



Northern
Territory
Government

Land Clearing Guidelines

Northern Territory Planning Scheme



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Territory

A Territory Government initiative

Technical Report No. 20 / 2009D
Land Clearing Guidelines

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FOREWORD

In February 2002 the Northern Territory Government released the Territory's first Land Clearing Guidelines. Since that time my Department has undertaken a number of reviews and reissued updated guidelines. Unlike much of southern Australia, the Territory's environment and landscape has not suffered from the serious and widespread problems associated with excessive broadscale land clearing. Less than 1% of the Territory has been developed, and a high proportion of that area has been to facilitate development of our towns and infrastructure. Continued development will involve some clearing of native vegetation for agriculture, industry and urban development. The NT Government is committed to sustainable land use, achieved in part by minimising the impacts of land clearing on the Territory's natural resources.

Since the initial release of the Land Clearing Guidelines, this Government has required that land clearing receives consent and is undertaken in a responsible and sustainable manner. This area of policy continues to change as new challenges like managing the Territory's greenhouse gas emissions become more important. It is important to ensure that our processes keep pace with the community's determination to protect the health of our rivers and wetlands, which depend fundamentally on the condition and continued functioning of the landscapes through which they flow.

This revision of the Guidelines makes a major contribution to our capacity to manage landscapes well, and signals Government's intention to enact new laws for the management of native vegetation. They will differ in detail from related laws in other States and Territories, but will share some basic features because they all aim to maintain or improve the health of our environment by recognising and protecting the many roles played by native vegetation. These Guidelines will be reviewed following introduction of the new native vegetation legislation.

I commend the Land Clearing Guidelines (2010) and believe they provide a valuable tool for sustainable resource management in the Northern Territory by providing landholders with guidance about the steps involved in clearing vegetation on their properties, and the rationale behind those considerations. The Guidelines help ensure that development is sustainable and the impacts of clearing are minimised to protect our unique environment, which belongs to all of us and to future generations. If you have any concerns after using these guidelines, please contact my Department on 08 8999 3631 or write to the Executive Director, Natural Resources of the Department of Natural Resources, Environment, The Arts and Sport.

KARL HAMPTON

Minister for Natural Resources, Environment and Heritage

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Purpose of the guidelines

The NT Land Clearing Guidelines (2010) play a role in guiding good land development practice in the Northern Territory by establishing standards for native vegetation clearing. The guidelines recognise that decisions to clear native vegetation are significant because clearing will lead to at least some change in landscape function. The guidelines seek to manage clearing in a way that promotes the greatest possible net benefit from use of land cleared of native vegetation.

The aim of the guidelines is to ensure that native vegetation management:

- facilitates sustainable industry and development in the Northern Territory through broad-scale plans for retention and removal of native vegetation
- recognises and fosters the essential role played by native vegetation in sustaining every aspect of Northern Territory life
- maintains the essential character of Northern Territory landscapes and their resilience to climate change through retention of native vegetation
- contributes to national targets in carbon management by managing native vegetation to optimise sequestration of carbon.

The guidelines are recognised formally under the *Planning Act* and referenced in the NT Planning Scheme. Applicants who wish to clear native vegetation must demonstrate how they have considered the guidelines. The consent authority must have regard to the guidelines and ensure that an application to clear native vegetation is consistent with them. These guidelines have been adopted by the Pastoral Land Board so they also apply to land clearing on pastoral leases. The Pastoral Land Board publishes additional guidelines specific to land clearing on pastoral leases and these must also be addressed in applications.

The guidelines work at two levels. First, they provide procedural and technical information to assist landholders and land managers to meet their statutory responsibilities for environmental management in relation to native vegetation. Second, they provide guidance to consent authorities on the range of matters they must consider when making decisions about individual applications and their obligations to inform applicants about the reasons for decisions.

This document is presented in two sections. **Section A** contains the Technical Guidelines that need to be addressed in a clearing application. **Section B** contains supporting information that informs the technical guidelines including land management principles and relevant legislation.

SECTION A: TECHNICAL GUIDELINES

1. GENERAL GUIDELINES

These guidelines are intended to provide landowners with the information to assist in formulating a native vegetation management plan for their property. Applications for the clearing of native vegetation need to address the requirements of the *Planning Act* and the provisions of the NT Planning Scheme. The Pastoral Land Board has also adopted these guidelines for clearing on pastoral land.

The level of information required will vary depending on criteria such as the extent of clearing proposed, its location and the type of vegetation to be removed. Landowners who are contemplating the clearing of native vegetation should in the first instance contact the Department of Natural Resources, Environment, The Arts and Sport (NRETAS) or the Department of Lands and Planning to discuss their plans and for advice as to the level and type of information to be provided.

The NT Planning Scheme (Clause 10.3 Clearing of Native Vegetation – Performance Criteria) specifies that applications for the clearing of native vegetation are to demonstrate consideration of:

- the *Land Clearing Guidelines* (as amended from time to time) by the Department of Natural Resources, Environment, The Arts and Sport
- the presence of threatened wildlife as declared under the *Territory Parks and Wildlife Conservation Act*
- the presence of sensitive or significant vegetation communities such as rainforest, vine thicket, closed forest or riparian vegetation
- the presence of essential habitats, within the meaning of the *Territory Parks and Wildlife Conservation Act*
- the impact of the clearing on regional biodiversity
- whether the clearing is necessary for the intended use
- whether there is sufficient water for the intended use
- whether the soils are suitable for the intended use
- whether the slope is suitable for the intended use
- the presence of permanent and seasonal water features such as billabongs and swamps
- the retention of native vegetation adjacent to waterways, wetlands and rainforests
- the retention of native vegetation buffers along boundaries
- the retention of native vegetation corridors between remnant native vegetation
- the presence of declared heritage places or archaeological sites within the meaning of the *Heritage Conservation Act*

- the presence of any sacred sites within the meaning of the *NT Aboriginal Sacred Sites Act*.

Section 46 of the *Planning Act* also specifies information that applicants must address in their application.

If an application is for clearing more than 200 hectares it will also be referred to the Minister for Natural Resources, Environment and Heritage to determine whether additional information is required. This could include developing an Environmental Impact Statement (EIS) or a Public Environment Report (PER). In some cases where there are significant issues, applications to clear less than 200 hectares may also be referred to the Minister.

Meeting Criteria and Demonstrating Merits of a Development Proposal

This section sets out the type of information required in an application to deal with the environmental effects of proposed land clearing. Applications are also used to demonstrate the merits of a proposal. As such they should provide a thorough outline of the proposal to enable full consideration.

When formulating a development plan, applicants should consider retaining native vegetation that connects with native vegetation on adjoining properties. A separate section of these guidelines relates to assessing the cumulative effects of clearing at a regional scale in the Daly River catchment. During the assessment process, the consent authority will consider the cumulative effect of clearing from any application at a sub-catchment and catchment scale.

Information to be Provided in Applications

Maps

Every application must contain:

1. A map showing the location of the parcel.
2. A map of the parcel showing areas previously cleared and proposed area or areas of clearing.
3. A map or maps of the parcel showing:
 - its boundary and the native and other vegetation types found on it, based on NRETAS maps or better mapping from other sources, if available
 - the boundary of the area or areas proposed for clearing
 - areas previously cleared
 - areas of rainforest, vine thicket, riparian vegetation, mangroves, sand sheet heaths and wetlands) and any buffers provided
 - areas of vegetation that will not be cleared because they are specifically protected e.g. sacred sites, essential habitats, heritage sites
 - native vegetation retained to provide connections with other areas of native vegetation

- native vegetation retained for visual or other public amenity, including buffers around property boundaries
 - locations of any threatened plants and the areas excluded from clearing to protect them.
4. A map or maps showing
- locations of records of threatened native animals in or around the proposed clearing and any areas excluded from clearing to protect the site
 - any area of essential habitats for wildlife and buffers to protect them in relation to the area(s) proposed for clearing
 - locations of unusually dense populations of native fauna, including seasonal aggregations and the steps taken to protect those features.

Supporting Information

Every application should contain:

Vegetation and Flora

- estimates in hectares of the area of each native vegetation type on the parcel pre-development and the amount of each vegetation type to be cleared and retained
- a list of threatened plant species, data deficient plant species and cycad species found on the parcel
- a description of the areas considered unsuitable for clearing because they occur on excessive slopes, poor or erodible soils, or otherwise unfavourable circumstances
- a discussion of management of areas of native vegetation to be retained as corridors
- a discussion of how weeds will be managed on the parcel

If flora surveys were carried out recently on the parcel, attach a copy including survey date and the names of those involved.

Native Animals (Fauna)

- a list of native animals recorded from the parcel and its surrounds that may be affected by the land clearing
- a list of threatened animal species that may be found on the parcel and its surrounds that may be affected by the development
- estimates of the area excluded from clearing in order to protect fauna
- a statement of the likely regional effects on threatened fauna or assemblages of native animals
- sources of the information consulted and used for all of the above.

If fauna surveys were carried out recently in the area, attach a copy including survey date and the names of those involved.

Where they are known to occur, narrow range endemic species should also be considered in clearing proposals. Any single clearing proposal should be limited to directly affect no more than 10% of the known range (or known number of localities) of any species, and no clearing proposal should result in the cumulative loss (that is, based on consideration of all prior clearing) of more than 30% of the known range (or known number of localities) of any species. Information about narrow range endemics can be supplied to you by the Biodiversity Conservation unit of the Department of Natural Resources, Environment, The Arts and Sport.

Significant Vegetation Types and Habitats

Sensitive or significant vegetation communities include rainforest, vine thicket, closed forest or riparian vegetation, mangroves, monsoon vine forest, sand sheet heath and vegetation containing large trees with hollows suitable for fauna.

Tree hollows provide valuable habitat for fauna. A Top End eucalypt forest that has either five or more eucalypt stems greater than 50cm diameter at breast height per hectare, and/or 30 or more eucalypt stems greater than 40cm diameter at breast height per hectare is considered to be of high value for biodiversity. Such forests are likely to be 150 to 300 years old or even more and, are considered sensitive or significant vegetation requiring special protection. Applications should show how the presence of tree hollows was assessed and how it is proposed to maintain habitat containing large trees.

Significant Areas and Land Features

An application should provide details about existing or proposed national parks or public/private reserves or conservation zones under a Planning Scheme or Parks and Conservation Masterplan that adjoin the property. In addition, if the property contains or adjoins significant natural land features such as sinkholes, caves, ranges, craters or sites of geological or geomorphologic significance, the application must demonstrate how impact on those features will be minimised.

If the site or property falls wholly or partly within or is adjacent to areas recognised as being of conservation or cultural significance (i.e. from NRETAS Maps, Northern Territory Parks and Conservation Masterplan, Register of the National Estate) an application should provide information about the nature of those features and their significance i.e. local, regional, national or international and how it is proposed to ensure they are not impacted by the development.

Sinkholes

Sinkholes may be open, covered, buried or partially filled with soil, field stones, vegetation, weathered bedrock, water or miscellaneous debris. They can open directly to underground aquifers. Land clearing can modify surface runoff, which may allow surface water and suspended contaminants to enter sinkholes. This can be mitigated by retaining vegetated buffers, as described in Table 1 below, to help prevent contaminants entering aquifers.

SINKHOLE TYPE	BUFFER WIDTH (METRES)*
Closed	50
Open	100

*The buffers will be necessarily wider where the sinkhole lies within another buffer or corridor of retained vegetation that is wider

Table 1: Native Vegetation Buffers to Sinkholes

Buffers and Corridors

Applications should show how buffers and other areas of retained vegetation are used to maximise connectivity, including in relation to retained vegetation on neighbouring properties. This is particularly important where individual areas of proposed clearing will be more than 100 hectares. Table 2 below outlines minimum widths required for native vegetation buffers and corridors.

In certain circumstances buffers of the recommended width may not be feasible on small properties or properties on which buffers and corridors create unmanageable parcels of land. Applications proposing to vary these buffers should include supporting information to enable the consent authority to consider why a reduction in the recommended buffers is appropriate.

It is also recognised that for some land uses, especially grazing, continuous and uninterrupted clearing can have practical benefit. Buffers and corridors may be varied from those in Table 2 if the applicant proposes to offset clearing through retention of native vegetation on other parts of the property. These can include:

- larger than recommended buffers around environmentally significant or sensitive vegetation;
- additional areas of native vegetation retained along drainage lines and riparian vegetation;
- configurations of retained native vegetation that directly connect similar vegetation types or particular wildlife populations within properties; and/or
- configurations of retained vegetation that directly connect different vegetation types within properties.

CLEARING SIZE (ha)	MINIMUM WIDTH (metres)*	LOCATION	PRIMARY PURPOSE
< 8	25	Boundaries	Visual amenity Chemical spray
8–20	50	Boundaries	Visual amenity Chemical spray Wildlife habitat
20–100	100	Boundaries Landscape corridors	Wildlife habitat and movement
> 100	200	Boundaries Landscape corridors	Wildlife habitat and movement Regional connectivity

*Firebreaks are additional to vegetated buffers.

Table 2: Native Vegetation Buffers and Corridors (Excluding Riparian Buffers)

Rivers, Creeks and Wetlands

Native vegetation within and immediately surrounding a watercourse is known as riparian vegetation and requires buffers. Buffers are also required on other water features including permanent and seasonal wetlands, lagoons and billabongs.

Drainage areas are often poorly defined and may not be an obvious part of a stream system (Figure 1). They act as sediment traps, filtering water before it reaches defined streams and large water bodies. Disturbance of drainage areas can have consequences in terms of flooding and erosion both on and offsite. Certain types of vegetation indicate wet or seasonally inundated areas that are largely unsuitable for development and can extend above the 100 year flood levels now referred to as the 1 per cent annual exceedance probability (AEP) line.

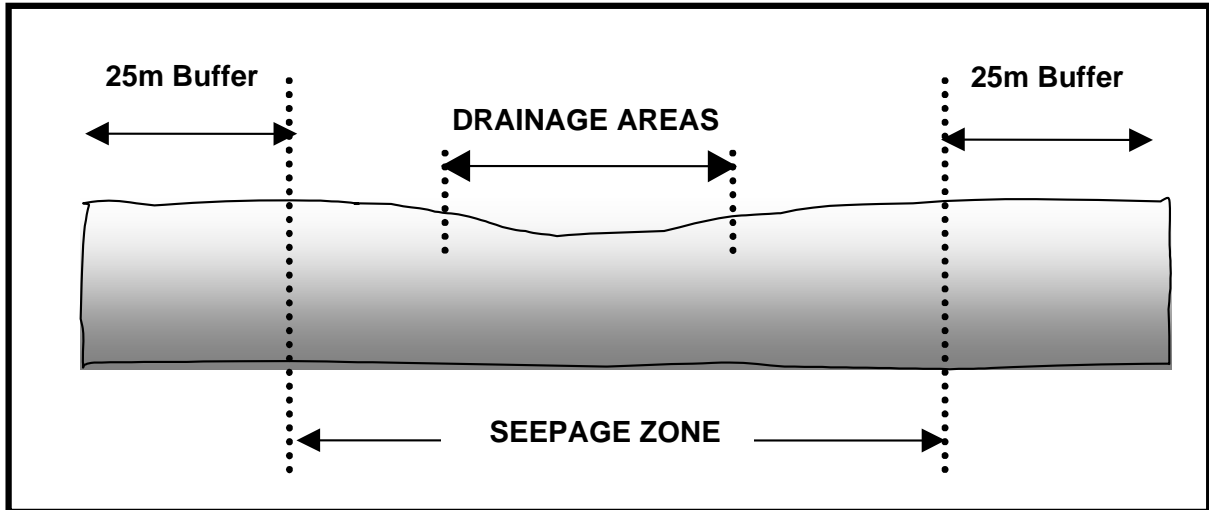


Figure 1: Poorly Defined Drainage Areas

The minimum width of a riparian vegetation buffer is related to the classification of the stream. Better-defined watercourses are commonly classified according to an ordered hierarchy called stream order. Stream order grades watercourses based on the number of lesser tributaries that flow into it, as shown in Figure 2.

A fact sheet about stream order is available from Department of Natural Resources, Environment, The Arts and Sport.

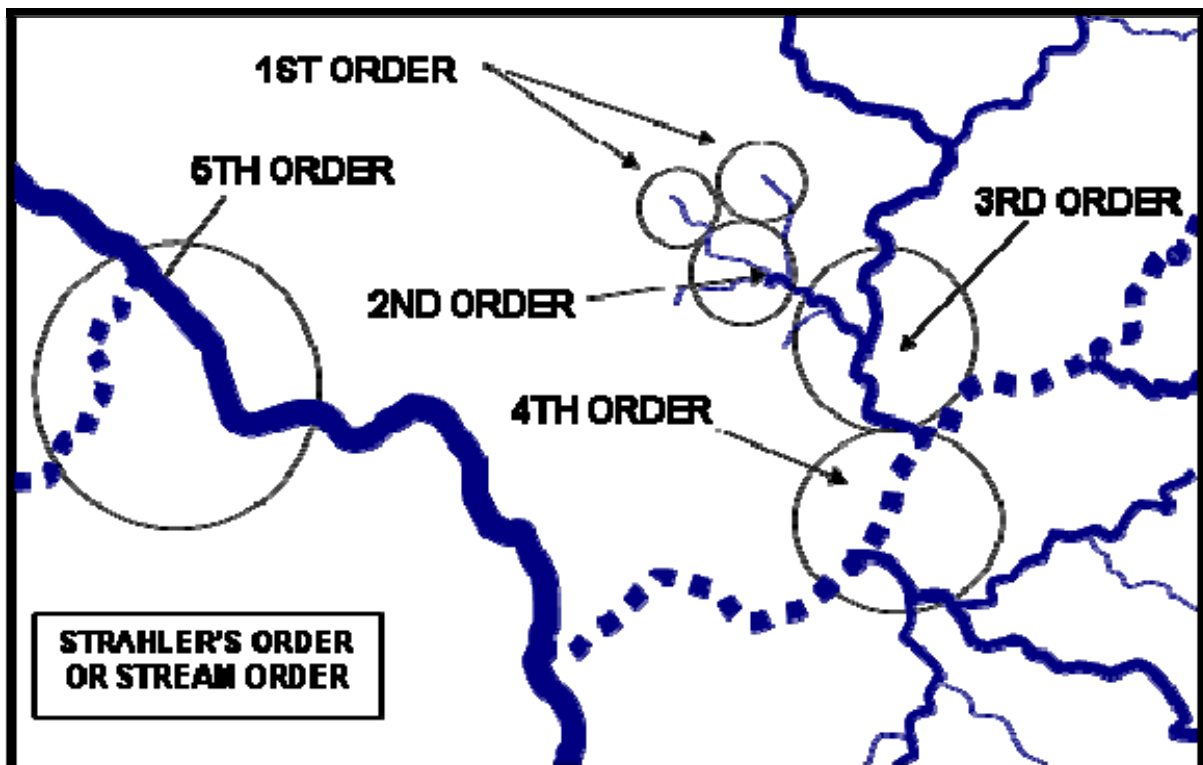


Figure 2: Stream Order

Watercourses with no tributaries are first-order streams. Two first-order streams join to form a second-order stream, two second-order streams join to form a third-order stream, and so on. Rivers will most often be fifth- or sixth-order streams, which reflects the larger catchments of these features. Stream order can be determined from a topographic map of an appropriate scale, generally 1:100 000 but should be confirmed on the ground. Table 3, below, outlines minimum widths required for riparian native vegetation buffers.

WATERWAY	STREAM ORDER	MINIMUM BUFFER WIDTH (metres)*	MEASURED FROM:
Drainage areas	Not applicable	25	The outer edge of the seepage zone (see Glossary)
Intermittent streams	First	25	The outer edge of riparian vegetation, where mapped otherwise the primary bank of the outer stream channel where there is more than one channel or the stream is braided.
Intermittent streams	Second	50	As above
Creeks	Third and fourth	100	As above
Rivers	Fifth and sixth	250	As above
Wetlands (e.g. swamps, lakes, billabongs) and mangroves	Not applicable	200	The outer edge of areas that are inundated or saturated at a frequency to at times support plants and/or animals adapted to saturated and/or inundated conditions. The water may be static or flowing fresh, brackish or salt, including areas of coastal marine waters. (see Glossary).

* Buffers will be necessarily wider where recognisable, unmapped floodplain or riparian vegetation is wider than the minimum width specified in this table. Buffers may be narrower if the applicant can clearly demonstrate that riparian vegetation and river function are confined to areas closer to the stream.

Table 3: Riparian Native Vegetation Buffers

Soil Landscape

Soil landscape information describes the soil in the context of the landscape (e.g. slope, landform, drainage), recognising that land management opportunities and limitations relate to the combination of soil and landscape characteristics.

Soil landscape is critical information for any development. Clearing should not occur on:

- imperfectly to poorly drained and very poorly drained soils, as defined by McDonald et al (2008)
- areas of high and very high erosion risk unless detailed erosion and sediment control planning is undertaken.

Appendix A shows a typical Top End wet season cross section and indicates the location in the landscape of imperfectly and poorly drained soils.

A clearing application must contain information about soil types and slope in the proposed area including specific information about the characteristics of the soil landscape. These include minimum and maximum slope, rock, soil colour, soil depth and soil drainage defined in the *Australian Soil and Land Survey Field Handbook* (McDonald et al, 2008).

An erosion and sediment control plan (ESCP) or soil conservation plan may be necessary to prevent erosion and offsite impacts such as sedimentation in waterways. (see Sources of information).

Erosion risk

Clearing native vegetation exposes soils for at least a short time. Landform, position, slope and management are all critical factors in determining erosion risk. Table 3, below, provides an indication of erosion risk based on slope.

Most Northern Territory landscapes are considered at least a moderate erosion risk because of intense rainfall. Soil landscapes that are considered fragile will always require additional erosion and sediment control planning. Fragile landscapes can include sandy and dispersive soils and those derived from granite, siltstone, and wind blown sediments such as sand dunes. Sodic or dispersive soils, sometimes found on floodplains, are highly erodible below the surface and also considered extremely fragile. All drainage areas including drainage depressions, stream banks, creeks and levees are considered extremely fragile because runoff is concentrated in these areas during rainfall. Shallow soils on steep slopes are also a high erosion risk and will always require erosion and sediment control planning. Extensive investigations and research in the Northern Territory have revealed that slopes of 1 per cent or greater are an erosion risk.

The amount of soil cover is critical in reducing erosion, especially under agricultural land use. When soil is disturbed through clearing for agricultural land uses, it is essential that maximum cover from stubble mulching, minimal or no tillage practices or pasture is maintained at the highest possible levels. Trials show that at least 50 per cent ground cover, whether it is green or brown vegetative cover, can significantly reduce erosion.

For this reason the applicant should take proposed land use into account when assessing risk categories.

The following classes define erosion risk and are illustrated in Table 4:

- **Low (L)** - Soils at low risk due to minimal slopes, soils and slow run-off. Clearing plans should follow erosion and sediment control advice.
- **Moderate (M)** - Soils at risk due to gentle slopes, and moderate run-off. Clearing plans should incorporate erosion and sediment control planning.

- **High (H)** - Soils at high risk due to substantial slopes, rapid run-off and/or fragile landscapes. Clearing plans require sediment and run-off control planning. If clearing is permitted erosion and sediment control plans will be required, possibly with engineered soil conservation structures.
- **Very High (V)** - Soils at very high risk due to excessive slopes, flooding, rapid run-off and/or fragile landscapes. Clearing plans will require detailed sediment and run-off control planning. If clearing is permitted erosion and sediment control plans will be required, often with engineered soil conservation structures.

SLOPE*				
<1%	1%	1-2%	2-3%	>3%
L	M	M-H	H	V

*Slope alone does not prohibit clearing in high and very high erosion risk areas but highlights that these areas would require careful and detailed planning and management to prevent land degradation.

Table 4: Erosion Risk Determined by Slope

Greenhouse Gas Emissions

Clearing vegetation results in greenhouse gas emissions through the loss of stored carbon from vegetation and soil, and emissions of carbon dioxide, methane and nitrous oxide from the burning and decaying of cleared vegetation. The Department of Natural Resources, Environment, The Arts and Sport will generate an estimate of the greenhouse gas emissions from the proposed clearing, using information provided by the applicant and modelling software developed by the Australian Government (National Carbon Accounting System/FullCAM). The estimate will be provided to the relevant consent authority with an associated calculation of the carbon cost based on current or modelled carbon prices.

This information will inform the consent authority's assessment of the benefit or detriment of the development to the public interest.

The information required from the applicant to estimate a carbon cost includes:

- accurate calculation of the area of each vegetation type to be cleared, stratified by soil type (there should be separate estimates of the area of each unique combination of vegetation type and soil type)
- a clear and appropriately scaled map identifying areas to be cleared, providing GPS coordinates for corners of the clearing polygon(s)
- detailed description of the proposed timing and method of clearing, including the timing of any proposed burning of cleared vegetation, planned timing of introduction of any pasture or crop, and planned timing of commencement of any grazing
- description of measures proposed to minimise or delay emissions from removed vegetation or soils, including any carbon sink enhancement actions.

Cultural Heritage

If the proposal is on a property that contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed, a full description of those sites must be provided. The result from a register search from the Aboriginal Areas Protection Authority is required with all applications. An authority certificate is also desirable. This is not compulsory under the NT *Aboriginal Sacred Sites Act* but, without a certificate, a developer would not have immunity from prosecution if the development disturbed a sacred site. If a development site contains or adjoins post-settlement sites of historical or other cultural significance, details should be provided. If there is reason to believe that places or objects of cultural significance may be disturbed, an archaeological or other heritage survey may be required. A copy of the report should be provided. Details of consultation with the Department of Natural Resources, Environment, The Arts and Sport Heritage Branch on these issues should be provided.

Water Supply and Drainage

If the proposal is within a proclaimed or proposed water management zone or water control district an application should contain its name and any beneficial use declarations. Further information is available through NRETAS Maps or by consulting Department of Natural Resources, Environment, The Arts and Sport Natural Resources Division and planning scheme zones from the Department of Lands and Planning.

If the proposal is in a drinking water catchment an application should indicate the name of the area and give details of any consultation with the Power and Water Corporation.

Irrigation developments

If the proposed development requires water, the clearing application must include:

- the purpose for which the water will be used
- total water requirement for each of the proposed uses (megalitres per annum)
- anticipated pattern of usage (monthly maximum and minimum usage)
- source of the water (e.g. dam, bore, surface water)
- where a water extraction licence is required, documentation and details of any application for a licence to extract water or proposals to purchase water from other entitlement holders.

Criteria Relevant to Coastal and Marine Areas

Coastal areas (dunes and beaches including inter-tidal zones)

Applications to clear in coastal areas or in areas subject to tidal influence (e.g. floodplain systems associated with tidal rivers and creeks, coastal monsoon vine thickets and mangroves) must contain additional information. This may include:

- a plan for acid sulphate management where the area is considered a moderate to high acid sulphate soil risk
- potential or expected impacts of the land clearing on sensitive or fragile coastal landscapes and the steps taken to reduce and manage risks.

Mangroves, rainforest and monsoon vine thickets are found in coastal areas and are considered sensitive or significant vegetation. It is recommended that the clearing of these communities should be avoided. Applicants must demonstrate how the extent to be cleared has been minimised.

On floodplain systems associated with tidal rivers, an application must demonstrate how land clearing will be managed to reduce risk of saline intrusion through damage to levees or other barriers.

Marine areas

Applications to clear on land adjoining marine areas should consider increased levels of sedimentation, changed nutrient flows and altered salinities if freshwater flows are reduced by upstream development. The extent of the expected impact should be described along with information about how it will be minimised. Areas of particular concern include:

- sensitive benthic communities, such as seagrasses or coral reefs
- marine conservation reserves or areas recommended for reservation in the National Representative System of Marine Protected Areas or NT Marine Protected Areas Strategy or of significance in the NT Marine and Coastal Biodiversity Management Strategy
- areas used extensively for recreation or for commercial fishing activities
- marine and coastal areas used by Indigenous communities for hunting or other purposes in accordance with custom or tradition.

Vegetation on Previously Cleared Land (Also Known as Regrowth)

Once a permit has been issued to clear native vegetation from a specified site and permit conditions have been fully complied with, the permit generally covers maintenance of the area, including continued removal of native plants to maintain the use for which clearing was originally approved.

However, substantial areas of the Northern Territory were cleared without specific approval before clearing controls were introduced. Controls have been in place under the *Pastoral Land Act* since 1994 and under the *Planning Act* since 2002. Some areas that were initially cleared before controls were introduced, and hence without permits, have shown substantial recovery of native vegetation.

In these situations, landowners who wish to remove native vegetation—other than by mowing—to resume the first intended land use or for new uses must seek approval under the present controls and in line with these guidelines. In reaching a decision the consent authority will consider:

- assessments of the value of the regrowth relative to undisturbed native vegetation
- the present or potential role of the regrowth in management of the site in accordance with contemporary best practice
- evidence from the applicant that the use for which consent was originally sought had continued and efforts to maintain the site by management of native vegetation in a manner consistent with that use had also continued.

While desirable that clearing is directed to areas previously cleared in preference to uncleared areas, in some circumstances this may not be appropriate such as where:

- soils or topography of previously cleared sites are regarded as unsuitable for the proposed use
- sites previously cleared would not be eligible to receive approval under these guidelines
- configurations of native vegetation may be more favourable for biodiversity or other values, including remediation of damage, if some areas of regrowth were retained.

The Department of Natural Resources, Environment, The Arts and Sport will work with landholders who have substantial areas of regrowth on their properties to help establish optimal configurations of retained vegetation.

Assessment will generally be faster if there are records of prior approval for clearing and inspections or other evidence confirm that the area had been cleared in line with the prior approvals.

2. GUIDELINES FOR INDIVIDUAL CATCHMENTS

Different catchments require different approaches to development which reflect their unique environmental characteristics. The Daly River catchment is the first such area for which there is sufficient scientific data to enable distinct guidelines to be developed. As our understanding of catchment processes develops, further catchment-specific guidelines may follow for other catchments.

Daly River Catchment

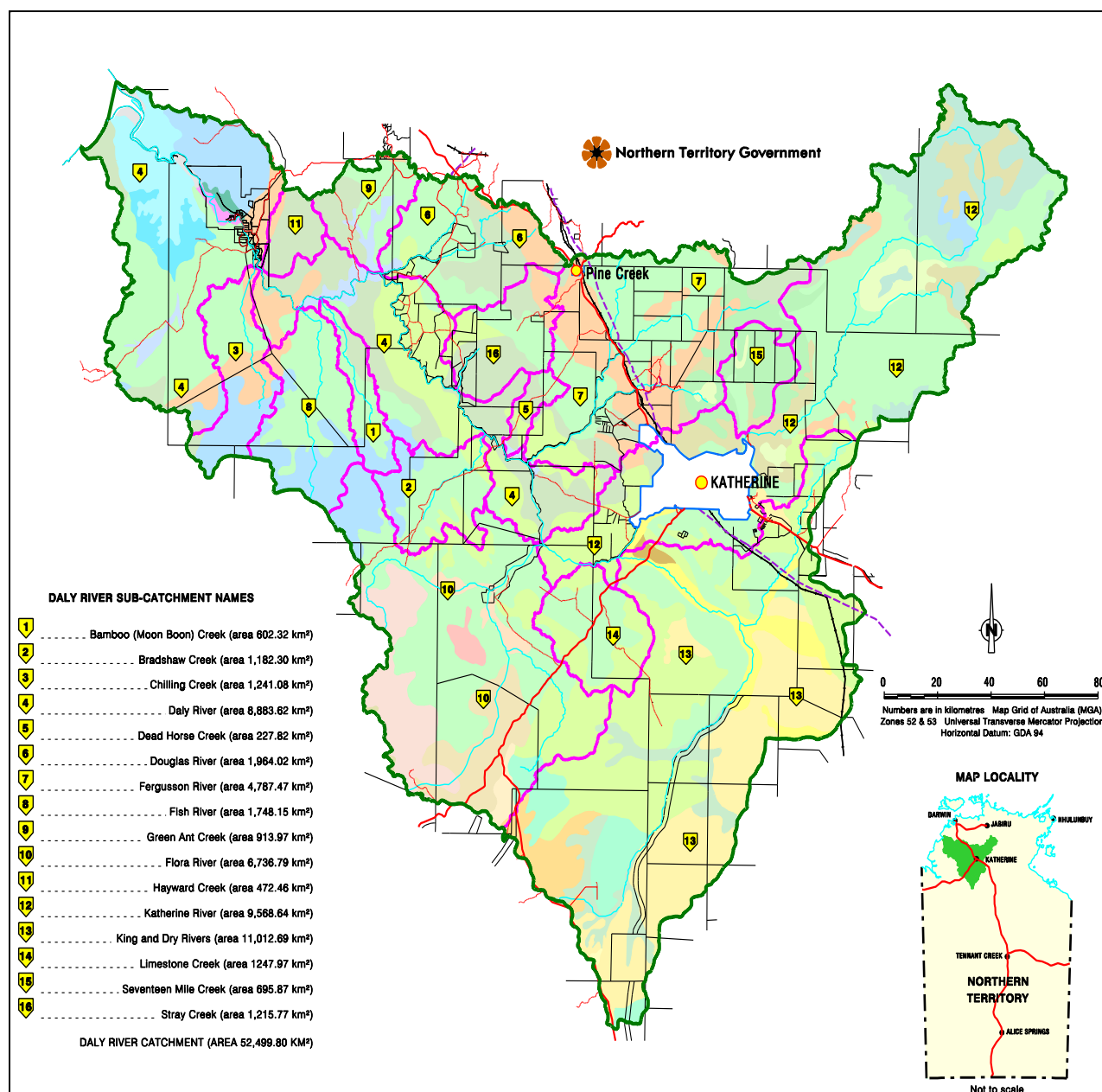


Figure 3: Daly River Catchment

Studies have shown that the Northern Territory public places a high value on the services provided by the Daly River in its present condition. Additional research is under way to underpin protection of the river and the values it offers.

This section applies to the Daly River catchment (Figure 3) and properties whose boundaries straddle or intersect the catchment. Where provisions of this section differ from those in other parts of these guidelines, this section will apply.

Vegetation buffers and setbacks

In the Daly River catchment changes in downstream water quality in the Daly River catchment must be minimised. The standard riparian watercourse buffers apply to the Daly River catchment. However, two additional minimum buffer requirements also apply, outlined in Table 5 below. Note also that the character or form of a floodplain or wetland may require that a buffer be wider than the usual minimum of 250m.

WATERWAY	STREAM ORDER	BUFFER* WIDTH	MEASURED FROM:
Rivers	Daly River	1000m	The outer edge of riparian vegetation, where mapped, otherwise the primary bank of the outer stream channel where there is more than one channel or the stream is braided.
Wetlands	Daly River catchment area	250m	The outer edge of areas that are inundated or saturated at a frequency to at times support plants and/or animals adapted to saturated and/or inundated conditions. The water may be static or flowing fresh, brackish or salt, including areas of coastal marine waters. (see Glossary).

* Buffers will be necessarily wider where recognisable, unmapped floodplain or riparian vegetation is wider than the minimum width specified in this table. Buffers may be narrower if the applicant can clearly demonstrate that riparian vegetation and river function are confined to areas closer to the stream.

Table 5: Buffers for the Daly River Catchment

Cascade assessment process

To ensure biodiversity, water quality and land condition is protected throughout the catchment, all major vegetation types within smaller river or creek sub-catchments of the Daly River have a maximum threshold of vegetation that can be approved for clearing (Table 6). Vegetation types are defined using consistent mapping across the Northern Territory and each sub-catchment extent is defined from an assessment report of the Daly River catchment.

Sub-catchments apply to the following rivers and creeks:

- Bamboo Creek,
- Bradshaw Creek,
- Chilling Creek,
- Daly River,
- Dead Horse Creek,
- Douglas River,
- Fergusson River,
- Fish River,
- Green Ant Creek,
- Flora River,
- Hayward Creek,
- Katherine River,
- King and Dry rivers,
- Limestone Creek,
- Seventeen Mile Creek, and
- Stray Creek.

In addition to limits on vegetation types and catchment areas, each property or parcel has a maximum area of permitted clearing.

COMPONENT	CONDITION
Daly River catchment	Maximum of 20% to be cleared
Vegetation types total	Maximum of 30% of any vegetation type to be cleared
Sub-catchment area	Maximum of 40% of any sub catchment to be cleared
Vegetation within any sub-catchment	Maximum of 40% of any vegetation type in each sub catchment to be cleared
Property (parcel) scale >100 ha	Maximum of 70% of any property (parcel) to be cleared

Table 6: Clearing Limits for the Daly River Catchment

Daly River Management Advisory Committee

Applications for the clearing of native vegetation including regrowth, in the Daly River catchment will be referred to the Daly River Management Advisory Committee for comment. The Daly River Management Advisory Committee was formed by the Northern Territory Government to develop options for the sustainable use and conservation of natural resources within the Daly River region. The fundamental goal of the Committee is to promote the highest standards of management of land, water and other resources in the region so that important values identified by residents and the wider community are protected.

Property Vegetation Plans

An application for clearing native vegetation in the Daly River catchment must be accompanied by a Property Vegetation Plan. The plan will cover the whole property and will provide details of areas planned to be cleared of native vegetation during the life of the plan. The plan will show how landholders propose to comply with these guidelines to maintain favourable land management practices after clearing. Demonstration that post-clearing management will be to the highest standards will be an important consideration for assessors and the consent authority.

Property Vegetation Plans should show how landholders will:

- ensure that firebreaks are appropriately located and maintained
- ensure that roads, fences and tracks have erosion control measures
- encourage the revegetation of areas previously cleared inappropriately
- deal with the long-term management of areas of regrowth
- adapt management practice in accordance with experience gained during development of the property and knowledge generated in regional scientific studies.

Applicants are encouraged to obtain professional advice from private consultants, government agency officers or other reliable sources of information and to discuss their plans with appropriate government agencies prior to lodgment and well in advance of the intended time of clearing.

The Property Vegetation Plan must incorporate the adaptive management framework for vegetation clearing developed by Daly River Management Advisory Committee. This will ensure that any clearing will retain healthy functioning landscapes, preserve regional ecosystem values, not harm or interfere with cultural values, meet government and community requirements and provide landholders with information on the effectiveness of management actions. When there is evidence that these goals are not being achieved, the framework ensures that appropriate processes are implemented to rectify the impacts.

The framework will provide for adaptation by:

- clearly specifying management goals
- careful design of management interventions using the best available information, including formal experiments when possible

- using the best available analysis to predict outcomes from management decisions about vegetation clearing and condition of remnants
- monitoring actual outcomes using agreed indicators
- ensuring that all legitimate interests have access to information on outcomes
- using evidence of departures from predictions to trigger agreed responses
- promptly implementing responses
- modifying goals, processes and practice in the light of experience gained.

Advice about developing and implementing an adaptive management framework for a property is available from Department of Natural Resources, Environment, The Arts and Sport.

SECTION B: SUPPORTING INFORMATION

1. LAND MANAGEMENT INFORMATION

Operational Techniques

Choosing the Right Time of Year

The time of year and seasonal conditions under which clearing is undertaken will affect the cost, ease, duration and environmental impact of the operation. Clearing should be undertaken when soil moisture conditions are optimal. This avoids the need for excessive and costly sucker control, reduces wear and tear on equipment and minimises soil disturbance.

Decisions about the best time to clear should be based on an assessment of the likelihood, duration and intensity of rain and resultant soil moisture conditions. These factors are particularly critical when clearing for linear structures, given the higher potential for concentration of water and erosion. Soil moisture conditions primarily determine the best time of year for clearing. If the soil is too wet, machinery efficiency can be impaired by bogging and track slip which can chew up and compact the soil unnecessarily. If the soil is too dry, machinery wear and fuel usage is significantly increased as tree trunks tend to snap rather than pull cleanly and suckers are more likely to reappear.

Given natural seasonal and climatic variability across the Northern Territory, the most appropriate time to clear will depend on location. Experience and local knowledge and advice should be used to work within the recommendations below. The best Top End conditions are likely to occur early in the Wet season, following the first rains but before the monsoon, or late in the Wet season (March/April) to the early Dry season (May). The best conditions in Central Australia are likely to be after rainfall, which can occur at any time of the year.

Marking the Area to be Cleared

Approved clearing sites should be well flagged to avoid confusion and unnecessary and illegal removal of native vegetation. Both the landowner and the machinery operator can be held accountable for the clearing of native vegetation in areas without a permit so care must be taken to ensure that the areas being cleared are authorised and that a copy of the permit to clear is available at all times during the clearing operation. Managers and clearing contractors should inspect the site together prior to clearing to confirm the location of approved clearing.

Permits to clear native vegetation include map grid references and often aerial photography as a background image so that the areas allowed for clearing can be easily interpreted on the ground. Techniques to flag a site include measuring out distances from known points such as corner posts and fence lines and using a compass and scale ruler to navigate to points on the permit plan.

Most professional clearing contractors now use GPS (Global Positioning System) equipment mounted in their vehicles to ensure correct alignment with permits and it is possible to obtain GPS point or polygon files from the Department of Natural Resources, Environment, The Arts and Sport of the approved clearing to upload onto a GPS.

Managing Site Access

Uncontrolled or excessive access to a site that is being or has just been cleared may have environmental impacts on a proposed development. Access should be managed to prevent the introduction of weeds or the unnecessary compaction or rutting of soils by vehicles.

All earthmoving equipment should be thoroughly cleaned and checked for weed seeds and debris before entering a site. This is particularly important if the equipment has been involved in weed management work at another location. Freshly exposed soils provide fertile ground for weeds to establish quickly and can add to the management costs. Weed spread into adjacent native vegetation can further increase the risk of fires.

Formalise a wash down and check site outside the immediate work area and plan vehicle access routes by placing flagging tape or signage to minimise the risk of rutting and erosion.

Minimising Soil Disturbance

The felling and ground preparation techniques to be used will also determine the degree of soil disturbance. Felling techniques are largely dictated by the scale of the proposed clearing and the proposed future land use. Environmental impacts vary according to the methods of felling. These impacts should be considered and minimised.

Clear felling or chaining is a common technique used to clear larger areas of land. When done at the right time it can minimise soil disturbance through clean pushovers and reduced vehicle movements over a site. However, the risk with clear felling is that large areas of soil are exposed at the one time so careful timing is extremely important to avoid creating large areas of erosion. Weed management can also become an issue after selective clearing.

Strip clearing involves the clearing of broad lines of vegetation along contours leaving intervening strips of native vegetation. These vegetation strips reduce the speed of storm water runoff and the potential for erosion across long slopes. Strips must be appropriately spaced, accurately surveyed to follow the contour and have good ground cover to prevent the down-slope concentration of runoff.

Selective clearing can be undertaken using lighter machinery such as graders or smaller bulldozers. However, care must be taken to not overwork the site, which can lead to the loss of topsoil or compaction and wheel rutting. At a very small scale selective clearing can be undertaken using chainsaws or chemicals. Maintenance of drainage and erosion and sediment control works will also minimise the potential for soil erosion.

Greenhouse Gas Emissions

Depending on how vegetation is disposed of, there may also be significant emissions of carbon dioxide and very potent greenhouse gases like methane and nitrous oxide. Minimising loss of native vegetation ensures that valuable carbon stores are retained. Other options available to reduce greenhouse gas emissions include staged developments, selective thinning of vegetation rather than complete removal and mulching felled material rather than the “traditional” method of burning to dispose of felled timber.

Post-Clearing Debris Management

Post-clearing debris should be cleaned up using a stick rake rather than a blade to further minimise soil disturbance. Windrows concentrate water and increase the potential for erosion. To avoid channelling and concentration of runoff, work along the contour and remove windrows immediately following construction or maintenance. Debris should be pushed with a stick rake to the inside of the permitted area and not to the outside and then burnt, mulched or removed as soon as practical. Methods proposed for disposal of cleared vegetation can influence assessments of the greenhouse gas emissions from the operation.

Windrows of debris that cannot be removed should be aligned down the contour or in a manner appropriate for the safe disposal of runoff. Debris should be pushed with a stick rake to either side of the alignment and burnt or removed to prevent the concentration of runoff. This may not be necessary in more arid, less densely vegetated areas. Debris should not be piled close to native vegetation, existing crops or other infrastructure. Under the *Bushfires Act* a Permit to Burn is required before igniting any felled material during fire control periods. For borrow pit rehabilitation and linear developments such as pipelines or cables, vegetation may be respread over the alignment to discourage water concentration.

Developing On Sloping Land

It is important to be aware of the state of land that you propose to clear under different seasonal conditions. In the Top End, carry out site inspections late in the Wet season and gather land information that will identify wet or seasonally waterlogged areas. If inspections can only be carried out in the Dry season, indicative plant species trees such as pandanus, grevillea, swamp mahogany, brush box and paperbarks can be used to identify seasonally wet environments. Small shrubs and limited vegetation cover can indicate severely leached, impoverished soils found on outcrops. Steep slopes should not be cleared of native vegetation. In central Australia coolabah, dense stands of mulga or perennial grasses such as silky browntops and cotton bush indicate drainage areas. Official flood level information and local anecdotal information can also be useful.

The steepness and length of slope is a particularly important factor in soil erosion risk. A steep slope occurs when there is a large change in height over a short distance. A long slope is one which has a gradual sustained rise over a longer distance. Given the high intensity of rainfall in the Northern Territory, significant soil erosion can occur on small slopes, even below one per cent in certain conditions. The detail of slope information required will depend on the size and nature of the area proposed for clearing and its intended use.

Contour or topographic maps, string lines, water levels and electronic levels can be used to obtain slope measurements of varying accuracy. Applicants should determine requirements for erosion and sediment control measures and in particular, ensure drainage works are protected. Use structural erosion and sediment control measures if it is necessary to clear land that presents an erosion hazard. Measures include contour banks, cross drains, drop structures, flumes, sediment traps and basins and buffer strips. Interpreting slope by eye is not reliable and it recommended that clinometers, which are inexpensive, be used.

Environmental Considerations

The Value of Regrowth

All native vegetation has some value, but obviously better developed growth offers a wider array of benefits. Woinarski (2008a) notes that the value for biodiversity often increases with age as the diversity of plants increases, their numbers increase and the proportion of plants large enough to provide shelter and food also increases. Some fauna will do well in immature regrowth but many others will not have all of their needs met until a site has avoided severe disturbance for a long time. For example, studies in the Daly River demonstrate that the convergence in faunal communities towards that of intact forest increases in a relatively orderly manner with the stature (age) of regrowth. When regrowth reaches 8m to 10m height (probably 10 to 20 years), its faunal community closely resembles that of intact forest. A notable exception is for hollow-associated species, which are more abundant in intact forest than regrowth, independent of the regrowth stature.

Denser larger stems in more mature regrowth and soils associated with less disturbed sites have more carbon sequestered than areas of relatively immature regrowth. So the carbon pollution costs of clearing will often be much lower for regrowth than for mature native vegetation. Denser vegetation will also moderate cross-landscape flows of water more than thinner stands, and taller, denser stands perform better as shades, windbreaks and visual or noise barriers.

Sites of Significance

In general, relevant agencies will be able to provide details of sites supporting significant biodiversity values. Applicants should ensure that details of such records, including regional or local flora and fauna surveys are referred to in the application and the steps taken to protect them are set out. All sites should be identified using GPS points for corners with boundaries clearly marked.

A search of the Northern Territory records available from sources such as NRETAS Maps can provide information on the distribution of fauna in relation to the site. However an absence of records does not mean that there are no species of interest or concern present. Requests for further information can be made to NRETAS, the NT Museum, research organisations or by using private organisations that provide such services.

Native Vegetation Buffers

It is important to provide buffers between all areas of retained vegetation and areas used for production (Bennett, 1998) and to maintain functional linkages among the areas of retained native vegetation. If retained native vegetation is left as isolated fragments, it will rapidly lose the most sensitive species of plants and animals and continue to run down until value for biodiversity and other ecosystem functions is severely compromised. The location and size of buffers and corridors should integrate with those on the applicant's property and neighbouring properties. Shade for cattle should be retained as clumps of trees rather than individual isolated trees and should be separated from watering points. Shade clumps, buffers and corridors are important and must be clearly marked on the proposed clearing map.

Connections in the Landscape

A key underlying principle of conservation biology is to reduce the fragmentation of areas of native vegetation. Fragmentation restricts the ability of animals to live, move and adapt across landscapes and can ultimately lead to localised extinctions. Different species require different size habitats and a diversity of plant communities. For example, without the capacity to move between habitats, animals are unable to interbreed and populations may subsequently decline. Whereas some animals are able to exist in relatively small patches of native vegetation, others roam more widely across and rely on significantly larger and intact home ranges.

Landholders can contribute to maintaining healthy networks of habitat and wildlife by combining retention of native vegetation with their agricultural and other land use patterns. Large, uninterrupted and contiguous areas of cleared land remove any trace of habitat for animals and replace many native plants with only a few introduced species. Such patterns of clearing have proved to be unsustainable and can be very costly to rehabilitate. Retaining connections between areas of native vegetation is an important part of maintaining biological and visual diversity in the landscape, but also provides other benefits.

Connectivity can be achieved through planning at the regional scale. If regional conservation plans identify areas important for maintaining landscape connectivity, landholders should make proposals for retaining native vegetation and placing corridors in a way that is compatible with those plans.

Size and Shape of Retained Areas

As well as connectivity to other areas, the size and shape of a remnant native vegetation patch will determine its viability as a functioning ecosystem. The thinner a patch is, the more likely it is to experience “edge effects” such as wind damage, weed invasion and fire. Similarly, the smaller the ratio of edge is to size (a circular shape has the lowest ratio) the slower the decline in quality over time. Patches of native vegetation that have not been cleared are recognised as significant animal habitats in the heavily modified agricultural landscapes of southern Australia, even though many species have been lost from them. In the Northern Territory regulations seek to minimise the isolation of those patches.

Tree Hollows

Tree hollows are found in mature woodland environments in living and dead trees. They have an important role for nesting and shelter for a number of native arboreal mammals and birds. They occur in all native vegetation types with a woody component, but have been best studied in the *Eucalyptus miniata*—*E. tetradonta* forests of the Top End. There is a substantial variation in the structure of these forests, and this variation in tree size and density influences distribution of tree hollows. Hollows, especially large hollows, are far more likely to occur in larger trees. This means that there is variation in the value of forests and woodlands to biodiversity.

Native Vegetation Setbacks (Buffers)

Native vegetation buffers act as setbacks from a feature or place to reduce the adverse impacts from changed land uses. Native vegetation setbacks are most commonly used adjacent to waterways to ensure that water quality is not degraded from excessive runoff, soil erosion and sedimentation that can result from cleared land. They are also used to reduce impact on other natural features such as the area below break of slope, sensitive or significant vegetation, sinkholes and wetlands. Native vegetation setbacks can be used between neighbours to maintain privacy and aesthetics and to reduce chemical spray drift, noise and visual pollution. These areas also serve as habitat for a rich array of species and facilitate movement within landscapes for native animals.

Native vegetation corridors should be positioned on a property to enable wildlife movement to vegetation on adjoining land. They can coincide with drainage floors and be positioned along boundaries and along the contours of otherwise cleared areas to inhibit sheet flow of water down long slopes and to protect from erosion. They are generally more effective and viable the larger or wider they are and are particularly important on larger properties and between neighbouring properties.

Special Protection for Threatened Species

Threatened species are those plants and animals that are rare and limited in their abundance and distribution in the wild, so that there is significant risk of losing them altogether. Northern Territory threatened species classifications are determined through processes adopted nationally and internationally. Criteria for assessment include absolute population numbers, any recorded reduction in population size, the number of sub-populations, their extent, the degree of population fragmentation and the degree of fluctuation in their geographic range, combined with analysis of the probability of extinction. The Northern Territory Government maintains a list of the flora and fauna species that have been assessed as threatened, rare, endangered and critically endangered. Loss of habitat and fragmentation of what remains is a principal cause of species loss or reduced viability that may lead to extinction.

Narrow range endemics are species of plants or animals that have their entire distribution restricted to a very small area. This does not necessarily mean that these species are currently listed as threatened. However, such species may be particularly vulnerable to any changes or developments that affect their range, as even relatively localised clearing may have a disproportionately large impact on such species.

2. RELEVANT LEGISLATION

Experience nationally and in the Territory has shown that, in the absence of effective regulation, land clearing has often been done in ways that damage natural capital and compromise the wider public interest. Clearing of native vegetation therefore requires application, assessment, and issue of a permit, apart from some minor exceptions set out in the relevant legislation for zoned, unzoned and pastoral land. Assessments include consideration of all of potential impacts and ways of reducing impacts summarised in the preceding section. Applications must provide information about all these issues. The application and assessment processes may therefore be quite demanding, especially for larger applications where risks are correspondingly increased.

Anyone who intends to develop a property in a way that requires clearing of native vegetation must be aware of planning controls, land capability and biodiversity issues that relate to the land. Prospective land buyers should consider these issues before buying a property.

This section provides information about the law and procedures for seeking consent to applications that involve clearing native vegetation. Applicants should visit the Department of Natural Resources, Environment, The Arts and Sport or Department of Lands and Planning websites or offices to ensure that they understand the current legislative requirements.

Planning Act and Pastoral Land Act

The two primary pieces of NT legislation that control the clearing of native vegetation are the *Pastoral Land Act* and the *Planning Act*. The *Pastoral Land Act* controls clearing on pastoral leases. The Act provides a form of tenure of Crown land that facilitates sustainable use of land for pastoral purposes and the economic viability of the pastoral industry. It also provides for the prevention or minimisation of degradation or other damage to the land and its indigenous plant and animal life.

The *Planning Act* controls clearing on all other land subject to the operation of other pieces of legislation listed below. The Act controls land clearing through the mechanism of assessing applications for development (pursuant to part 5 of the Act) and by reference to the requirements of the NT Planning Scheme, specifically clauses 10.2 and 10.3.

Both the objects of the *Planning Act* and the statements of principle in the NT Planning Scheme reflect the Government's commitment to appropriate outcomes for land use planning and development control. These principles include promotion of best practice environmental management; sustainable use and development of land and water resources consistent with the principles of sustainable development; and assisting in the conservation of areas and sites of environmental, cultural or heritage value as identified by government.

Other Legislation

Clearing may also be impacted by other legislation. It is recommended that applicants seek relevant professional advice before making any application for clearing. Primary sources of advice are government agencies, especially the Department of Natural Resources, Environment, The Arts and Sport and the Department of Lands and Planning or alternatively, private consultants.

Bushfires Act

The *Bushfires Act* establishes the legal framework and responsibilities for bushfire management in the Northern Territory. The fundamental principle established by the Act is that the responsibility for bushfire management rests with the landholder. A key consideration when clearing native vegetation is that there are minimum standards for firebreaks on boundary and internal fence lines.

Heritage Conservation Act

The NT Heritage Register lists all places and objects that have been formally declared to be of heritage value. A place or object listed on the register is then protected under the *Heritage Conservation Act*. Written permission must be obtained before any such place is disturbed. All prehistoric archaeological places, whether registered or not, are also provided with a level of protection under the *Heritage Conservation Act*. Written permission must also be sought for these sites before any disturbance occurs. An application for clearing must demonstrate consideration of the presence of any declared heritage places or archaeological sites.

Northern Territory Aboriginal Sacred Sites Act

An Authority Certificate for works on or near Aboriginal sacred sites must be sought from the Aboriginal Areas Protection Authority. The authority will advise if there are any issues requiring attention as part of the clearing process. Certificates are issued pursuant to the *Northern Territory Aboriginal Sacred Sites Act* and must be provided with applications for clearing.

Soil Conservation and Land Utilization Act

The *Soil Conservation and Land Utilization Act* provides for the prevention of soil erosion and for the conservation and reclamation of soil. The Commissioner for Soil Conservation may issue a soil conservation order if he or she is of the opinion that actions on an area of land would create a danger of soil erosion.

Territory Parks and Wildlife Conservation Act

The *Territory Parks and Wildlife Conservation Act* requires that approval be obtained to take or interfere with any protected wildlife as defined under the Act. Essential habitats may be declared under the *Territory Parks and Wildlife Conservation Act*. Permission to undertake certain activities in these areas must be sought from the Minister for Natural Resources, Environment and Heritage. Plant and animal species listed as endangered, rare or threatened are afforded special protection. All native orchids and cycads are protected species. Under Section 74 of the Act the Territory Parks and Wildlife Commission may negotiate and enter into agreements with a landowner relating to schemes for the protection and conservation of wildlife in, and the protection of the natural features of, the land. Permission for the commercial harvest of native vegetation, or the non-commercial harvest of protected plant species, must also be sought under the *Territory Parks and Wildlife Conservation Act* from the Department of Natural Resources, Environment, The Arts and Sport.

Applications for clearing must demonstrate consideration of the presence of threatened wildlife and/or essential habitats declared pursuant to this Act.

Environmental Assessment Act

The *Environmental Assessment Act* aims to ensure that matters affecting the environment are fully examined and taken into account. All applications to clear more than 200 hectares are directed to the Minister to determine whether additional information is required. This could include development of an Environmental Impact Statement (EIS) or Public Environment Report (PER).

If full assessment is required, the scale and complexity of a proposed development and the significance of potential impacts will determine if assessment is at the level of EIS or PER. The landowner is responsible for preparing an EIS or PER. A number of firms in the Northern Territory offer commercial services to assist with preparing such documents.

Water Act

The *Water Act* provides for the investigation, allocation, use, control, protection, management and administration of water resources, and for related purposes. Applications for clearing must demonstrate whether there is sufficient water for the intended use of the cleared land.

Environmental Protection and Biodiversity Conservation Act

The Commonwealth *Environmental Protection and Biodiversity Conservation Act* may also apply if a development is likely to have environmental impact on a matter of national environmental significance such as listed threatened species, migratory species and listed ecological communities. It is the responsibility of the landowner or land manager to ensure that all mandatory approvals for clearing pursuant to this Act are obtained. It is recommended that applicants visit the Commonwealth Department of the Environment, Water, Heritage and the Art's website and seek professional assistance in preparing their application if this Act applies.

Native Title Act

In many parts of the Territory native title has not been extinguished. The *Native Title Act* requires consultation with native title holders regarding some forms of land development which might include clearing of native vegetation, particularly where associated with a change in the nature of production activity.

Within their geographical jurisdictions land councils are responsible for undertaking consultations with Aboriginal people for relevant land clearing proposals.

Where registered sacred sites may be present, procedures for consultation regarding site protection need to be negotiated between the relevant land council and the Aboriginal Areas Protection Authority. If you are uncertain about whether the *Native Title Act* impacts upon your proposal you should seek legal advice.

Mining Act

Land clearing on mining interests is controlled by application of the *Mining Act* and mining management plans.

3. OBLIGATIONS OF LANDOWNERS AND LAND MANAGERS

These guidelines assist landowners in identifying the potential impacts of native vegetation clearing and how to plan to minimise them.

Good Planning and Good Execution of Plans

Good planning and good execution of plans depends on a full understanding of environmental capability, what the risks are and what to do to minimise those risks. A good plan will:

- identify resource attributes such as vegetation, water, soils, slope and drainage
- show recognition of cultural values associated with the land
- be clear about the intended use of the land
- describe the activities or inputs required to achieve that use
- assess the risk of damage to the land and to other users of the land such as wildlife (on-site or off-site)
- outline the inter-relations between the elements above.

Minimising Local Impact

Local impacts may appear small but have the potential to be cumulative and longstanding. Adequate planning and monitoring can reduce local impacts.

Minimising Cumulative and Regional Impacts

Damage to the integrity of natural and production systems often accumulates in increments. Individual developments may appear unthreatening because they keep on-site change within acceptable limits but combined with other actions can trigger more widespread change. The consent authority will be attentive to risks associated with cumulative impacts.

Onsite and Offsite Impacts

Clearing of native vegetation can affect areas outside the proposed development in a number of ways. For example, disturbance of soil, if poorly managed, can lead to sediment movement into adjoining waterways. Reduced water quality may damage fish habitat and so affect users over large areas. Greenhouse gas emissions from clearing have effects that are borne by the wider community and affect the wider public interest. All applications must show that, as well as dealing with onsite impacts, the broader effects on other lands and the public interest have been considered and steps to taken minimise them.

4. THE GUIDELINES IN CONTEXT

The National Context and the Northern Territory's Place in It

The Northern Territory is a 'young' jurisdiction and relatively isolated from large population centres. Outside our towns the area of land developed for the production of food and other large scale uses that require clearing remains a relatively small proportion of total land mass. This provides an opportunity for the Northern Territory to learn from mistakes made elsewhere and to keep the environmental impacts of native vegetation clearing in balance with the economic and social benefits.

Poorly managed land clearing is associated with landscape instability, soil loss, sedimentation of waterways, and long term declines in agricultural productivity. Hydrological changes may include shifts in the proportions of water running off or infiltrating into groundwater, altering the way natural systems function. Frequency and severity of flooding may increase in extensively cleared landscapes. In much of Australia, salinisation of soils is a common problem.

Even when severe physical consequences are avoided, fragmentation of landscapes and loss of connectivity can impair ecological function. Land clearing has been recognised throughout the world as a principal cause of biodiversity loss, and is listed in Australia (under the Commonwealth *Environmental Protection and Biodiversity Conservation Act*) as a threatening process causing or accelerating biodiversity decline. This is particularly significant when it is considered that Top End savannas are part of the world's largest relatively intact tropical savannas and hence have global conservation significance.

Clearing of native forests and woodlands is also a major contributor to emissions of greenhouse gases. Global estimates of the proportion of annual emissions due to deforestation (felling for forestry and land clearing) are about 17 per cent, larger than the transport sector globally. In Australia, 1990 emissions from land clearing were estimated at 136.5 Mt CO₂-e but were reduced to 62.9 Mt CO₂-e in 2006, which represented 10.9 per cent of Australia's total greenhouse gas emissions. In the Northern Territory, which produces more emissions per capita than any other State or Territory, clearing accounted for 7.1 per cent of total emissions in 2006.

Successive analyses have shown that minimising land clearing and other deforestation is a low-cost way to meet national emission targets. The Australian Government is strongly promoting international recognition of avoided deforestation as an important global emission reduction strategy. Australia cannot take such a position credibly unless its domestic land clearing policy is in order, so the Australian Government has made commitments to introduce national standards to govern land clearing. Such steps would be consistent with the National Framework for the Management and Monitoring of Australia's Native Vegetation, which is endorsed by all governments and promotes the conservation and restoration of native vegetation, including reduction of land clearing on land of all tenures. Under the Carbon Pollution Reduction Scheme proposed for Australia, if land clearing is not managed, other sectors of the economy would have to meet the cost of this source of growth in carbon pollution.

At the same time, it must be recognised that the Northern Territory, with a total area of 1.35 million square kilometres, or 17 per cent of the Australian land mass, is very different compared with most other parts of Australia. To date less than 1 per cent of that area has been cleared for all developments including urban, infrastructure, agriculture and mining uses. It is in the Northern Territory's interests to develop robust management systems for land clearing that support orderly development. This would also demonstrate to the rest of Australia that the

Northern Territory has made a real effort to protect natural and cultural values and to contribute to national targets in greenhouse gas mitigation and to reduce the cost of carbon management. In line with those obligations, the Northern Territory Government committed, during the 2005 election, to minimise greenhouse gas emissions with, among other things, improved land clearing controls and mandatory public reporting of emissions.

Northern Territory Goals in Native Vegetation Management

Native vegetation in the Northern Territory is diverse, ranging from extensive mulga, spinifex and hummock grasslands in the south to open woodlands, closed forests, floodplains and mangroves in the north. More than 4200 species of vascular plants have been identified. The Northern Territory's native vegetation is a valuable natural resource that will be managed in a responsible, controlled and sustainable manner for the benefit of all generations.

A proposal to clear an area of native vegetation is a significant enough activity to warrant assessment and careful decision-making. The larger the area cleared, the greater the risk of adverse consequences. Intact landscapes are more likely to provide long-lasting habitat and adapt to climate change than fragmented ones.

The clearing of native vegetation is to be managed to allow for orderly and sustainable development and to:

- avoid impacts on environmentally significant or sensitive vegetation
- be based on land capability and suitability for the intended use
- avoid impacts on drainage areas, wetlands and waterways
- avoid habitat fragmentation and impacts on native wildlife corridors
- avoid impacts on highly erodible soils
- avoid local and cumulative regional impacts on the ecological function of landscapes within which clearing is permitted
- avoid significant effects on regional biological diversity
- maintain visual amenity and avoid other off-site impacts on the interests of other land users and the wider public
- limit contribution to emissions of greenhouse gases
- avoid damage or destruction of sacred sites and other places or attributes of cultural significance to Aboriginal people.

In addition to meeting the standards set out in these guidelines, there are a number of options available for landholders to voluntarily protect parts of their properties. One example is the *Territory Parks and Wildlife Conservation Act*, under which a landholder can enter into an agreement for the protection and conservation of wildlife in and the protection of the natural features of the land.

Why Good Management Of Land Clearing Is So Important

Native vegetation plays a pivotal role in the health of the Northern Territory environment by protecting cultural heritage and water resources, forming and protecting soil, sustaining biodiversity, providing habitat for native wildlife, storing and cycling nutrients, providing carbon sinks and maintaining regional weather patterns. Native vegetation has economic value to the Northern Territory by maintaining water table levels and reducing the risk of salinity and soil erosion, providing shelter for stock and crops, conserving genetic resources and providing sites for tourism and recreation. Native vegetation also provides us with a sense of place and identity that contributes to the Territory lifestyle. This includes recognising a cultural, social and spiritual dimension of native vegetation for Aboriginal people.

While some level of clearing is necessary for the continued development of the Northern Territory's social and economic environment, it must be done in ways that minimise risks. Removing native vegetation generates local, regional and national costs that must be balanced against benefits.

Good management of land clearing involves ensuring that we keep:

- enough native vegetation in the landscape to slow water flows, trap pollutants and provide habitat for wildlife
- native vegetation in the right places to deliver these benefits
- the right sorts of native vegetation to deliver these benefits
- enough carbon in plants and soils to meet national and regional targets.

Water Quantity and Quality

Native vegetation influences flows of surface water and the infiltration of water through soils into aquifers. Plants also use significant quantities of water themselves. Deep-rooted trees can move sufficient water through evapotranspiration to alter the position of water tables. Native vegetation therefore influences the amount of water available for natural and production systems and the time over which it is available. For example, in a well-vegetated catchment surface flows may be lower in total than in an equivalent heavily cleared area, but continue over longer periods; groundwater flows (e.g. to springs) may be greater and extend further into the dry season

The surface over which water flows and the soils through which it moves affect the quality of water ultimately reaching rivers, streams and wetlands and groundwater storages. Water quality is determined by inorganic and organic substances carried in suspension or solution. Living biological pollutants, including disease organisms, may also be carried in water. Native vegetation can help remove pollutants and improve water quality by slowing flows and allowing solids to fall out of suspension, enhancing infiltration through healthy soils, and even absorbing some pollutants directly as nutrients. Other pollutants such as heavy metals may bind to organics associated with native vegetation and be rendered less bioactive.

Many of the same measures set out in these guidelines to protect landscape stability and biological diversity also help maintain water availability and quality.

Soils and Landforms

Our landscapes are shaped and reshaped by movement of water and air. Those forces, acting on underlying variation in geology, and interacting with biological processes, have produced the diversity of landscapes that we now enjoy.

Physical and biological influences on the way landscapes look and function interact strongly with each other. In particular, native vegetation enhances the stability of landforms and soils by moderating the rate and severity of physical processes. Removing vegetation cover from even small areas can greatly accelerate undesirable change by, for example, unleashing gully erosion processes that are difficult to control and carry damage into parts of the environment distant from the area initially disturbed. Minimising risks of destabilising soils and landforms is one of the most important goals of these guidelines.

Risk is managed first by restricting the range of situations in which vegetation can be cleared at all (e.g. by requiring avoidance of slopes and particularly erodible soils). Risk is further reduced by steps taken within cleared areas. These may involve techniques that minimise mechanical disturbance during and after clearing. Other steps will be taken to interrupt or slow flows of water or wind movement. Methods are dealt with in some detail later in these guidelines

Biodiversity

Biodiversity refers to the variety and variability of plants, animals and other living organisms and the ecosystems in which they occur. Native vegetation is itself an expression of biodiversity, but there are many other links between retention of native vegetation and the protection of biodiversity. The diversity of plants in native vegetation provides food and shelter of different types and at different times and so supports many different animals. So keeping samples of all of the different vegetation types is necessary if to avoid immediate losses.

Effects of land clearing on wildlife are multiple. Clearing reduces the amount of habitat and hence the places where wildlife can live. Clearing also isolates whatever habitat may remain so disconnected populations become more fragile. Clearing damages the dynamics of water and nutrient flows and provides opportunities for weedy plants to establish. These effects destabilise ecological function, reducing quality and hence potential population size, further compromising viability. Land management after clearing, such as the use of pesticides and fertilisers, adds to pressures and can indirectly reduce biodiversity.

Good clearing practice and native vegetation retention plans need to deal with all of these issues.

GLOSSARY

Alignment - A route for a linear development such as a road, fence line, firebreak, railway line, power line or pipeline.

Amenity – An aspect of land or landscape that enhances its value to people. In relation to a locality or building, means any quality, condition or factor that makes or contributes to making the locality or building harmonious, pleasant or enjoyable (*Planning Act*).

Biodiversity - The variety and variability of living organisms and the ecological complexes in which they occur.

Buffer - An area of land used or designed to isolate one area of land from another so that adverse effects arising from one area do not affect the other. Native vegetation buffers can be used, for example, to protect drainage lines, watercourses or sensitive vegetation communities and to improve public amenity.

Catchment - The source area for runoff flowing to a particular point.

Clean pull of timber - Occurs when soil moisture conditions are suitable for clearing, and timber is laid down with the majority of roots pulled out of the ground.

Clear felling - The removal of extensive tracts of native vegetation at a time.

Clearing of native vegetation - The removal or destruction, by any means, of native vegetation on an area of land, other than:

- the removal or destruction of a declared weed within the meaning of the *Weeds Management Act* or of a plant removed under the *Plant Diseases Act*
- the lopping of a tree
- incidentally through the grazing of livestock
- the harvesting of native vegetation planted for harvest
- the clearing of firebreaks or roads for access to the land or other land
- in the course of Aboriginal traditional use, including the gathering of food or the production of cultural artefacts
- by fire
- the removal or destruction of native vegetation occurring on a site previously cleared in accordance with a permit issued under the Act
- incidentally through mowing an area previously cleared of native vegetation.

Clearing of native vegetation includes the selective removal of a species of plant, a group of species of plants, a storey or group of storeys in whole or in part. The clearing of native vegetation is some times also referred to as land clearing.

Contour - A line connecting points of equal elevation.

Corridor - A band of vegetation that serves to connect distinct patches on the landscape, generally by linking larger, separated patches of vegetation.

Development Consent Authority - The Development Consent Authority is established under the *Planning Act*. Divisions of the authority determine development applications within their division area. Outside those areas, the consent authority is the Minister.

Drainage areas – Also known as drainage lines, drainage floors, dambos and swales are poorly defined depressions or channels down which surface water regularly concentrates and flows. Drainage areas may become temporarily inundated as storm water flows across a catchment to more significant waterways or water bodies. They play an important role, slowing runoff and allowing sediments to drop from suspension before reaching better-defined channels and water bodies. The period of inundation is for short periods only. However, water may be held for extended periods over the wet season. Unlike watercourses, drainage areas do not form well-defined channels.

Drainage system - Areas surrounding and including drainage lines and watercourses. These areas are subject to periods of inundation, may be subject to seasonal water logging and have vegetation types which often indicate a wetter environment than the surrounding country. Alterations to drainage systems may adversely impact on the drainage of adjacent land

Easement - An easement allows an individual or company a right to use or engage in some activity over land that is owned by someone else.

Endangered species - Species in danger of extinction and whose survival is unlikely if the causal factors continue operating (see also **Threatened species**).

Erosion and sediment control measures - Activities based on structural works, vegetation management, tillage operations and/or other management options designed primarily to achieve control of soil erosion and sedimentation.

Erosion hazard - The susceptibility of an area of land to the agents of erosion such as wind and water. Erosion hazard is dependent on a combination of climate, landform, soil, land use and land management factors.

Erosion risk – The intrinsic susceptibility of an area of land to the agents of erosion such as wind and water. Erosion risk depends on a combination of climate, land form and soil characteristics. As opposed to erosion hazard, land use or management factors are not considered in determining erosion risk

FullCAM – A model developed under the National Carbon Accounting System and used to construct Australia's national greenhouse gas emissions account for the land sector. The model estimates and predicts all biomass, litter and soil carbon pools in forest and agricultural systems incorporating a balance of emissions from clearing and uptake of carbon from end uses such as pasture or horticulture.

Habitat - The natural environment in which plants or animals exist.

Horticulture - Vegetable and fruit cropping.

Land capability - The ability of land to accept a type and intensity of use permanently, or for specified periods under specified management, without permanent damage.

Land clearing – Refer to definition of clearing of native vegetation above.

Land degradation - The decline in quality, including the capability, of natural land resources, commonly caused through improper use.

Land resources - Physical, chemical and biological elements relating to the land. Includes geology, soils, landform, vegetation and the location and behaviour of water in the landscape.

Land unit - An area of relatively uniform landform, soils and vegetation types.

Map scale - The relation, expressed as a ratio, between a unit of length on a map and the actual length it represents on the land surface.

Narrow range endemics - Species of plants or animals that have their entire distribution restricted to a very small area. This does not necessarily mean that these species are currently listed as threatened. However, such species may be particularly vulnerable to any changes or developments that affect their range, as even relatively localised clearing may have a disproportionately large impact on such species.

Native vegetation - Means terrestrial and intertidal flora indigenous to the Northern Territory, including grasses, shrubs and mangroves.

1 per cent annual exceedance probability (AEP) flood line - The line adjacent to a waterway at which the probability of floodwaters reaching that height is 1 per cent in any year.

Pasture improvement - The replacement of native cover by introduced species to be used for grazing.

Primary bank - The first bank at the edge of a waterway. A secondary bank is usually found beyond the primary bank and tends to include more productive land.

Rainforest – Plant communities including vine thicket and monsoon forest dominated by trees often forming a closed canopy with little light reaching the ground. Epiphytes and climbing plants are common. In these guidelines it refers to patches larger than 0.2 hectare.

Regrowth – Native vegetation recurring on an area of land that has been cleared at some time in the past.

Rehabilitation - The treatment of degraded or disturbed land to achieve an agreed level of capability and stability, preferably at least equal to that which existed prior to degradation or disturbance

Riparian - Plant communities that occur adjacent to a waterway and function to buffer (or protect) the water body.

Runoff - That portion of rainfall not immediately absorbed into, or detained upon the soil, and which thus becomes surface flow. Runoff is the major agent of water erosion. The amount of runoff depends on rainfall intensity and duration, slope, surface roughness, vegetation cover, and surface soil conditions including moisture content

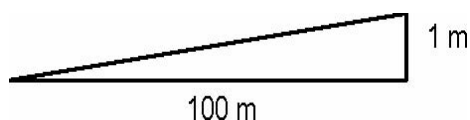
Riparian vegetation - Vegetation belonging to a river bank and located from the normal river level to the edge of the floodplain.

Sediment - Material that is being or has been removed from its original site by the action of wind, water or gravity.

Seepage zone - Land that through a combination of topography, slope, soil type, poor drainage and/or shallow ground water tables is subject to water logging and/or inundation for extended periods; usually of a minimum of two or more weeks, delineated by a seepage line.

Sensitive or significant vegetation – Sensitive or significant vegetation communities such as rainforest, vine thicket, closed forest or riparian vegetation (clause 10.3 of the NT Planning Scheme). It is used in these guidelines to also include mangroves, monsoon vine forest, sand sheet heath and vegetation containing large trees with hollows suitable for fauna.

Slope - An incline in the land's surface, upward or downward, from the horizontal. Slope can be expressed as a degree, percentage or ratio. A 1 per cent or 100:1 slope rises one metre over a distance of 100m and is equivalent to just under 0.6 degrees.



Soil erosion - The detachment and transportation of soil and its deposition at another site by wind, water or gravitational effects. Accelerated soil erosion occurs primarily as a result of the influence of human activities.

Stick rake - An attachment for heavy machinery consisting of a number of vertical bars. A stick rake is used to push debris, but allows soil to pass through.

Stream order - Describes the relative size and frequency of well-defined watercourses.

Threatened species - Species that are classified by the Northern Territory Government as “Extinct in the Wild”, “Critically Endangered”, “Endangered”, “Vulnerable”, “Near threatened” and “Data deficient” are termed threatened species.

Unzoned land - Land where land use controls apply but that is not zoned. If the land is not subject to the operation of an Act other than the *Planning Act* a permit is required to clear more than 1 hectare of native vegetation.

Wetland - Areas that are inundated or saturated at a frequency to at times support plants and/or animals adapted to saturated and/or inundated conditions. Wetlands are associated with drainage areas that are defined above. The water may be static or flowing fresh, brackish or salt, including areas of coastal marine waters. Indicators include one or more of the following:

- Topographic position: landscape features that experience periods of wetness by inundation and/or saturation from precipitation, ground water or lateral surface and/or sub-surface flow. Typical landforms include, but are not limited to; drainage depressions, swamps, floodplains, stream channels and levees (McDonald et al 2008). In arid and semi arid Australia the periods of wetness are less regular due to intermittent rainfall cycles.
- Soils: Characterised by poorly and very poorly drained soils and may include areas of imperfectly drained soils in associated transition areas which seasonally facilitate lateral water movement (McDonald et al 2008).
- Biological Community: plants and/or animals adapted to and dependent on inundated and/or saturated conditions for at least part of their life cycle.

Zoned land - Land that is mapped on a zoning map and includes municipal areas such as Litchfield, Palmerston, Darwin, Alice Springs, Katherine and Tennant Creek.

FURTHER READING

Applegate, RJ (1983). Guidelines for the rehabilitation of borrow pits in the Top End, Conservation Commission of the NT, Technical Report No. 13, NT Government Printer, Darwin.

Australian and New Zealand Environment and Conservation Council (2000). National Framework for the Management and Monitoring of Australia's Native Vegetation, Department of Environment and Heritage. Canberra.

Barson, MM, Randall, LA and Bordas, V (2000). Land Cover Change in Australia. Results of the collaborative Bureau of Rural Sciences – State Agencies' Project on Remote Sensing of Land Cover Change. Bureau of Rural Sciences, Canberra.

Bennett, AF (1998). Linkages in the Landscape: The role of Corridors and Connectivity in Wildlife Conservation. IUCN, Gland, Switzerland and Cambridge, UK.

Chamber of Mines and Petroleum (Inc). Department of Mines and Energy and Conservation Commission of the NT (undated), Code of Conduct for Mineral Exploration in Environmentally Sensitive Areas in the Northern Territory.

Conservation Commission of the NT and Department of Mines and Energy (1991). Guidelines for Mineral Exploration in Coastal Areas of the Northern Territory. Government Printer of the NT.

Department of Climate Change (2008) State and Territory Greenhouse Gas Inventories 2006, Australian Government, Canberra.

Department of the Environment, Sport and Territories (1995). Native Vegetation Clearance, Habitat Loss and Biodiversity Decline. An Overview of Recent Native Vegetation Clearance in Australia and its Implications for Biodiversity. Biodiversity Series, Paper No. 6 Biodiversity Unit, Commonwealth of Australia, National Capital Printing, Canberra.

Department of the Environment, Sport and Territories (1996). The National Strategy for the Conservation of Australia's Biological Diversity, Canberra.

Department of Lands, Planning and Environment (1999). Environmental Guidelines for Reclamation in Coastal Areas, Environment and Heritage Division.

Isbell, R (2002). The Australian Soil Classification, CSIRO Publishing, Melbourne.

McDonald, RC, Isbell, RF, Speight, JG, Walker, J and Hopkins, MS (2008). Australian Soil and Land Survey Field Book, Inkata Press, Melbourne.

Morton et al (1995). Refugia for Biological Diversity in Arid and Semi Arid Australia. Biodiversity Series, Paper No. 4 Biodiversity Unit, Commonwealth of Australia, National Capital Printing, Canberra.

National Land and Water Resources Audit (2001). Australian Native Vegetation Assessment 2001, Land and Water Australia, Commonwealth of Australia, Canberra.

O'Gara, F.P (1998) *Striking the Balance: Conservation Farming and Grazing Systems for the Semi-arid Tropics of the Northern Territory*, Department of Primary Industry and Fishery, Darwin.

Productivity Commission (2003). Impacts of Native Vegetation and Biodiversity Regulations, Melbourne.

Woinarski, J (2008) Information brief: hollow availability and “old-growth” in tropical eucalypt forests, Department of Natural Resources, Environment, The Arts and Sport, Darwin.

Woinarski, J (2008a) Information brief: the value of regrowth vegetation to biodiversity, Department of Natural Resources, Environment, The Arts and Sport, Darwin.

INFORMATION TO ASSIST IN PREPARATION OF AN APPLICATION

INFORMATION ABOUT:	WHO	WHERE
Adaptive management plan for the Douglas-Daly region	Northern Territory Cattlemen's Association, Northern Territory Government, National landcare program (DAFF)	www.ntca.org.au/douglasdaly/adaptive_mgmt.html
Areas and species of conservation significance	Department of Natural Resources, Environment, The Arts and Sport	www.nt.gov.au/nreta/parks/masterplan/publications/index.html
Areas on the Register of the National Estate	Australian Heritage Council	www.environment.gov.au/heritage/ahc/management/index.html
Climate Change	Department of the Chief Minister	www.dcm.nt.gov.au/dcm/legislation/climatechange/index.html
Comprehensive information on tropical savannas	Tropical Savannas CRC	www.landmanager.org.au
<i>Environment Protection and Biodiversity Conservation Act</i>	Australian Department of Environment, Water, Heritage and the Arts	www.environment.gov.au/epbc/index.html
Integrated natural resource management plan	Natural Resource Management Board (NT)	www.nt.gov.au/nreta/natres/nht/inrm/finalplan.html
Land, soil, water and vegetation (NRETAS Maps)	Department of Natural Resources, Environment, The Arts and Sport	www.nt.gov.au/nreta/nretamaps/
Land, soil, water, fire, flora, fauna and vegetation (INFONET)	NRM Board of the NT, Savannas CRC, NT Government	http://138.80.128.135/infonetbooklet/
National water quality guidelines	Australian Department of Environment, Water, Heritage and the Arts	www.environment.gov.au/water/quality/nwqms/index.html

INFORMATION ABOUT:	WHO	WHERE
Northern Territory Legislation (Current)	NT Department of the Chief Minister	www.nt.gov.au/dcm/legislation/current.html
Recreational use and drinking water guidelines	NT Department of Health	www.health.nt.gov.au/Environmental_Health/Water_Quality/index.aspx
Socioeconomic data	Australian Bureau of Statistics	www.abs.gov.au
Soil management including erosion and sediment control	Department of Natural Resources, Environment, The Arts and Sport	www.nt.gov.au/nreta/natres/soil/management/index.html
Soil and land management, including Striking the Balance	Department of Regional Development, Primary Industry, Fisheries and Resources	www.nt.gov.au/d/index.cfm?header=Technical%20Publications www.nt.gov.au/d/Primary_Industry/index.cfm?Header=Striking%20the%20Balance
Sources of greenhouse gas emissions	Department of Natural Resources, Environment, The Arts and Sport	www.nt.gov.au/nreta/environment/greenhouse/emissions/source.html
Vegetation maps	Department of Natural Resources, Environment, The Arts and Sport	www.nt.gov.au/nreta/natres/natveg/vegmapping/datasets.html
Weeds	Department of Natural Resources, Environment, The Arts and Sport	www.nt.gov.au/nreta/natres/weeds/ntweeds/index.html

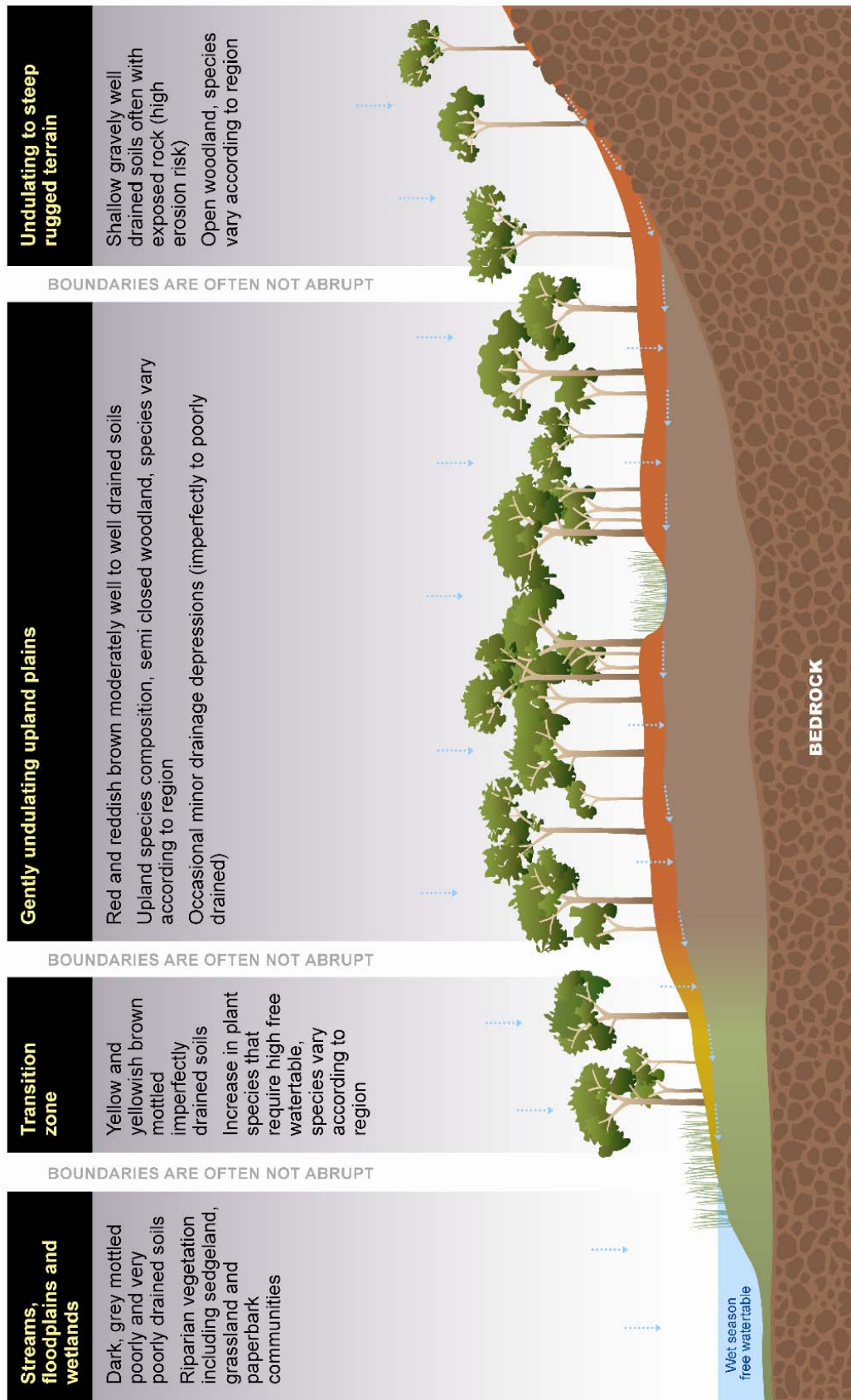
ADVICE AND ASSISTANCE

INFORMATION	AGENCY & LOCATION	PHONE
Topographic & Cadastral Mapping, Aerial Photos	Maps NT	
	Land Information Division, Department of Lands and Planning	
	3 rd floor, NAB House, 71 Smith St, Darwin	8995 5300
	1 st floor, Katherine Government Centre, 5 First St, Katherine	8973 8926
	1 st floor, Alice Plaza, Todd Mall, Alice Springs	8951 9200
Vegetation And Land Management (Soil Conservation, Erosion And Sediment Control And Vegetation Management Advice)	Land Management Unit	
	Natural Resources Division, Department of Natural Resources, Environment, the Arts and Sport	
	3 rd floor, Goyder Centre, 25 Chung Wah Terrace Palmerston	8999 4572
	32 Giles Street Katherine	8973 8838
	1 st floor Alice Plaza, Todd Mall Alice Springs	8951 9208
Land Resources (Land Capability Advice)	Land Sciences Unit	
	Department of Natural Resources, Environment, the Arts and Sport	
	4 th floor, Goyder Centre, 25 Chung Wah Terrace, Palmerston	8999 4586
	32 Giles Street Katherine	8973 8838
	1 st floor, Alice Plaza, Todd Mall, Alice Springs	8951 9208
Water Resources (Groundwater Advice)	Water Management Branch	
	Department of Natural Resources, Environment, the Arts and Sport	
	4 th floor, Goyder Centre, 25 Chung Wah Terrace, Palmerston	8999 4455
	32 Giles Street Katherine	8973 8840
	1 st floor, Alice Plaza, Todd Mall, Alice Springs	8951 9254

INFORMATION	AGENCY & LOCATION	PHONE
Native Fauna And Threatened Species	Biodiversity Conservation Unit	
	Department of Natural Resources, Environment, the Arts and Sport	
	Vanderlin Drive, Berrimah	8995 5000
	Arid Zone Research Institute	8951 8226
	Tom Hare Building, Stuart Highway, Alice Springs	
Native Flora	Herbarium	
	Department of Natural Resources, Environment, the Arts and Sport	
	Herbarium	8999 4516
	4 Mansfield Street, Palmerston	
	Tom Hare Building, Arid Zone Research Institute, Stuart Highway, Alice Springs	8951 8226
	Weed Management	Weed Management Branch
	Department of Natural Resources, Environment, the Arts and Sport	
	3 rd floor, Goyder Centre, 25 Chung Wah Terrace, Palmerston	8999 4567
	32 Giles Street Katherine	8973 8857
	99 Patterson Street, Tennant Creek	8962 4495
	1 st Floor, Alice Plaza, Todd Mall	8951 9210
Environmental Assessment	Environment, Heritage and the Arts Division	
	Department of Natural Resources, Environment, the Arts and Sport	
	Archaeological And Heritage Places	Heritage Branch
	Department of Natural Resources, Environment, the Arts and Sport	
	1 st Floor, AXA Building, 9-11 Cavanagh St, Darwin	8999 5051

INFORMATION	AGENCY & LOCATION	PHONE
Aboriginal Sacred Sites	Aboriginal Areas Protection Authority	
	1 st floor, TII Building, 74 Cavanagh Street, Darwin	8981 4700
	Belvedere House, Cnr. Bath and Parsons Streets, Alice Springs	8951 5023
Primary Industries	Department of Regional Development, Primary Industry, Fisheries and Resources	
	Berrimah Farm, Makagon Road, Berrimah	8999 2284
	Katherine Research Station, Katherine	8973 9739
Development Assessment Services (Clearing On Zoned Land)	Development Consent Authority, Department of Lands and Planning	
	Ground Floor, Cavanagh House, 38 Cavanagh Street, Darwin	8999 8959
	First Floor, Government Centre, 5 First Street, Katherine	8973 8951
Clearing On Pastoral Land	Rangeland Management Department of Natural Resources, Environment, the Arts and Sport	
	3 rd Floor, Goyder Centre, 25 Chung Wah Terrace, Palmerston	8999 4575
	32 Giles Street, Katherine	8973 8842
	1 st Floor, Alice Plaza, Todd Mall, Alice Springs	8951 9224
Pastoral Land Board	Pastoral Land Board Department of Natural Resources, Environment, the Arts and Sport	
	3 rd Floor, Goyder Centre, 25 Chung Wah Terrace, Palmerston	8999 4667

APPENDIX A: GENERAL WET SEASON LANDSCAPE CROSS SECTION



Not to scale (Adapted from CSIRO 1976)

