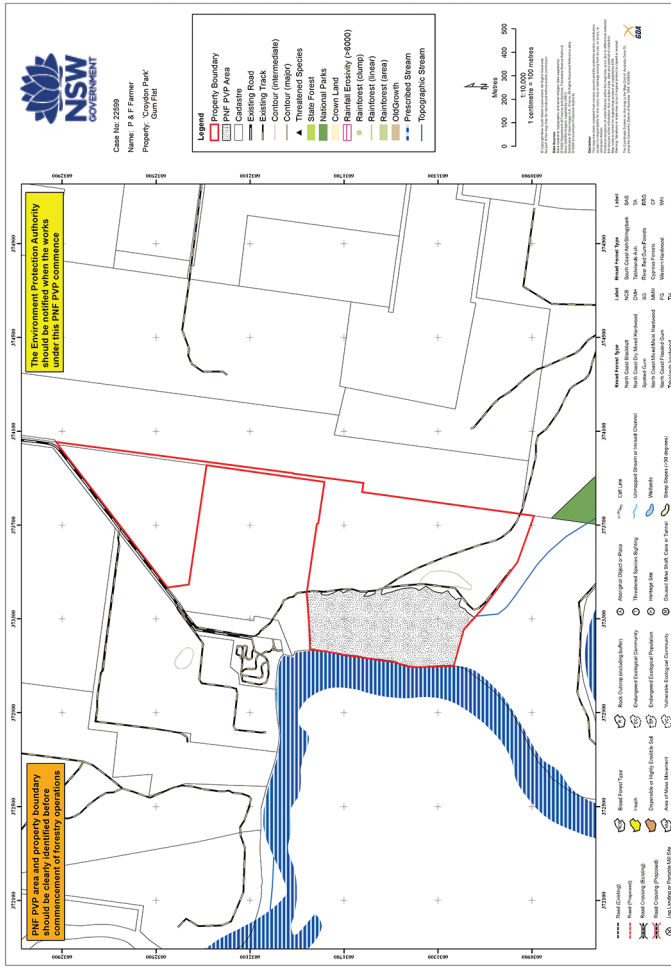
Additional features must be marked on the FOP by the person planning the forestry operation. These features include, but are not limited to,

- Existing and proposed roads
- Existing and proposed drainage feature crossings
- Log landings and portable mill sites
- Landscape features

The FOP map is based on a topographic map. If the forestry operations area for the current operation does not include the entire approved PNF area, the FOP map will show the area covering the current operation. This is referred to as the FOP area in the FOP.

Symbols are used on maps to represent features which exist on the ground. These symbols are shown in the FOP map legend.

*Figure 7.1: An example of a FOP map*



## 7.2.2 Interpreting the Forest Operation Plan map

### Direction

The FOP map is aligned with the top to the north and the bottom to the south.

### Orientating a map

The map is oriented when it is placed in the same alignment as features on the ground. This is done by rotating the map until identifiable features lie in the same direction on the map as on the ground. Alternatively, orientation can be achieved by aligning the top of the map with the north end of the compass needle.

Orienting the map when it is being read is a good habit to get into. It helps with interpreting features on the map and finding those same features on the ground.

### Scale

The map scale is the relationship between distance on the map to the actual distance on the ground.

**? How do I…**

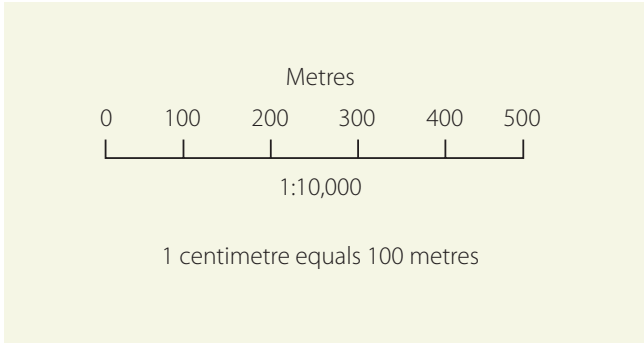
**Use the map scale**

A scale of 1:25,000 means that 1 unit of distance on the map represents 25,000 units on the ground.

So, 1 centimetre on the map = 25,000 centimetres on the ground (this is the same as 250 metres or 0.25 kilometres)

A scale bar on the map is another way to determine distance on the ground (Figure 7.2).

*Figure 7.2: Example of a scale bar from a FOP map*

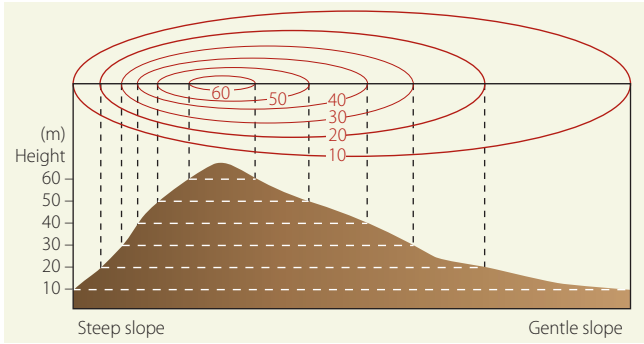



## Contour lines

Contour lines are drawn on the map to connect points that are the same height above a known point. On the map, each contour is drawn at a specific height above sea level, with the vertical distance between contours being the same distance. This difference in height is called the **contour interval**. The contour interval on the FOP map is 10 metres. Some contour lines have the height above sea level printed in places along the line.

The height and spacing of contours relates to the shape (topography) of the ground (Figure 7.3).

*Figure 7.3: The relationship between contour lines and slope*

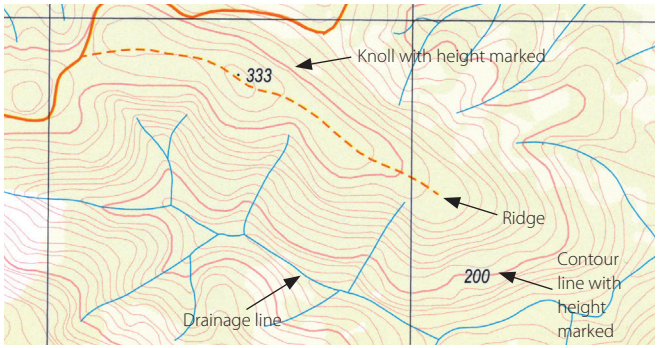


The most important points to remember about contour patterns are:

- contour lines close together indicate steep slopes
- contour lines far apart indicate gentle slopes
- evenly spaced contours indicate uniform slope

Each topographical feature such as a ridge, knoll or stream is represented by characteristic contour patterns (Figure 7.4).

*Figure 7.4: Topographic map with features labelled*




## 7.3 Measuring trees and stands

Measuring trees and stands provides useful information about how much wood is present on your property. These measurements are also required to ensure that you comply with a number of sections of the Code.

### 7.3.1 Height

#### Measuring tree height

There are a number of ways to measure tree height using a variety of measuring tools from a tape measure, a clinometer and tape measure, to a Vertex. Each method varies in its accuracy and ease of use.

The easiest technique is by using a tape measure and two people. The first person stands well back from the tree, and the second person stands at the base of the tree.

Holding a 40 centimetre section of tape vertically out in front of them, the first person closes one eye and looks past the edge of the tape so the tree appears next to the tape. Moving the tape so the end (0 centimetre) lines up with the base of the tree, they can then measure the apparent height to the top of the tree.

The next step is to mark 10% of this apparent height on the tree. The second person puts a mark on the tree where the first person tells them to (the point where 10% of the apparent height is). The height from the ground to the mark on the tree is 10% of the tree height. Measure this height on the tree and multiply the measurement by 10 to get the total tree height. For this method, there is no need to know how far away the first person is from the tree.

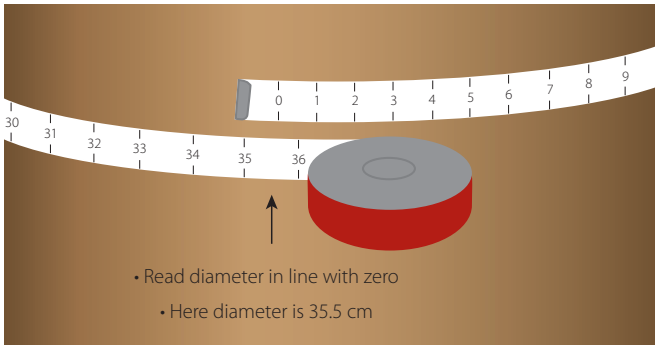
### Measuring stand height

Stand height is the average height of the five dominant trees within the stand of each broad forest type. These trees must be within the proposed harvest area.

## 7.3.2 Measuring tree diameter

In Australia it is standard practice to measure the diameter of a tree at 1.3 metres above the ground on the uphill side. This is termed 'Diameter at Breast Height Over Bark' (DBHOB). A height of 1.3 metres is used because it is a convenient height for most people, is usually above any buttressing or fluting at the base of the tree and is usually not obstructed by undergrowth. Diameter is usually measured with a fibreglass or metal diameter tape and is expressed in centimetres. (Figure 7.5)

*Figure 7.5: Measuring tree diameter*




## 7.3.3 Basal area

### Tree basal area

Basal area is the cross-sectional area of a tree measured at **breast height** (1.3 metres) over bark (Figures 7.6 & 7.7). As this is an area measurement, the units are in metres squared.

*Figure 7.6: Measurement of breast height*

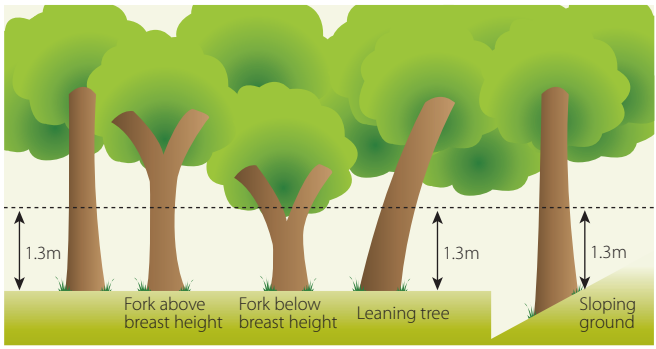
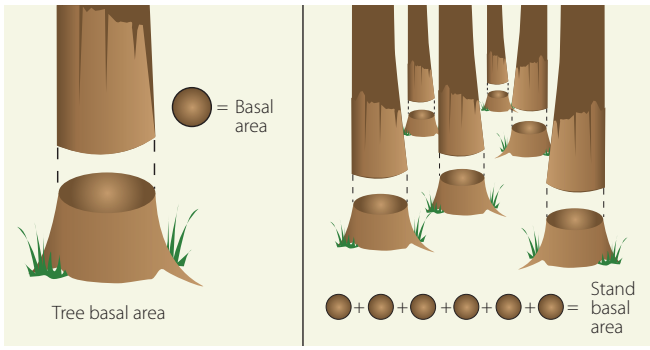



*Figure 7.7: Tree and stand basal area*

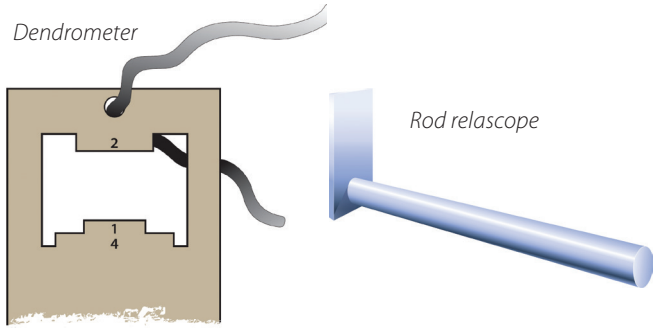



### Stand basal area

Stand basal area is the sum of the basal areas of all trees within the operational area expressed in metres squared per hectare (Figure 7.7). Imagine you cut down every tree in a 1 hectare area of land and that all the stumps were 1.3 meters high. The stand basal area is the total surface area of all of those cut stumps. Stand basal area can be measured in either of two ways, angle count sampling or fixed area plot.

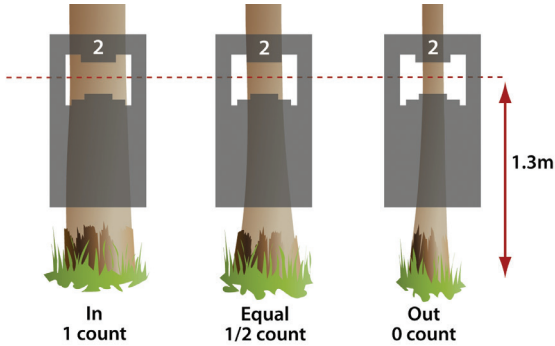
***Angle count sampling:*** This method provides an easy and unbiased measurement of basal area using one of a range of tools for determining basal area (Figure 7.8).

*Figure 7.8: Dendrometer and rod relascope for angle count sampling.*




The method requires the measurer to stand adjacent to a fixed point and 'sweep' around with the eye above the fixed point, assessing which trees are 'in', 'equal' and 'out'. All the trees that are 'in' and 'equal' are tallied as 1 and 0.5 trees, respectively (Figure 7.9). The final tally is multiplied by a basal area factor (BAF) to determine the basal area for the angle count plot.

*Figure 7.9: Assessing 'in', 'equal' and 'out' trees using a BAF of 2*




***Fixed area plots:*** This method requires the user to establish a number of fixed area plots within which the diameter of each tree is measured and converted to a basal area. The basal area for each tree is then summed and converted to a basal area per hectare, by adjusting for the area of the plot.

In the Code, stand basal area is assessed by taking an average across the stand in accordance with approved guidelines (see 'Additional resources' at the end of this section). Angle count sampling is quicker and easier than fixed area plot measurement, but is less accurate.

## 7.4 Assessing regeneration

The Code requires landholders to assess regeneration and stand stocking 36 months after a regeneration event occurs. In the Code for River Red Gum Forests, a regeneration event is the second period of inundation following a harvesting or thinning operation.

## 7.5 Using Global Positioning Systems

Global Positioning Systems are an accurate means of identifying where you are in the forestry operations area and can be of significant value for mapping and for field marking, particularly in dense undergrowth or where topographic features are not obvious. Various hardware and software are used to locate certain points on the earth (e.g. property boundaries, roads). This technology uses a receiver to pick up signals from satellites that orbit the earth and convert these signals to provide the location of the GPS unit. Although they can be very accurate, the accuracy is limited by the quality of the receiver, satellite reception, topography, canopy cover and other factors.

Even if you have a GPS, you still need to be able to understand and interpret topographic maps.

## 7.6 Additional resources

Guideline 1 – Guidelines for assessing regeneration and stocking

Guideline 4 – Techniques for measuring stand height

Guideline 5 – Techniques for measuring stand basal area (in press)

TAFE NSW offer courses in mapping – www.tafensw.edu.au

# Glossary of forestry terms

| Term | Description | Page # |
|---|---|---|
| Accidentally felled | A tree is accidentally felled into any area of land only if it is apparent that techniques of directional felling were used in an attempt to fell the tree away from the area. Despite the above, a tree is not accidentally felled into an area if the person responsible knew or could reasonably have been expected to know that the tree would fall into the area. | 37 |
| Australian Group Selection | A silvicultural technique that creates canopy openings for the purpose of stimulating regeneration in certain forest types. | 12, 14 |
| Backcut | Relates to tree felling. The backcut is the final cut made to fell the tree. It is on the opposite side of the direction of fall. Also see 'scarf'. | 41 |
| Batter | An earth slope formed from fill material (fill batter) or cut into the natural hillside (cut batter) during road construction. | 48, 53, 56 |
| Cohort | A group of trees developing after a single disturbance event. | 25 |
| Diameter at breast height over bark (DBHOB) | The diameter of a tree measured at 1.3 metres above the ground. Measurements are made over the bark and horizontal to the trunk. | 12, 13, 21, 22, 27, 80 |
| Directional felling | The felling of a tree so it falls in a pre-determined direction. | 29, 32, 38, 41 |
| Dispersible soil | A structurally unstable soil which readily disperses into its constituent particles (clay, silt, sand) in water. | 44 |
| Drainage depression | A shallow depression with a smoothly concave cross-section that conveys runoff only during or immediately after periods of heavy rainfall. | 35, 39, 67 |

# Glossary of forestry terms

| Term | Description | Page # |
|---|---|---|
| Drainage feature | A drainage depression, drainage line, river or watercourse. | 8, 35, 36, 37, 39, 40, 42, 43, 44, 56, 57, 58, 60, 61, 62, 63, 65, 66, 68, 72, 75 |
| Drainage line | A channel down which surface water naturally concentrates and flows. Drainage lines exhibit one or more of the following features which distinguish them from drainage depressions:<br>» evidence of active erosion or deposition, e.g. gravel, pebble, rock, sand bed, scour hole or nick point<br>» an incised channel more than 30 centimetres deep with clearly defined bed and banks<br>» a permanent flow. | 35, 38, 79 |
| Drainage structure | A structure designed to convey water away from a road, track or area of soil disturbance. | 43 ,45, 46, 54, 56, 63, 65, 69 |
| Earth windrow | A mound of soil material or gravel on the edge of a road or snig track formed by the spillage from the edge of a blade or similar machine during earthmoving operations. | 53, 54 |
| Exclusion zone | An area of land (within a specified distance of landscape features identified in Tables A or C) where forestry operations are prohibited, unless otherwise allowed under the Code. | 22, 32, 33, 37, 38, 39, 40, 41, 45, 61, 63, 64, 68 |
| Extraction track | A track constructed for use by forwarding machinery. | 34 |
| Flood runner | A natural depression that carries the initial flood flows before complete innundation occurs. | 35, 67, 68 |

| Term | Description | Page # |
|---|---|---|
| Food resource trees | Trees with recent V-notch incisions or other incisions made by a yellow-bellied glider or squirrel glider. Recent incisions are incisions less than two years old as evidenced by the fact the incision has not grown over. | 12, 24, 25, 27 |
| Forestry operations | All clearing resulting from activities associated with forest management including harvesting operations, construction and maintenance of roads and tracks, and prescribed burning for regeneration. | 1, 3, 4, 7, 8, 9, 10, 12, 15, 16, 18, 19, 22, 28, 31, 32, 33, 37, 38, 42, 65, 69, 72, 74, 75, 84 |
| Geotextile | Cloth or clothlike materials intended for use in the soil, usually for filtering or containing soil water. Often used to prevent or control erosion. | 62 |
| Girders | High-quality logs used in a round- or flat-faced form to support a deck such as a bridge, wharf or a large end-section; heart-free, sawn timber suitable for heavy construction. | 1 |
| Gully stuffer | An existing drainage feature formed by filling the drainage feature with trees, debris, spoil, soil, rock or other material to the level of the road or track. | 56, 58, 59, 66 |
| Habitat tree | A tree retained for habitat purposes under the Code. | 16, 24, 25, 32 |
| Harvesting operations | Harvesting operations include:<br>» timber felling, snigging and extraction<br>» construction and maintenance of log landings, snig tracks and extraction tracks. | 68, 69 |
| Highly erodible soil | A soil where the particles are readily detached and transported by erosive forces. The presence of these soils may be identified by evidence of existing erosion (gully or rill erosion), or by commonly known problem soil types, e.g. some coarse-grained granites. | 44 |

# Glossary of forestry terms

| Term | Description | Page # |
|---|---|---|
| Incised channel | A channel more than 30 centimetres deep with clearly defined bed and banks. | 35, 36, 37, 39, 40 |
| Landscape timber | Sawn timber used for landscaping purposes. | 1 |
| Log landing | An area (usually cleared) where timber products are assembled for processing and sorting before being loaded onto a truck. | 8, 42, 51, 63, 65, 67, 68, 69, 70, 71, 75 |
| Nest trees | Trees with nests or roosts of any species of raptor, including powerful owls, barking owls, sooty owls and masked owls.<br>Trees with nests of colonial-nesting water birds (groups of stick-nests). | 24, 26, 27 |
| Net harvestable area | The area under the PNF **Plan** where harvesting is permitted in accordance with the Code. | 14, 15 |
| Old growth | Ecologically mature forest where the effects of disturbance are now negligible. This includes an area of forest greater than 5 hectares where:<br>» the overstorey is in late to over-mature growth stage with the presence of relatively large old trees (many containing hollows and often with the presence of dieback or dead branches in the crown)<br>» the age (growth) structure of the stand measured as relative crown cover consists of less than 10% of regeneration and advance growth and more than 10% of late to over-mature (senescent) growth<br>» the effects of unnatural disturbance are now negligible<br>» Old growth woodlands west of the Great Dividing Range, while comprising a characteristic canopy of late to over-mature trees (many with hollows), may comprise a woodland structure with less diverse or often shrubby understorey and a groundcover of grasses and herbs. | 7, 9, 19 |

| Term | Description | Page # |
|---|---|---|
| Portable mill site | A site where a portable mill (easily movable milling equipment) operates. | 8, 51, 67, 68, 75 |
| Prescribed stream | Stream listed in the Major Rivers database of the Assessment Methodology database Office of Environment and Heritage website. | 23, 36, 37, 38, 39, 40, 94 |
| Protected trees | Trees required to be retained under clause 4.3(3):<br>» plants of the *Xanthorrhoea* (grass trees), *Allocasuarina* (forest oak) (except bull oak (*Allocasuarina luehmannii*) and genus Banksia<br>» for the River Red Gum Forests, Acacia salicina (cooba), *Exocarpos strictus* (dwarf cherry) and *Eucalyptus microcarpa* (grey box)<br>» other trees that are required to be retained by this Code. | 24, 28 |
| Recruitment tree | A tree capable of developing hollows to provide habitat for wildlife and which comes from the next smaller cohort than habitat trees. | 25, 26 |
| Regenerate | Renewing tree cover by establishing young trees naturally or artificially. | 12, 13, 17 |
| River Red Gum Forests | A forest dominated by *Eucalyptus camaldulensis* consistent with description of Forest Type 199 (River Red Gum) in State Forests of NSW, Research Note 17. | 1, 12, 13, 16, 21, 33, 84 |
| Riparian exclusion zones | Those areas within the distances specified for 'Drainage feature' as listed in Table C where forestry operations are not permitted, unless otherwise allowed by this Code. | 32, 37, 38, 39, 40, 41, 68 |
| Road | Any route used for vehicular access to, and the transport of logs from, the point of loading (log landing) within the forest area. | 4, 8, 19, 32, 34, 37, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 56, 60, 62, 67, 70, 74, 75, 84 |

| Term | Description | Page # |
|---|---|---|
| Rollover bank | A crossbank constructed with a smooth cross-section and gentle batters, which is well-compacted. | 49, 50, 51 |
| Roost trees | Trees with nests or roosts of any species of raptor, including powerful owls, barking owls, sooty owls and masked owls, and trees which support maternity bat roosts. | 26, 27 |
| Sawlog | Log of a species suitable for processing through a sawmill into solid timber products. | 1 |
| Scarf | Relates to tree felling. The scarf is the wedge-shaped piece of wood that is cut from the side of the tree in the direction of fall. It is also known as the face cut or notch cut. | 41 |
| Silvicultural operations | The activities associated with the management of trees within a forest for the purpose of meeting sustainable long-term productivity objectives, including thinning, single tree selection and creation of canopy openings. | 4, 10, 11, 12 |
| Single tree selection | A harvesting operation where the trees harvested are either single trees or small groups of trees. For the purposes of this Code, single tree selection operations will not create canopy openings. | 11, 13 |
| Sleeper | Sawn timber used for railway construction to fix the tracks in place. | 1 |
| Snig track | A track used by snigging or skidding equipment. | 8, 42, 52, 56, 63, 64, 65, 66, 67, 69, 70 |
| Spoon drain | A drain with a semi-circular cross-section, which has no associated ridge of soil. Its capacity is solely defined by the excavated channel dimensions. | 48, 50, 51 |

| Term | Description | Page # |
|---|---|---|
| Stand height | Mean height of the five dominant trees in the stand. Measurement of stand height must conform to methods described in approved guidelines. | 14, 15, 80 |
| Stocking level | A measure of the frequency of occurrence of tree stems assessed as being capable of growing to canopy level. Measurement of stocking levels must conform with methods described in approved guidelines. | 16 |
| Thinning | A silvicultural practice where some trees are removed in order to increase the growth of retained trees. | 12, 13, 16, 84 |
| Timber products | Commercial timber products removed from or felled within the forest, including sawlogs, sleepers, landscape timber, pickets, veneer logs, poles, girders, piles and pulp logs. | 2, 10 |
| Veneer log | High quality logs that are rotary peeled or sliced to produce sheets of veneer. | 1 |
| Walkover techniques | Timber extraction or snigging without removing or unduly disturbing the existing natural groundcover, i.e. where no snig track construction involving soil disturbance is required. | 38, 39, 63, 65 |
| Wetland | Includes any shallow body of water (such as a marsh, billabong, swamp or sedgeland) that is:<br>» inundated cyclically, intermittently or permanently with water<br>» vegetated with wetland plant communities. | 19, 20, 21, 22, 23, 25, 36, 72, 112 |

## **Appendix A:** Listing of major rivers that exist within the River Red Gum Forests

| Major rivers |
|---|
| BARWON RIVER from the confluence of the Macintyre River and Weir River (Qld) near Mungindi and extending to its confluence with the Culgoa River |
| BIRRIE RIVER |
| BOKHARA RIVER |
| CULGOA RIVER |
| DUMARESQ RIVER from the confluence of the Dumaresq or Severn River (Qld) and Tenterfield Creek and extending to its confluence with Macintyre River |
| MACINTYRE RIVER from its source near Glencoe to its confluence with the Weir River (Qld) near Mungindi |
| DARLING RIVER from its confluence with the Culgoa River to its junction with the Murray River |
| GWYDIR RIVER (GWYDIR RIVER, GOONAL BRANCH of GWYDIR RIVER [Part], BIG LEATHER WATERCOURSE [Part], BALLONE CREEK [Part], BUNDARRA or GWYDIR RIVER) |
| NAMOI RIVER from its source to its junction with the Barwon River at Walgett |
| BOGAN RIVER from its source to its junction with the Barwon River |
| CASTLEREAGH RIVER from its source to its junction with the Macquarie River |
| MACQUARIE OR WAMMERAWA RIVER from its source to its junction with the Barwon River |
| LACHLAN RIVER from its source to its junction with the Murrumbidgee River |
| MURRUMBIDGEE RIVER from its source to its junction with the Murray River |
| MURRAY RIVER from its source to the South Australian border |
| NARRAN RIVER |
| PAROO RIVER |
| WARREGO RIVER |

# **Appendix B:** Listing of prescribed streams & permanent watercourses that exist within the River Red Gum Forests

DARLING RIVER from its confluence with the Culgoa River to its junction with the Murray River and the following tributaries and effluents of the Darling River:

Acres Billabong
Ana Branch of Darling River
Bickerjerry Creek
Booligal Creek
Bow Creek
Briarie Creek
Bunbulya Creek
Bunker Creek
Burbar Creek
Coonalhugga Creek
Coopara Creek
Cullewie Creek
Enerwena Creek
Green Creek
Irrara Creek
Jamiesons Billabong
Kallyanka Creek
Kerribree Creek
Kerrigundi Creek
Lake Creek
Marra Billabong
Middle Creek
Milkengay Creek
Mogila Creek
Monday Creek
Mulga Creek
Myers Creek
Natalio Creek
Nebie or Nebine Creek
Nooramia Creek
Papepapinbilla Creek Paroo Channel
Pine Creek
Possum Creek
Redbank Creek
Snake Flat Creek
Talowla Billabong
Talyawalka Creek
Tandou Creek
Talyawalka Ana Branch of Darling River
Teryaweynya Creek
The Dry Bogan
The Little Warrambool
Tinghi Creek
Tongo Creek
Two Mile Creek
Undeathi Creek
Upper Talyawalka Ana Branch of Darling River
Wannara Creek
Widgeegoara Creek
Willyeroo Creek
Woychugga Creek
Yampoola Creek
Yanda Creek
Paroo River
Warrego River

LACHLAN RIVER and the following tributaries and effluents of the Lachlan River from its source to its junction with the Murrumbidgee River:

Abercrombie River

Back Creek – tributary of Eua, Ooma, or Boyd Creek

Back Creek – tributary of Goobang Creek

Barmedman Creek (Mandamah or Barmedman Creek and Barmedman or Back Creek)

Bartleys Creek

Belubula River

Berthong Creek – tributary of Bland Creek

Bianalong Creek

Billabong Creek

Binda Creek

Binni Creek

Blackmans Creek

Blakney Creek

Bland Creek (Bland or Yeo Yeo Creek)

Bocobra Creek

Bolong River

Bomobbin Creek

Booberoi Creek

Boorowa River

Boree Creek

Bouyaree or Cabbage Garden Creek

Bowan Creek

Box Creek

Bramah Creek

Bribbaree Creek (Bribaree Creek)

Brothers Creek – tributary of Manus Creek

Brundah Creek

Bulla Creek

Bundaburrah Creek

Burra Burra Creek

Burra Creek

Burrangong Creek

Burrangylong Creek

Burthong Creek – tributary of Eremeran Creek

Cadiangullong Creek

Canoble Creek

Canomodine Creek

Caragabal Creek

Cargo Creek

Congou Creek

Conimbla Creek

Cooks Vale Creek

Coombing Rivulet

Copperhannia Creek

Cowriga Creek

Crokers Creek

Crookwell River

Crowie Creek

Crowther Creek (Crowther, Koorawatha, or Back Creek)

Cudgell Creek

Diamond Creek

Dicksons Creek

Dulladerry Creek

Emu Creek

Eremeran Creek

Eua Creek (Ooma or Boyd Creek)

Euglo Creek (Humbug Creek)

Eurow Creek

Felled Timber Creek

Flyers Creek

Galwary Creek

Geegullalong Creek
Goobang Creek
Goonigaldoorigang Creek
Grabben Gullen Creek
Graingers Creek
Gunningbland Creek
Hovells Creek
Isabella River
Island Creek
Jacks Creek
Jerrara Creek
Jerrawa Creek
Jims Creek
Kangarooby Creek
Kangiara Creek
Kongaloolah Creek
Lampton Creek
Langs Creek
Lerida Creek
Licking Hole Creek
Limestone Creek
Little Caragabal Creek
Little Plains Creek
Longs Creek
Mandagery Creek
Mandurama Ponds
Manildra Creek
Manna Creek (Bogardillon or Manna Creek)
Manus Creek
Marobee Creek
Merrill Creek
Merrimajeel Creek
Merrowie Creek (Marrowie or Gonowlia Creek)
Mianga Creek
Middle Creek (Middle Billabong Creek)
Milburn Creek
Milvale Creek (Part) (Tumbleton Creek)
Mirrool Creek
Mitchells Creek
Mogong Creek
Moolbong Creek
Morongla Creek
Muggabah Creek
Mulgowrie Creek
Mulgunnia Creek
Mumble Creek
Murringo Creek
Murrumbidgil Creek
Narraburra Creek
Narrallen Creek
Narrawa Creek
Native Dog Creek
Neila Creek
Nerathong Creek
Noobys Creek
Nyrang Creek
Oaky Creek – tributary of Mandagery Creek
Oolong Creek
Panuara Rivulet
Paling Yards Creek (Paling Yard Creek)
Parliament Creek
Peters Creek (Outer Weedallion Creek)
Phils River – tributary of Bolong River
Phils Creek – tributary of Hovells Creek
Pinnacle Creek
Pint Pot Creek
Pudman Creek
Red Creek
Reedy Creek – tributary of Mandagery Creek

Reedy Creek – tributary of Phils River
Retreat River
Ridgey Creek
Rocky Bridge Creek
Rushy Creek
Sandy Creek
Shaving Holes Creek
Silent Creek
Sletes Creek
Spring Creek
Tenandra Creek
The Crooked Creek
Thompsons Creek
Top Creek
Torriganny Creek
Tuena Creek
Tumbleton Creek
Tyagong Creek
Waarbilla Creek
Wah Wah Creek (Worway or Wah Way Creek)
Wallamundry Creek
Wallaroi Creek (Yarnel Creek)
Warradgery Creek
Waugoola Creek
Weedallion Creek
Werong Branch of Abercrombie River
Wheeo Creek
Wiarborough Creek
Willandra Creek (Willandra Creek and Willandra Billabong Creek)
Yandumblin Creek
Yangellawah Creek (Little Billabong or Yangellawah Creek)
Yarrabundi Creek

MURRAY RIVER from its source to the South Australian border and the following tributaries and effluents of the Murray River:

Aluminy Creek
Ana Branch of Darling River
Aratula Creek
Armstrongs Creek
Back Creek
Backwater Creek
Barbers Creek
Barratta Creek
Basin Creek
Bengalow Creek
Billabong Creek
Blind Creek
Bogong Creek
Bookit Creek
Bowna Creek
Box Creek
Brookong Creek
Buccaneit Creek
Bullatale Creek
Bullock Creek
Bullockhide Creek
Burra Creek
Burragorrima Creek
Burrumbury Creek
Christies Creek
Cocketgedong Creek
Cockran Creek
Colligen Creek
Colombo Creek
Coobool Creek

Coppabella Creek

Cunninyeuk Creek

Deans Creek

Dicks Creek

Eagle Creek

Eight Mile Creek

Euroley Creek

Forest Creek – tributary of Moulamein or Billabong Creek

Forest Creek – tributary of Kyalite or Edward River

Frenchmans Creek

Geehi River (Geehi or Swampy Plain River)

Gol Gol Creek

Gulpa Creek

Horse Creek

Jerra Jerra River (Jerra Jerra Creek)

Jimaringle Creek

Jingellic Creek

Khancoban Creek

Kyalite or Edward River

Lankeys Creek

Little Billabung Creek

Little Merran Creek

Little Murray River

Majors Creek

Mallan Mallan Creek

Manie Creek (Tittara Creek)

Mannus Creek

Maragle Creek

Merangatuk Creek

Merran Creek

Merribit Creek

Middle Creek

Moulamein Creek (Billabong Creek)

Mullanjandra Creek

Munderoo Creek

Murain Yarrien Creek

Native Dog Creek

Niemur River

Noeyanga Creek

Nooroong Creek

Nowranie Creek

Nyangay Creek

Nyrangi Tuppal Creek

Ooronong Creek

Paddys River

Paiko Creek (Peacock Creek)

Papanue Creek

Pelham Creek

Porthole Creek

Puah Creek

St Helena Creek

Seven Mile Creek

Spring Creek

Spring Flat Creek

Swampy Plain Creek

Swampy Plain River [Part] (Murray or Swampy Plain River)

Taylors Creek

Ten Mile Creek

The Box or Forest Creek – tributary of Kyalite or Edward River downstream from its junction with Moulamein or Billabong Creek

Thulabin Creek

Thule Creek

Tipperary Creek

Tooma River

Towrong Creek

Tumbarumba Creek

Tuppal Creek

Turn Back Jimmy Creek

Two Mile Creek

Urangeline Creek (Urangeline Creek and Urana Creek)

Wakool River

Waldaira Creek

Wangamong Creek [Part] (Algudgerie Creek and Wongamong or Coreen Creek)

WantagongCreek)

Washpen Creek

Washpool Creek (Washpool Gully)

Wee Wee Creek

Welumba Creek

Werrimble Creek

Whymoul Creek

Woomargama Creek (Mountain Creek)

Wyam Creek

Yallakool Creek

Yanco Creek (Yanko Creek)

Yarra Yarra Creek

Yarrein Creek – effluent of Kyalite or Edward River

Yarrein Creek – tributary of Wakool River

Yellow Bog Creek

MURRUMBIDGEE RIVER and the following tributaries and effluents of the Murrumbidgee River from its source to its junction with the Murray River:

Adelong Creek

Adjungbilly Creek

Alum Creek

Back Creek

Bago Creek

Ballallaba Creek

Ballinafad Creek

Bareena Creek

Beavers Creek

Beavers Island Creek

Big Badja River

Billabung Creek

Blind Creek

Bogolong Creek

Bramina Creek

Bredbo River

Bridle Creek

Brooks Creek (Shinglehouse or Brooks Creek)

Buddong Creek

Budgee Creek

Bullenbong Creek (Bullenbung Creek)

Bumbolee River

Bundidgerry Creek (Bundidjeery Creek)

Burkes Creek

Caddigat Creek

Carabost Creek

Celeys Creek

Cooleman Creek

Cooma Creek

Cooneys Creek

Coonoon Creek

Coppabella Creek

Cowra Creek

Cudgel Creek

Cungegong Creek

Cunningham Creek (Cunningham Creek and Connaughtmans Creek)

Dairy Creek

Demondrille Creek
Derringullen Creek
Douglas Creek
Gillenbah Creek
Gilmore Creek
Ginninderra Creek
Goobarragandra River
Gooda Creek
Goodradigbee River
Graveyard Creek
Gum Creek
Gundaroo Creek
Happy Jack River
Hillas Creek (Hillas or Yaven Yaven Creek)
Houlaghans Creek
Jeir Creek (Jeir or Oaky Creek)
Jeremiah Creek
Jerrabombera Creek
Jugiong Creek
Keajura Creek (Six Mile Creek)
Kybeyan River
Kydra Creek
Kyeamba Creek
Long Creek
Manie Creek (Tittara Creek)
Micalong Creek
Mirrool Creek
Mitta Mitta Creek
Molonglo River
Monkem Creek
Mountain Creek
Mundawaddery Creek
Murraguldrie Creek
Murrumbateman Creek (Morumbateman Creek)
Muttama Creek
Numeralla River (Umaralla River)
Oak Creek
O'Briens Creek
Old Man Creek
Paiko Creek (Peacock Creek)
Peppercorn Creek
Pinchgut Creek
Queanbeyan River
Rocky Ponds Creek (Spring Creek)
Sandy Creek
Shaking Bog Creek (Bondi Creek)
Slacks Creek
Spring Creek – tributary of Cooneys Creek
Tala Creek
Tantangara Creek
Tarcutta Creek (Tarcutta or Oberne Creek)
The Gum Creek
The Peak Creek
Tinderry Creek
Tumut River
Uara Creek
Umbango Creek
Wah Wah Creek (Worway or Wah Way Creek)
Waldaira Creek
Wambrook Creek
Wantiool Creek
Warroo Creek
Winifred Creek (Punch Bowl Creek)
Yammatree Creek
Yanga Creek
Yanco Creek (Yanko Creek)
Yarrangobilly River
Yass River

BOGAN RIVER and the following tributaries and effluents of the Bogan River from its source to its junction with the Barwon River:

Barabadean Creek
Belar Creek
Beleringar River
Bonar Billa Creek
Boomi Creek
Bradys Cowal
Bulbodney Creek
Bullock Creek
Burrill Creek
Cadungle Creek
Cookopie Creek
Crowal Creek (Whitbarrow Creek)
Duck Creek
Emu Plains Creek
Enerwena Creek – effluent of Duck Creek
Genaren Creek (Back Creek)
Grahway Creek (Pange Creek)
Gunningbar Creek
Ingumburamy Creek
Moore Creek
Mulla Mulla Creek
Native Dog Creek
Pange Creek East
Ten Mile Creek
Tigers Camp Creek
Tomingley Creek
Yangunyah Cowal
Yarra Yarra Creek

CASTLEREAGH RIVER and the following tributaries and effluents of the Castlereagh River from its source to its junction with the Macquarie River:

Baby Creek
Back Belar Creek
Backwater Creek
Bandicoot Creek
Baronne Creek
Belar Creek
Bidden Creek
Binnia Creek (Weetaliba Creek – tributary of Castlereagh River downstream from Binnaway).
Black Swamp Creek
Boltons Creek
Bucklanbah Creek
Bulgan Creek
Butheroo Creek
Calga Creek
Collis or Bungle Gully Warrambool Creek
Coonamble Creek
Coybil Creek
Cumbadoon Warrambool
Dead Mans Creek
Denmire Creek
Dinby Creek (Six Mile Creek)
Dinnykymine Creek
Four Mile Creek
Frazers Creek
Gamble Creek (Piambra Creek)

Gidgenboyne Creek

Gidgenbar Watercourse

Greenbah Creek

Gulargambone Creek (Galargambone or Tooraweanah Creek)

Gunyillah Creek

Ironbark Creek

Jack Halls Creek

Judes Creek

Merrimbah Creek (Bullarora or Tourable Creek)

Merrygoen Creek

Mogie Melon Watercourse

Mount Granby Creek

Mow Creek

Mowlma Creek

Mungery Creek

Murrumbah Creek (Murrumbah or Walla Walla Creek)

Myall Plain Creek

Nebea Creek

Nedgera Creek

Oaky Creek – tributary of Warrena Creek

Piangula Creek

Quanda Quanda Creek

Queensborough Creek

Ranters Creek

Sand Creek

Spring Creek

Tenandra Creek

Teridgerie Creek (Terembone, Teridgerie or Urawilkie Creek)

Terrabile Creek

Terrawinda Creek (Ulimambri Creek)

Tunderbrine Creek

Uargon Creek

Ulinda Creek

Wallaroo Creek

Wallumburrawang Creek

Wambelong Creek

Waniouri Creek (Wansouri Creek)

Warrena Creek

Worinjerong Creek (Warringerong Creek)

Weetaliba Creek – tributary of Merrimbah, Bullarora, or Tourable Creek

Wilber Creek

Wingabutta Creek (Wangabutta Creek)

Womat Creek

Woolshed Creek

Yallagal Creek

MACQUARIE OR WAMMERAWA RIVER and the following tributaries and effluents of the Macquarie or Wammerawa River from its source to its junction with the Barwon River:

Ade Creek

Back Creek

Balrudgery Creek

Bara Creek

Baragonumbel Creek

Bell River

Belourie Creek

Beni Creek (Beni or Deep Creek)

Beragoo Creek

Big Creek

Black Willow Creek
Blathery Creek
Boduldura Creek
Bomely Creek
Boothaguy Creek (Calf-Pen Creek)
Boreenore Creek
Bowenbong Creek
Brammegan Creek
Branch Creek
Branch Gully
Brisbane Valley Creek
Buckinbah Creek (Burrawong or Burgoon Creek)
Budgebegumbil Creek
Bugabada Creek
Bulgeraga Creek
Bullagreen Creek
Bullock Flat
Burrandong Creek
Burrundulla Creek (Oakey Creek)
Cainbill Creek
Camerons Creek
Campbells River
Captain Kings Creek
Carwell Creek
Catos Creek
Catula Creek
Chain of Ponds Creek
Cheshire Creek (Cheshires or Jesse Creek)
Clear Creek
Cockabutta Creek
Collieblue Creek
Collier Creek
Cookamobil Creek
Coolaburragundy River
Coolamigal Creek
Coolbaggie Creek
Cooyal Creek
Coxs Creek
Crooked Creek – effluent of Macquarie River downstream from Warren
Croppy Creek
Cudgegong Creek
Cudgegong River
Cumboogle Creek (Bugle Cuble Creek)
Cunningham Creek (Crudine Creek)
Curra Creek
Curragurra Creek
Darigal Creek
Deep Creek
Diana Creek
Dilga Creek
Dilladerry Creek
Dog Trap Creek
Duck Creek – effluent of Macquarie River
Duckmaloi River (Fish or Duckmaloi River)
Dun-Dun Creek
Dunns Plain Creek
Emogandry Creek
Emu Swamp Creek
Erudgere Creek (McDonald's Creek)
Ewenmar Creek
Fish River (Fish River Creek)
Ganguddy Creek
Ginger Creek
Goan Creek
Goodiman Creek
Goolma Creek
Goondy Creek
Goorangore Creek

Goulburn Creek

Gowdaweda Creek

Green Valley Creek

Guigong Creek

Gullengambel Creek

Gundare Creek

Gundy Creek

Gunningbar Creek

Hawkins Creek

Herveys Range Creek

Hyandra Creek

Jannam Creek

Jones Creek

Kickabil Creek

Kinggarragan Spring Creek (Clarkes Creek)

Lawsons Creek

Lewis Ponds Creek

Little River

Long Creek

Loombah Creek

Marra Creek

Marthaguy Creek (Warren Creek)

Meadows Creek

Merinda Creek

Meroo Creek

Merrigal Creek

Merri Merri Creek

Middle Arm Creek

Mitchells Creek

Mogriguy Creek

Molong Creek

Morphetts Creek

Muckerwa Creek

Mumbedah Creek

Narangarie Creek

Native Dog Creek

Newrea Creek

Nora Creek

Norfolk Island Creek

Nubrigyn Creek

Oakey Creek – tributary of Lewis Ponds Creek

Oakey Creek – tributary of Macquarie River upstream from Burrendong Dam

Oaky or Wickets Creek – tributary of Macquarie River downstream from Bathurst

Paddys Creek

Palmers Oaky Creek

Piambong Creek

Pinnacle Swamp Creek

Pipeclay Creek

Pyramul Creek

Queen Charlottes Creek (Queen Charlottes Vale Creek)

Redbank Creek – tributary of Meroo Creek

Reedy Creek – tributary of Wialdra Creek

Reedy Creek – tributary of Lawsons Creek

Rocky Ponds Creek

Sandy Creek – tributary of Talbragar River

Sandy Creek – tributary of Buckinbah, Burrawong or Burgoon Creek

Sandy Creek – tributary of Mitchells Creek

Sawpit Gully

Sewells Creek

Slapdash Creek

Solitary Creek

Spicers Creek

Spring Creek – tributary of Muckerwa Creek

Spring Creek – tributary of Muckerwa Creek downstream from the junction of Muckerwa and Ginger Creeks

Spring Creek – tributary of Spicers Creek

Spring Creek – tributary of Talbragar River

Stockyard Creek

Stoney Creek – tributary of Macquarie River downstream from Bathurst

Stony Creek – tributary of Cooyal Creek

Stubbo Creek

Summer Hill Creek [Fredericks Valley (Summer Hill) Creek and Fredericks Valley Creek]

Swallow Creek

Swan Creek

Talbragar River

Tallawang Creek

Tambaroora Creek

Trianbil Creek

Tucklan Creek

Turee Creek

Turon River

Two Mile Creek

Uamby Creek

Ulomogo Creek

Uungula Creek

Wando Wandong Creek

Wemabung Creek

Wialdra Creek

Williwa Creek

Winburndale Rivulet

Wisemans Creek

Wollerang Creek

Woolandara Creek

Wooloowoolanley Creek

Worobil Creek

NAMOI RIVER and the following tributaries and effluents of the Namoi River from its source to its junction with the Barwon River at Walgett:

Attunga Creek

Baly Creek

Baradine Creek (Baradine or Milchomi or Bungle Gully Creek and Baradine or Spring or Yearinan Creek [Part] and Dandry Creek [Part])

Barraba Creek

Big Jacks Creek

Black Mountain Creek

Bobbiwa Creek

Bohena Creek (Bohena or Brigalow Creek)

Bomera Creek

Borah Creek – tributary of Manilla River

Borah Creek – tributary of Yaminba Creek

Borambil Creek

Brigalow Creek – tributary of Namoi River downstream from Sheepstation Lagoon

Bugaldie Creek

Bullawa Creek

Bundulla Creek

Carbeen Creek

Carlisles Gully

Cauborn Creek

Chilcotts Creek

Cobrabald River (Cobrabald Creek)

Cockburn River

Coghill Creek (Coghill or Sandy Creek)

Collis or Bungle Gully Warrambool Creek – effluent of Baradine Creek

Colly Creek

Collygrach Creek

Connors Creek

Coomoo Coomoo Creek

Coormore Creek

Cowallah Creek

Coxs Creek (Turrabeile, Coxs or Bone Creek)

Crow Mountain Creek

Cubbaroo Warrambool

Currabubula Creek

Cuttle Creek

Dandry Creek

Doughboy Hollow Creek (Doughboy Creek)

Driggle Driggle Creek

Drildool Warrambool

Dubbo Creek (Etoo or Dubbo Creek)

Duncans Creek

Dungowan Creek

Dunnadie Creek (Wearne Creek)

Etoo Creek (Part) (Etoo or Dubbo Creek)

Eulah Creek (Bulah Creek)

Eumur Creek

Fracers Creek

Garrawilla Creek (Girrawillie Creek)

GilGil Creek

Goona Creek

Goonbri Creek

GoonooGoonoo Creek

Greenhatch Creek

Gunidgera Creek

Halla Linga Creek

Halls Creek (Cuerindi or Halls Creek)

Hawkins Creek

Horsearm Creek (Horse Arm Creek)

Ingleba Creek

Ironbark Creek

Jacks Creek

Jacob and Joseph Creek

Jamiesons Creek

Kerringle Creek (Gullingall Creek)

Little Jacks Creek

MacDonald River (Muluerindi or MacDonald River)

MacDonalds Creek

Mallalee Creek

Manilla River

Maules Creek (Maules or Kihi Creek)

Menedebri Creek

Middle Creek – tributary of Maules Creek

Middle Creek – tributary of Coormore Creek

Mitchells Creek

Mollee Creek (Nuabla Creek)

Mooki River (Conadilly or Mooki River)

Moore Creek

Mulgate Creek

Mulla Mulla Creek (Mulla Creek)

Myall Camp Warrambool

Nangahrah Creek

Narrabri Creek

Narran River

Nombi Creek

Oaky Creek

Omaleah Creek
Onus Creek
Orphants Well Creek
Pagan Creek
Peel River
Phillips Creek
Pian Creek
Pringles Rocky Creek (Pringles Rocky Gully)
Pump Station Creek (Taylors Creek)
Quipolly Creek (Coeypolly Creek)
Quirindi Creek
Rangira Creek (Tulcumbah Creek)
Rocky Creek – tributary of Coghill Creek
Rocky Creek – tributary of Etoo Creek
Sandy Creek – tributary of Peel River
Saveall Creek
Shearins Creek
Smiths Creek
Spring Creek – tributary of Bohena Creek
Spring Creek – tributary of Halls Creek
Spring Creek – tributary of Namoi River downstream from Narrabri
Swamp Oak Creek
Talluba Creek
Tamilies Creek
Tangaratta Creek
Timbumburi Creek
Tulla Mullen Creek
Turrabelle Creek
Turragulla Creek
Ulaman Creek
Warrabah Creek
Warrah Creek
Watsons Creek
Wearne Creek
Werah Creek
Werries Creek
Wongo Creek
Yaminba Creek
Yaraman Creek
Yarramanbah Creek (Yarrimanbah Creek)
Yarramanbully Creek
Yearinan Creek (Baradine or Spring or Yearinan Creek [Part])

BARWON RIVER and the following tributaries and effluents of Barwon River from the confluence of Macintyre River and Weir River (Qld) near Mungindi and extending to its confluence with Culgoa River:

Ballamanga Creek
Ballone Creek
Berawinnia Creek (Berawinia or Cardenyabba Creek)
Birrie River
Boggy Creek
Bogree or Marshalls Pond Creek
Bokhara River
Boomangera Creek
Boomi River
Budelah Creek
Bunna Bunna Branch of Wallon Creek
Carole Creek (Carore Creek and Medgun Creek)

Cato Creek
Commillomori Creek
Courallie Creek (Coorallie Creek)
Curramanga Creek (Caramanga Creek)
Crawfords Arm Creek
Crooked Creek
Croppa Creek
Culgoa River
Geary Creek
Gehan Creek
Gil Gil Creek
Gingham Watercourse
(The Gingham Watercourse)
Ginghet Swamp Creek
Grawan Creek
Hospital Creek
Hughys Arm Creek
Little Bumble Creek
Manamoi Creek
Marra Creek
Meeki Creek
Mooni River (Mooni Creek)
Mt Pleasant Creek
Mungaroo Warrambool
Mungle Back Creek
Mungle Creek
Myall Hollow Creek
Narrandool Creek
NeeNee Creek
Reedy Water Creek
Sugarloaf Arm Creek
Tarpaulin Creek
Tarrian Creek
Ten Mile Creek
Thalaba Creek
The Big Warrambool
The Watercourse Lagoon
Wallon Creek
Waterloo Creek
Whalan Creek-tributary of Boomi River
Womat Creek
Yallaroi Creek

CUTTABURRA CREEK and the following tributaries:

Brindingabba Creek
Kulkyne Creek

DUMARESQ RIVER and the following tributaries and effluents of Dumaresq River from the confluence of the Dumaresq or Severn River (Qld) and Tenterfield Creek and extending to its confluence with Macintyre River:

Bald Rock Creek
Bark Hut Creek
Beardy River
Black Creek
Black Swamp Creek
Bluff River
Bow Creek
Campbells Creek
Camp Creek
Carpet Snake Creek
Catarrh Creek
Deepwater Creek

Deepwater River
Gipsies Creek
Glen or Robertsons Creek
Highland Home Creek
Little Oakey Creek
Mole River
Morah Creek
Oakey Creek
Pyes Creek
Rocky Creek
Silent Grove Creek
Spring Creek
Sugarloaf Creek
Swamp Oak Creek
Tenterfield Creek
Vegetable Creek
Washpool Creek

GWYDIR RIVER (GWYDIR RIVER, GOONAL BRANCH of GWYDIR RIVER [Part], BIG LEATHER WATERCOURSE [Part], BALLONE CREEK [Part], BUNDARRA or GWYDIR RIVER) and the following tributaries and effluents of the Gwydir River from its source to its junction with the Barwon River:

Abington Creek
Auburn Vale Creek
Back Creek (Flat Bottom or Gournama Creek)
Bakers Creek
Ballala Creek
Ballin Boona Creek
Basin Creek
Big Leather Watercourse
Boomi River
Boorolong Creek
Bora Creek – tributary of Gwydir River upstream from Keera Crossing
Borah Creek – tributary of Gwydir River up stream from Bingara
Browns Creek
Cachs Creek (Five Mile Creek)
Camerons Creek
Capel Creek (Oakey Creek – tributary of Macintyre Creek)
Carole Creek (Carore Creek and Medgun Creek)
Chippenham Creek
Cobbadah Creek
Copes Creek
Courallie Creek
Georges Creek
Goonal Creek (Goonal Branch of Gwydir River [Part])
Gouron Gouron Creek
Gwydir Ana Branch (Great Ana Branch of Gwydir River [Part])
Gwydir Pool (Great Ana Branch of Gwydir River [Part])
Gurley Creek
Hallams Creek
Halls Creek – tributary of Gwydir River downstream from Moree
Halls Creek (Bingara or Halls Creek) tributary of Gwydir River at Bingara
Hobbs Gully
Honeysuckle Creek
Horton River

Keera Creek (Reedy Creek – tributary of Middle Creek)

Kellys Gully

Kentucky Creek (Kentucky Ponds)

Laura Creek (Sandy Creek – tributary of Laura Creek)

Limestone Creek

Louisa Creek

Macintyre Creek

Mallowa Creek

Mehi River (Meei or Gwydir River)

Mia Mia Creek

Middle Creek

Molong Creek (South Molong Creek)

Moomin Creek

Moredun Creek (Moredun, Clerks or Kellys Creek)

Morse Creek

Mosquito Creek

Myall Creek

Noogera Creek

Oaky Creek – tributary of the Gwydir River downstream from the junction of the Gwydir and Horton Rivers

Pallal Creek

Plains Creek

Ponds Creek (The Ponds Creek)

Rocky Creek

Rocky River

Roumalla Creek

Sandy Creek – tributary of Myall Creek

Sheep Station Creek – tributary of Gwydir River

Sheep Station Creek – tributary of Myall Creek

Stony Batter Creek (Stonybatter Creek)

Swamp Oak Creek

Tarran Creek

Teatree Gully (Tea Tree Gully)

Terry Hie Hie Creek

Turrawarra Creek

Tyreel Creek

Warialda or Reedy Creek

Weah Waa Creek

Winter Station Creek

Wolongimba Creek

MACINTYRE RIVER and the following tributaries and effluents of this river from its source near Glencoe to its confluence with the Weir River (Qld) near Mungindi:

Apple Tree Gully

Arrawatta Creek

Back Plain Creek

Bannockburn Creek

Black Gully

Cam Creek

Camerons Creek

Cunningham's or Jardines Creek

Ena Back Creek

Ena Creek

Frazers Creek

Frazers or Swamp Oak Creek

Furracabad Creek

Geary Creek

Gnoura Gnoura Creek

Goroo Lagoon

Gum Hut Creek

Kings Plains Creek

Long Plain Gully
Meriti Creek
Middle Creek
Morella Watercourse
Myall Creek
Newstead or Kings Creek
Nine Mile Creek
Ottleys Creek
Paradise Creek
Pindari Creek
Querra Creek
Robroy Gully
Severn River
Stonehenge Creek
Swan Brook
The Beardy Waters
Wean Creek
Wellingrove Creek
Whalan Creek
Wyndhams Creek

# **Appendix C:** Listing of major wetlands for the River Red Gum Forests

A major wetland is a wetland listed in the Directory of Important Wetlands of Australia (Native Vegetation Regulation 2005: Environmental Outcomes Assessment Methodology), which includes wetlands of national and international importance in NSW.

## Border Rivers/Gwydir Catchment Management Authority

Gwydir Wetlands

New England Wetlands

Morella Watercourse/Boobera Lagoon/Pungbougal Lagoon

## Central West Catchment Management Authority

Macquarie Marshes

## Lachlan Catchment Management Authority

Lake Cowal/Wilbertroy Wetlands

Booligal Wetlands

Cuba Dam

Great Cumbung Swamp

Lachlan Swamp (part of mid Lachlan Wetlands)

Lake Brewster

Lake Merrimajeel/Murrumbidgil Swamp

Merrowie Creek (Cuba Dam to Chillichil Swamp)

## Lower Murray Darling Catchment Management Authority

Menindee Lakes

Darling Anabranch Lakes

## Murray Catchment Management Authority

Koondrook and Perricoota Forests

Millewa Forest (National Park)

Wakool – Tullakool Evaporation Basins

Werai Forest (Indigenous Park Area – National Park)

Walla Walla Swamp (Gum Swamp)

## Murrumbidgee Catchment Management Authority

Lowbidgee Floodplain
Tomneys Plain
Black Swamp and Coopers Swamp
Lower Mirrool Creek Floodplain
Mid Murrumbidgee Wetlands
Tuckerbil Swamp
Big Badja Swamp
Coopers Swamp
Lake Bathurst
Lake George
Micalong Swamp
Yaouk Swamp
Pitt Town Lagoon
Bethungra Dam Reserve
Doodle Corner Swamp
Fivebough Swamp
Tomneys Plain

## Namoi Catchment Management Authority

Goran Lake

## Western Catchment Management Authority

Bulloo Overflow/Carypundy Swamp
Salisbury Lake (Lake Altibouka)
Narran Lakes
Talyawalka Anabranch & Teryawynia Creek
Green Creek Swamp
Lake Burkanoko
Lake Nichebulka
Murphys Lake
Paroo River Distributary Channels
Willeroo Lake
Yantabulla Swamp (Cuttaburra Basin)
Sturt National Park Wetlands
The Salt Lake
Blue Lake (Paroo)
Gilpoko Lake
Great Artesian Basin Springs
Green Lake
Mullawoolka Basin
Peery Lake (Peri Lake)
Poloko Lake (Olepoloko Lake)
Tongo Lake
Yantabangee Lake
Blue Lake (overflow)
Budtha Waterhole
Calbocaro Billabong
Camel Lake
Coona Coona Lake
Dick Lake
Dry Lake
Gidgee Lake
Gypsum Swamp
Horseshoe Lake
Horseshoe Lake (Bartons Creek)
Pelora Lake
Pirillie Lake
Taylors Lake
Tenannia Waterhole
Waitchie Lake
Wirrania Swamp
Yammaramie Swamp
Birdsnest Swamp
Bottom Lila Lake
Lake Yandaroo
Racecourse Swamp
Toms Lake
Yarran Swamp
Culgoa River Floodplain

# Private Native Forestry **Code of Practice** for the River Red Gum Forests

The following section is a direct copy of the February 2008 PNF Code of Practice excluding the Appendix.

Note: A full version of the Code, including the Appendix, can be found on the PNF webpage www.lls.nsw.gov.au/sustainable-land-management/private-native-forestry/private-native-forestry-code-of-practice

## Contents

# Introduction

The object of this Private Native Forestry Code of Practice (the 'Code') is to ensure the supply of timber products from privately owned forests, and Crown land that is not Crown-timber land within the meaning of the *Forestry Act 2012*, at a regular rate that can be maintained indefinitely for present and future generations, while at the same time maintaining non-wood values at or above target levels considered necessary by society for the prevention of environmental harm and the provision of environmental services for the common good.

'River Red Gum Forests' means forests dominated by *Eucalyptus camaldulensis*, being forests that are consistent with the description of Forest Type 199 (River Red Gum) set out in the document called *State Forests of NSW, Research Note 17*.

## Assessment of broadscale clearing for private native forestry

Under the Code, broadscale clearing for the purpose of private native forestry improves or maintains environmental outcomes if:

- it complies with the requirements of this Code
- any area cleared in accordance with the Code is allowed to regenerate and is not subsequently cleared except where otherwise permitted by this Code.

*Note – A landowner may seek development consent to undertake private native forestry (PNF) outside the provisions of the Code under the Native Vegetation Act 2003 (NV Act).*

## Minor variation of Code

If, when preparing a Forest Operation Plan under the Code, the projected impact on the net harvestable area is greater than 10%, a landholder can request an accredited expert to examine the Forest Operation Plan and determine if it is appropriate to modify the environmental prescriptions of the Code in a specified manner.

A private native forestry **Plan** may modify in a specified manner the environmental prescriptions of the Code if an accredited officer is satisfied that:

1. the variation of the environmental prescriptions is minor
2. the proposed clearing will improve or maintain environmental outcomes
3. strict adherence to the Code is in the particular case unreasonable and unnecessary.

# The Code

## 1. PNF Plans

1. Before any forestry operations commence on private land, a **PNF Plan** under the NV Act must be approved by the Minister.
2. Forest operations under an approved **PNF Plan** must be conducted in accordance with all provisions of this Code.
3. For the purpose of preparing a **PNF Plan**, the **Local Land Services** (**LLS**) will provide available digital information of landscape features (as identified in Table A) and any drainage features (as identified in Table C).

## 2. Forest operation planning and management

### 2.1 Forest Operation Plan

1. A Forest Operation Plan must be prepared before forest operations commence.
2. A Forest Operation Plan must be in an approved form and consistent with the provisions of this Code and the requirements of the Listed Species Ecological Prescriptions for River Red Gum Forests, which are set out in the Appendix to this Code.
3. The landowner and anyone else carrying out forest operations must read, sign and date the Forest Operation Plan.
4. A copy of the Forest Operation Plan must be available on-site when forest operations are occurring.
5. A Forest Operation Plan must contain the following:
   A. A map (or maps) showing:
      i. the location and boundaries of the area in which harvesting or other forest operations will occur
      ii. recorded locations of any populations or endangered ecological communities listed under the schedules of the *Threatened Species Conservation Act 1995* and species in the Listed Species Ecological Prescriptions for River Red Gum Forests, which are set out in the Appendix to this Code
      iii. the location of landscape features as listed in Table A and drainage features as listed in Table C
      iv. the indicative location of existing and proposed roads and drainage feature crossings
      v. the indicative location of log landings and portable mill sites.
   B. A written component that provides:
      i. details of ownership of the land
      ii. a description of the forest (including its disturbance history and current condition)

iii. the estimated stand height and basal area for each stand in the area

iv. details of forest access, including any necessary construction, upgrading or maintenance of forest roads and perennial stream crossings

v. details of harvesting and/or other proposed forest operations

vi. details of flora and fauna management actions

vii. details of tree marking activities (where applicable)

viii. details of activities to promote regeneration

ix. details of relevant silvicultural treatments that may be carried out as part of the Forest Operation Plan.

6. The landowner may amend the Forest Operation Plan at any time, except for matters referred to in clause 2.1(5)(b)(iii). Any amendments to either the map or the written component must be noted on the Forest Operation Plan.

7. The landowner must retain each Forest Operation Plan, including any amendments, for the life of the **PNF Plan** or for three years after completion of the harvesting operations for which it was prepared, whichever is the later date.

8. The landowner must provide the Forest Operation Plan, including any amendments, to an authorised officer from the Environment Protection Authority if requested to do so.

## 2.2 Reporting

1. The landowner must lodge a report to the Environment Protection Authority by 31 March each year if:

   A. forest operations have been carried out on the land to which the **PNF Plan** applies in the previous calendar year, or

   B. if in the current calendar year:

      i. it is intended to carry out forest operations in the next 12 months, or

      ii. forest operations have been carried out.

2. If forest operations have been carried out on the land to which the **PNF Plan** applies in the previous calendar year, the report must specify:

   A. the approximate volumes of the timber products harvested

   B. the approximate number of hectares on which forest operations occurred

   C. the silvicultural treatments that were applied during that period.

# 3. Silvicultural operations

## 3.1 Single tree selection and thinning

1. Single tree selection and thinning operations must not reduce the stand basal area below 12 square metres per hectare ($m^2$/ha). Ideally, single tree selection and thinning should aim to space trees according to the formula ¼ diameter at breast height over bark (cm)*100.

2. The **minimum** stand basal areas are to be calculated in accordance with the *Silvicultural Guidelines for the Code of Practice for Private Native Forestry* prepared by the Environment Protection Authority.

*Note: This provision:*
1. *uses stand basal area as a simple tool to determine disturbance thresholds*
2. *establishes harvesting limits to both maintain forest biodiversity values and manage forests while considering appropriate silvicultural practices.*

## 3.2 Australian Group Selection

1. Harvest operations that result in canopy openings must conform with the following requirements:
   A. the sum of canopy openings must at no time exceed 20% of the net harvestable area
   B. the maximum width of a canopy opening must not exceed twice the stand height
   C. the minimum distance between canopy openings must not be less than twice the stand height.
2. A **canopy opening** is an area greater than 0.1 hectares in size, measured between canopy perimeters, where any vegetation remaining within the opening is less than one-half of the stand height.

*Note: For the purposes of selecting an appropriate silvicultural management regime, reference should be made to the Silvicultural Guidelines for the Codes of Practice for Private Native Forestry.*

## 3.3 Regeneration and stocking

1. As determined by the percentage of stocked plots, a minimum stand stocking of 60%, within canopy openings and 70% elsewhere in the forest, must be achieved within 36 months of a regeneration event.
2. In this clause, **regeneration event** is the second period of inundation following a harvesting or thinning operation.
3. A harvesting operation must not occur in a previously harvested area until stocking levels meet the minimum stocked plot requirements in clause 3.3(1).
4. The percentage of stocked plots is to be measured in accordance with the method for measuring plots for sampling and measuring stocking found in the Environment Protection Authority's *Private Native Forestry Codes of Practice Guideline No. 1: Guidelines for assessing regeneration and stocking*.
5. A landowner must comply with any requirements of the Chief Environmental Regulator of the EPA for the purpose of regenerating or re-establishing the forest, if the minimum percentage of stocked plots has not been reached within 36 months following a regeneration event.

*Note: Stocking is a measure of the occurrence and distribution of trees of any age throughout the forest. The simplest way to assess whether a forest is adequately stocked is to sample the level of stocking by measuring a number of plots. Plots will be found to be either stocked or unstocked. The percentage of stocked plots reflects the adequacy of stocking within the forest. Where stocking is found to be inadequate, regeneration will be required to meet the stocking requirements.*

# 4. Protection of the environment

## 4.1 Protection of landscape features of environmental and cultural significance

1. Forest operations in and adjacent to specified landscape features must comply with the requirements in Table A.
2. Old growth will be identified according to the protocol approved by the Minister.

*Table A: Requirements for protecting landscape features*

| Landscape feature | Operational conditions |
|---|---|
| Endangered ecological communities listed in the *Threatened Species Conservation Act 1995* at the date the **PNF Plan** is approved by the Minister | Forest operations may only occur in endangered ecological communities as part of an approved Ecological Harvesting Plan approved by the Chief Environmental Regulator of the Environment Protection Authority, except that existing roads may be maintained. |
| Endangered populations listed in the *Threatened Species Conservation Act 1995* at the date the **PNF Plan** is approved by the Minister | Forest operations must not result in any harm to an animal that is part of an endangered population, or result in the picking of any plant that is part of an endangered population, except that existing roads may be maintained. |
| Vulnerable ecological communities listed in the *Threatened Species Conservation Act 1995* at the date the **PNF Plan** is approved by the Minister | Forest operations must not occur in vulnerable ecological communities, except that existing roads may be maintained. |
| Old growth forest | Forest operations must not occur within old growth forest, except that existing roads may be maintained. |

| Landscape feature | Operational conditions |
|---|---|
| Wetlands | Forest operations must not occur in any wetland other than wetlands that comprise a River Red Gum broad forest type or within 20 metres of any wetland, except that existing roads may be maintained. |
| Disused mineshafts (excluding open pits less than 3 metres deep) | Forest operations must not occur within 10 metres of disused mineshafts, except that existing roads may be maintained. |
| Aboriginal object or place as defined in the *National Parks and Wildlife Act 1974* | Forest operations must not occur:<br>» within 50 metres of a known burial site<br>» within 20 metres of an Aboriginal scarred or carved tree<br>» within 10 metres of a known Aboriginal object or place (this requirement does not apply to Aboriginal objects or places that may lawfully be destroyed). |
| Areas containing items identified as heritage items in an environmental planning instrument | Forest operations must not occur within 10 metres of a listed heritage site. |

## 4.2 Protection of habitat and biodiversity

1. Habitat trees must be retained in accordance with Table B.
2. Hollow bearing trees, recruitment trees, food resource trees, roost trees and nest trees are defined as habitat trees retained for the purposes of this Code.
3. An individual tree may satisfy more than one condition in the tree retention standards (see Table B), if it has the appropriate characteristics.
4. Retained habitat trees should, where possible, represent the range of species in mature and late mature growth stages.
5. Habitat trees should, where possible, be evenly distributed throughout the area of harvesting operations and within the net logging area. Preference should be given to trees with well developed spreading crowns and minimal butt damage.
6. For the purpose of this clause:

   A. A **hollow bearing tree** is a dominant or co-dominant living tree, where the trunk or limbs contain hollows, holes or cavities. Such hollows may not always be visible from the ground but may be apparent from the presence of deformities such as protuberances or broken limbs, or places where the head of the tree has broken off. If there are more than the minimum required number of habitat trees,

preference shall be given to the largest. Trees that pose a health or safety risk may be removed and, where possible, substituted with other hollow bearing trees, and if not possible, by recruitment trees.

B. **Dead standing** trees cannot be counted as hollow bearing trees.

C. A **recruitment tree** is a large vigorous tree capable of developing hollows to provide habitat for wildlife. Preference must be given to trees from the next cohort to that of retained hollow bearing trees.

D. **Roost, nest** and **food resource trees** are defined as:

i. trees with nests or roosts of any species of raptor including barking owls

ii. trees which support maternity bat roosts

iii. trees with recent V-notch incisions or other incisions made by a squirrel glider. Recent incisions are incisions less than two-years-old as evidenced by the fact the incision has not closed.

iv. River Red Gum broad forest type trees with a diameter at breast height over bark of 125 centimetres or larger

v. trees containing nests of colonial-nesting water birds (groups of stick-nests).

*Table B: Minimum standards for tree retention*

| **Trees that must be retained** |
|---|
| 5 hollow bearing trees per hectare, within 20–50 metres of any permanent watercourse, water bodies or major wetlands, must be retained. |
| 2 hollow bearing trees per hectare in all other areas must be retained. |
| One recruitment tree from the next cohort must be retained for every hollow bearing tree retained. |
| Where the total number of hollow bearing trees is less than 10 trees per hectare within 20–50 metres of any permanent watercourse, water bodies or major wetlands or 4 per hectare elsewhere, additional recruitment trees must be retained to bring the total number of trees retained up to 10 and 4 per hectare, respectively. |
| Additional recruitment trees above the number kept for the hollow bearing trees can be kept within the riparian buffer zone. |
| All roost, nest or food resource trees must be retained. |
| Clumps of habitat trees must be retained in River Red Gum broad forests where they constitute rookeries for water bird species such as herons, cormorants, spoonbills and egrets. |

## 4.3 Minimising damage to retained trees and native vegetation

1. As far as practicable, forestry operations must not damage protected trees.
2. Without detracting from subclause (1):
   A. debris must not be heaped around protected trees
   B. machinery operations must not harm protected trees
   C. directional felling techniques must be employed to avoid (as far as is practicable) damage to protected trees.
3. In this clause **protected trees** are defined as:
   A. trees required to be retained under clause 4.2
   B. plants of the genus *Xanthorrhoea* (grass trees), genus *Allocasuarina* (forest oak) (except bull oak (*Allocasuarina luehmannii*)), and genus *Banksia*
   C. *Acacia salicina* (Cooba), *Exocarpos strictus* (dwarf cherry) and *Eucalyptus microcarpa* (grey box)
   D. other trees that are required to be retained by this Code.

## 4.4 Drainage feature protection

1. Forest operations must not occur in riparian exclusion zones, other than in accordance with this clause, and except where otherwise allowed by this Code. For the purpose of this clause, riparian exclusion zones are defined as those areas within the distances specified for 'Drainage feature' as listed in Table C.

*Table C: Riparian exclusion and riparian buffer zones*

| Drainage feature | Riparian exclusion zone distance from drainage feature | Riparian buffer zone distance beyond exclusion zone |
|---|---|---|
| Any drainage feature with an incised channel | 5 metres | Nil |
| Prescribed Streams | 20 metres | 25 metres |

2. Riparian buffer zones extend from the boundary of the riparian exclusion zone outwards away from the drainage feature for the distance specified in Table C. Limited forest operations may occur within riparian buffer zones subject to the following limitations:
   A. machinery using walkover techniques may extract logs from any area within a riparian buffer zone
   B. all hollow bearing trees are retained
   C. only 30% of the pre-harvest basal area can be removed in any ten-year period and the minimum basal area limit of 12 $m^2$/ha is maintained within the riparian buffer zone
   D. felling is directed away from the drainage line/riparian exclusion zone

E. any furrows resulting from log removal are treated to prevent concentration of water flow

F. clearing and disturbance within the riparian buffer zone is minimised.

3. The distance specified in Table C must be measured from the mean water level of the Prescribed Stream and away from the stream. For other drainage features with an incised channel, the distance must be measured away from the edge of the incised channel.

4. Where harvesting is occurring adjacent to riparian buffer zones, all tree felling should employ directional felling to minimise as far as practicable disturbance to vegetation within the riparian buffer zone.

5. Where a tree cannot be felled into the area outside the riparian buffer zone using directional felling, it may be felled into the riparian buffer zone provided that not more than 6 trees within any distance of 200 metres along the boundary of the riparian buffer zone enter the riparian buffer zone.

6. Where a tree is felled into the riparian buffer zone, the crown must not be removed from the riparian buffer zone.

7. If a tree is accidentally felled into a riparian exclusion zone, it may be removed from that zone if it contains a saleable log, provided that the crown is cut off the log at the boundary of the exclusion zone and left where it has fallen, and that the log may be recovered without any machinery operating on the ground within the riparian exclusion zone. Such removal must result in minimal disturbance to the bed and banks of the drainage feature.

8. Trees may be felled within unmapped drainage depressions, and machinery may enter unmapped drainage depressions. However disturbance must be minimised by:

   A. using walkover techniques wherever possible

   B. preventing skewing of machinery tracks as much as possible

   C. operating with the blade up at all times (except during crossing construction)

   D. not snigging along drainage depressions.

9. New roads may be constructed and old roads re-opened within riparian buffer and exclusion zones provided that:

   A. the road is identified on the Forest Operation Plan

   B. the road prism crosses the riparian zones at right angles or as close to right angles as is practicable

   C. clearing and disturbance within the exclusion zone is minimised

   D. any other necessary permits have been obtained.

10. Machinery must not operate in drainage depressions or flood runners when the soil is saturated.

11. Australian Group Selection logging systems must not be used within:

   A. any riparian exclusion zone

   B. any riparian buffer zone.

# 5. Construction and maintenance of forest infrastructure

## 5.1 Construction and maintenance of roads

1. Clearing of native vegetation for the purpose of roads, drainage structures, log landings, mill sites, snig tracks or extraction tracks must not occur except in accordance with this Code, and the clearing must be limited to the minimum extent necessary.
2. Construction of new roads and drainage feature crossings should be minimised as far as practicable, consistent with the requirements for management, harvesting and fire control in the **PNF Plan** area.
3. As far as practicable, roads must be located to facilitate outfall drainage.
4. Clearing for road construction must be to the minimum extent necessary.
5. Trees and other debris must not be stacked in landscape features referred to in Table A or riparian exclusion zones or riparian buffer zones referred to in Table C.
6. Roads must be maintained according to Table D.
7. Roads must be maintained to ensure that road surfaces remain stable and drainage systems and sediment controls remain functional.
8. Soil exposure on road verges must be kept to a minimum.
9. Roads that are not required for ongoing property management must be stabilised and allowed to revegetate.
10. Haulage must not be undertaken over any section of road where the surface has broken down, as evidenced by ruttings more than 150 millimetres deep, for any distance exceeding 20 metres.
11. Haulage on natural surface roads must cease when there is runoff from the road surface, except for trucks that have already been loaded or partially loaded. These trucks can travel to their intended destination.
12. Where existing roads are overgrown and require re-opening, the clearing width must be minimised to the extent required to make the road trafficable.
13. As far as practicable, grass cover must be maintained and disturbance to existing drainage structures minimised.
14. Blading-off of roads must not occur.

*Table D: Maximum distance that water may travel along road surfaces, table drains and snig tracks*

| Road or snig track grade (degrees) | Maximum distance (metres) |
|---|---|
| 0 to ≤ 1 | 250 |
| > 1 to ≤ 2 | 200 |
| > 2 to ≤ 3 | 150 |
| > 3 to ≤ 4 | 125 |
| > 4 to ≤ 5 | 100 |

| Road or snig track grade (degrees) | Maximum distance (metres) |
|---|---|
| > 5 to ≤ 6 | 90 |
| > 6 to ≤ 7 | 80 |
| > 7 to ≤ 8 | 70 |
| > 8 to ≤ 9 | 65 |
| > 9 to ≤ 10 | 60 |

### 5.1.1 Road drainage

1. All reasonable steps must be taken to minimise soil erosion from roads. Accordingly, at least one of the following measures must be adopted, as appropriate in the circumstances:
   A. maintain vegetative cover (that is, plant material, living or dead) that protects the soil surface from erosion
   B. establish a grass cover using a sterile seed or native grass seed, where available
   C. crossfall-drain the road or track with outfall or infall drainage or by shaping the road to a crown so water drains to both of its sides
   D. construct drainage structures to convey water away from the road formation (for example, cross drains, mitre drains or relief culverts).
2. Drainage structures must be established on a road if concentrated water flow on the road surface or table drains is likely to occur for distances exceeding the relevant spacing, as shown in Table D.
3. Earth windrows resulting from road construction and upgrading operations must be removed from the shoulders of all roads unless they are specifically constructed to prevent erosion of fill batters or where infall drainage is used.
4. Earth windrows from road maintenance must be cut through at regular intervals to ensure that water flow on road surfaces does not exceed the distances specified in Table D.
5. Rollover banks must have a minimum effective bank height of 15 centimetres (consolidated). Spoon drains must have a minimum effective depth of 15 centimetres.
6. Drainage structures must divert water onto a stable surface and kept free of debris that may impede flow of water.

### 5.1.2 Roads crossing drainage features

1. Drainage feature crossings must be stable causeways, culverts or bridges. Existing gully stuffers may be used if they are stable, but new crossings of these types must not be constructed.
2. Crossings must be designed, constructed and maintained to minimise disturbance to the passage of fish and other aquatic fauna. They must be located and constructed to cause minimum disturbance to stream banks, stream beds and natural flows. The base of the crossing must be made of erosion-resistant material such as rock, concrete or heavy timber and must conform to the natural level of the stream bed.
3. Crossings must be constructed as close as practicable to right angles to the water flow unless an angled approach reduces soil and ground disturbance.

4. Disturbance to the bed and banks of the drainage feature during crossing construction or maintenance must be minimised. Disturbed areas must be reshaped and stabilised as soon as possible following crossing construction or maintenance.
5. Any approaches to a crossing over a drainage line must be drained, using a drainage structure, within 5 to 30 metres of the crossing. (Where this is impracticable, a drainage structure must be constructed as near as practicable to the crossing.)
6. Permanent drainage crossing structures must be designed to convey a 1-in-5-year storm event and withstand a 1-in-10-year storm event. Bridges must be designed and constructed so the natural stream flow is not restricted and erosion is minimised.
7. The surface of any crossing and the approaches on both sides of it must be made of stable material that is unlikely to be displaced during normal use of the crossing or approach.
8. Causeways must be constructed of stable, non-soil material such as crushed gravel, rock, bitumen, concrete, logs, or other stable material that is unlikely to produce water turbidity.
9. Construction equipment must minimise disturbance or damage to the watercourse bed and banks. Fill and construction material must not be placed into watercourses, and surplus fill must be located outside the drainage feature exclusion zone. Stream banks and bridge embankments must be protected to minimise erosion.
10. Soil stabilisation must be undertaken in all areas disturbed by crossing construction, upgrading or maintenance.

## 5.2 Log landings, portable mill sites and snig tracks

1. Wherever practicable, log landings and portable mill sites must be located in flood runners or drainage depressions.
2. Log landings and portable mill sites must be no larger than the minimum size necessary for efficient operations.
3. Log landings and portable mill sites must be located and constructed as far as practicable to allow effective drainage during harvesting operations.
4. Log landings and portable mill sites must not be located nearer than 10 metres to an exclusion zone or riparian buffer zone.
5. Runoff from log landings and portable mill sites must not be directly discharged into a drainage feature.
6. Vegetation and debris from log landings and portable mill sites must not be deposited in an exclusion zone, buffer zone or flood runner.
7. Woody waste and debris on log landings and portable mill sites must not be stacked against retained trees.
8. Bark accumulated on log landings and sawdust on mill sites must be progressively dispersed away from the site during harvesting operations to prevent significant accumulations.
9. On completion of operations, log landings and portable mill sites must be drained and reshaped to safely disperse runoff onto surrounding vegetation.

### 5.2.1 Snig tracks and extraction tracks

1. Snig track or extraction track construction must be minimised, and as far as practicable, walkover extraction must be used, and slash retained on snig and extraction tracks.
2. Soil disturbance and exposure on snig and extraction tracks must be minimised.
3. Old snig tracks or extraction tracks must not be used if they are incised and cannot be drained.
4. In re-opening old snig tracks and extraction tracks, the use of blades should be restricted to the removal of obstructions such as understorey vegetation, logs/tree heads and surface rock, and to ensuring that the track is adequately drained.
5. Snig tracks and extraction tracks must not encroach on exclusion zones or riparian buffer zones except designated crossings and where permitted by other code conditions.
6. Blading off of snig tracks and extraction tracks must not occur.
7. Snig tracks and extraction tracks must be located and constructed to ensure that water flow along the track surface does not exceed the distances specified in Table D. This could be achieved by one or a combination of the following techniques:
   A. retain existing groundcover using walkover techniques
   B. retain or cover the track surface with slash and harvesting debris
   C. construct or maintain the track with outfall drainage
   D. construct track drainage structures.
8. On completion of operations, the following measures must be implemented where practicable: snig tracks and extraction tracks must be reshaped; all earth windrows, wheel ruts, and log furrows must be removed; and recoverable topsoil must be spread back over the track.
9. Crossbanks must be constructed to have a minimum effective height of 35 centimetres unconsolidated, or 25 centimetres consolidated, and as a guide should not be greater than 50 centimetres in height.
10. Crossbanks must not be constructed of bark or woody debris.

### 5.2.2 Snig track and extraction track crossings on drainage

1. The location of log landings and snig/extraction tracks must be planned to minimise the number of crossings required.
2. Snig track and extraction track crossings must be stable causeways (including natural surface causeways), culverts or bridges. Existing gully stuffers may only be used if they are stable. New crossings of this type must not be constructed.
3. Machinery must not cross a drainage feature which is running water or when the soil is saturated, unless by means of a stable crossing.
4. Approaches to crossings must be as close as possible to right angles to the flow of water.
5. A crossbank must be installed on each approach, between 5 and 20 metres from the drainage feature crossing. The distance must be

measured from the top of the bank of the incised channel. The drainage structure must divert water onto a stable surface. If such a surface is not available, sediment control measures must be used to prevent sediment entering the drainage feature.

6. Disturbance to the bed and banks of the drainage feature must be minimised, and any spoil must be removed from the drainage feature.
7. All areas disturbed during crossing construction and use, including approaches, must be rehabilitated following completion of use. Rehabilitation includes the reshaping of the crossing to conform as closely as possible to the original ground surface. If groundcover is not likely to recover naturally, sowing with a suitable sterile seed or endemic native seed/fertiliser mix must be undertaken to establish effective groundcover.

### 5.2.3 Wet weather limitations for snigging, log landing and portable mill operations

1. Harvesting operations must not occur when:
   A. there is runoff from the snig track surface, or
   B. soils are saturated, or
   C. soil is rutted to a depth of more than 200 millimetres below the track surface over a 20-metre section or longer.
2. Forwarders, excavators and truck-mounted loaders may be used as stationary loaders when there is runoff from the log landing.
3. All other machinery on the log landing must remain stationary when there is runoff from the log landing surface, unless the log landing is constructed of gravel or other stable material.

NSW
GOVERNMENT