Resource Management Guidelines for the
Northern Territory

February 2002

LAND CLEARING GUIDELINES

Broadacre Developments
Linear Developments
Subdivisions

Northern Territory Government
Department of Infrastructure, Planning and Environment
Technical Report No. 27/2002

Land Clearing Guidelines

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Cover Photograph
Horticultural development in the Northern Territory.
FOREWORD

Unlike much of southern Australia, the Northern Territory’s environment and landscape has not suffered from the problems associated with broad scale land clearing. Less than 1% of the Territory has been cleared, and the greater proportion of that has been to facilitate development of our towns and infrastructure.

The future development of the Territory will involve some clearing of vegetation on land that is capable of supporting such enterprises. It is timely that this Government produces guidelines to assist people in undertaking clearing which minimises, as much as possible, the impacts of clearing on the environment, which after all belongs to all of us and to future generations.

This document has been produced solely as guidelines. It is not intended to be used as a Code of Practice or a Design Manual, but merely to help people undertaking clearing to conduct these operations in a responsible manner.

I would welcome any feedback on these guidelines so the document can continue to be reviewed and revised. If you have any concerns after using these guidelines, please contact my Department on 08 89994449 or write to the Executive Director Natural Resources of the Department of Infrastructure Planning and Environment.

I commend these guidelines as being a critical step to assist in the sustainable development of the Northern Territory.

[Signature]

KON VASKALIS
Minister for Lands and Planning
CONTENTS

Preface......................................................................................................................... iii
Acknowledgements........................................................................................................ iii
Figures............................................................................................................................ iv
Plates................................................................................................................................. iv
Tables................................................................................................................................. iv
Glossary.............................................................................................................................. v

Part A  Background................................................................................................. 1
1. Purpose and structure ................................................................................................. 3
2. Impacts of clearing ..................................................................................................... 5
3. Land clearing policy.................................................................................................. 7
4. Mandatory clearing approvals ................................................................................ 8
   4.1 Litchfield Shire ...................................................................................................... 9
   4.2 Pastoral leases ....................................................................................................... 9
   4.3 Other legislative controls .................................................................................. 10
5. Land capability.......................................................................................................... 12
6. Biodiversity protection.............................................................................................. 13

Part B  Planning......................................................................................................... 15
7. Clearing plans ........................................................................................................... 17
8. Site selection ............................................................................................................. 20
   8.1 No-go and ‘clear with care’ areas ...................................................................... 20
   8.2 Buffers and corridors ....................................................................................... 22
   8.3 Practical site issues ............................................................................................ 27
Part C  The clearing operation ................................. 31

9. Operational techniques .................................................................................................................. 32
   9.1 Timing ........................................................................................................................................ 32
      Soil moisture
      Recommended times
   9.2 Felling ....................................................................................................................................... 34
      Methods
      Debris removal
      Sucker control
   9.3 Ongoing management ............................................................................................................... 36

10. Erosion and sediment control ................................................................................................... 37

Part D  Special cases ................................................................. 41

11. Subdivisions ................................................................................................................................. 42
    11.1 Site selection ........................................................................................................................... 42
    11.2 Operational techniques ......................................................................................................... 43
    11.3 Erosion and sediment control ............................................................................................ 44
    11.4 Ongoing management .......................................................................................................... 44

12. Linear developments .................................................................................................................... 45
    12.1 Planning ................................................................................................................................. 45
    12.2 Operational techniques ......................................................................................................... 47
    12.3 Ongoing management .......................................................................................................... 48

References ........................................................................................................................................... 49

Appendices

A  Mapping resources ......................................................................................................................... 50
B  Stream order ................................................................................................................................. 52
C  Advice and assistance .................................................................................................................... 54
Preface

A range of other guidelines are relevant to the development of land in the Northern Territory. Some of these guidelines are relevant to specific uses or land tenures while others apply across the Territory. Full references for the following guidelines are provided on page 54.

- *Resource Management Guidelines for soil erosion and sediment control (yet to be released)*
- *Guidelines for the construction and maintenance of unsealed roads and access tracks in the Northern Territory (yet to be released)*
- *Guidelines for the rehabilitation of borrow pits in the Top End*
- *Guidelines for clearing pastoral land*
- *Code of conduct for mineral exploration in environmentally sensitive areas in the Northern Territory*
- *Guidelines for mineral exploration in coastal areas of the NT*
- *Environmental guidelines for reclamation in coastal areas*

Acknowledgments

Joanne Sedman, Maria Kraatz, Kate Hadden, and Jo Harkin had significant involvement in preparing early drafts of this document, as did several other officers of the Natural Resources Division of the Department of Infrastructure, Planning and Environment. Many other industry, government and non-government people and organisations also made a significant and welcome contribution.
Figures
Guideline structure ................................................................. 2
Drainage line buffers ............................................................. 24
Stream order methodology ...................................................... 52
Stream order example – Bennetts Creek .................................... 53

Plates
Broadacre clearing for horticulture ......................................... Cover
High value Wetlands ............................................................... iii
Wet Block .............................................................................. 4
Clearing impacts .................................................................... 6
Land clearing .......................................................................... 7
Roadside soil erosion ............................................................. 11
Vegetation indicating seasonal inundation ................................. 27
Slope interpretation ................................................................. 28
Site access ............................................................................. 29
Native vegetation .................................................................... 40
Scoured mitre drain ................................................................. 44
Topographic map .................................................................... 50
Cadastral map ........................................................................ 50
Aerial photograph ................................................................... 51
Land unit map .......................................................................... 51
Satellite image ......................................................................... 51

Tables
Clearing Plan information requirements & sources .................... 18
Clearing Plans: what to include ................................................. 19
Stream order and buffer widths ................................................. 24
Property size and native vegetation buffers .............................. 26
Strip clearing advantages and limitations ................................. 34
Slope threshold guidelines ....................................................... 38
Advice and assistance .............................................................. 54
GLOSSARY*

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

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

Blade plough
A heavy duty implement fitted with V-shaped blades which cut beneath the soil surface.

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 cutting of an entire forest stand in one cutting operation.

Clearing
The removal of vegetation by mechanical or chemical means, but not including removal of vegetation by grazing animals.

Contour
A line connecting points of equal elevation.

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. The Authority is comprised of a chairperson and four members, two nominated by local council and two appointed by the Minister for Infrastructure, Planning and Environment for a period of up to two years.

Discing
Cultivating or otherwise working the soil with an implement comprised of a series of heavy duty steel discs which cut and penetrate the soil.

Drainage line
A channel down which surface water naturally concentrates and flows. Drainage lines may become temporarily inundated as storm water flows across a catchment to more significant waterways or water bodies. The period of inundation is usually no more than 24 hours, however, water may be held for extended periods over the wet season. Unlike watercourses, drainage lines often 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 waterlogging 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. For example, a sewerage easement to the Power and Water Authority gives PAWA certain rights.

---

Endangered species
Species in danger of extinction and whose survival is unlikely if the causal factors continue operating.

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. See erosion risk.

Erosion risk
The intrinsic susceptibility of an area of land to the agents of erosion such as wind and water. Erosion risk is dependent 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.

Habitat
The natural environment in which plants or animals exist.

Horticulture
Vegetable and fruit cropping.

Incorporated Documents
Incorporated Documents are part of the NT Planning Scheme. They support land use objectives and can provide a guide to their implementation, or may be documents specific to a particular location or land use. Incorporated Documents can be used by the Development Consent Authority in the assessment of development applications.

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 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.

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.

Public amenity
Scenic or recreational enjoyment provided to the public by a given area of land.

Q100 flood line
The line adjacent to a waterway at which the probability of floodwaters reaching that height is 1 in 100 each year.

Rare species
Species which are uncommon but which are not currently considered endangered or vulnerable.

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.

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.
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.

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 waterlogging and/or inundation for extended periods; usually of a minimum of two or more weeks.

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% or 100:1 slope rises one metre over a distance of 100 m and is equivalent to just under 6°.

![1% slope diagram](image)

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 (see Appendix B).

Subdivision
The process whereby a parcel of land is divided into two or more parcels, or alternatively where multiple parcels are consolidated into one or more parcels. Requires formal surveying approval and registration of new titles.

Sucker
A strong shoot which grows from root material left under the surface.

Threatened species
A species or community that is vulnerable, endangered or presumed extinct.

Topographic map
A map indicating the shape of the ground surface as depicted by the presence of hills, mountains or plains.

Vulnerable species
Species believed likely to move into the “endangered” category in the near future if the causal factors continue operating.

Watercourse
A channel having well-defined beds and banks, down which surface water flows on either a permanent or semi-permanent basis, or at least for a substantial time after periods of heavy rainfall within its catchment. Includes rivers, creeks and streams.

Windrow
A long mound of soil or other material pushed up by mechanical means.
PART A
Background

Purpose and structure

Impacts of clearing

Land clearing policy

Mandatory clearing approvals

Land capability

Biodiversity protection
GUIDELINE STRUCTURE

PART A
Background

Purpose and structure
Impacts of clearing
Land Clearing policy
Mandatory clearing approvals
Land capability
Biodiversity Protection

PART B
Planning

Clearing Plans
Site selection

PART C
The Clearing operation

Operational techniques
Erosion & sediment control

PART D
Special cases

Subdivisions
Linear developments

APPENDICES

A Mapping resources
B Stream order
C Advice & assistance
1 Purpose and structure

These guidelines provide technical advice for planning and undertaking land clearing in the Northern Territory. Advice is provided for use by land owners, managers and developers on how to clear in a manner that will avoid/minimise adverse environmental impact.

In using this document, it is assumed that all mandatory approvals for clearing have been granted and the next step is to undertake the physical clearing operation.

Background and planning information is provided in Parts A and B, while more technical advice is provided in Parts C and D (see opposite). The Appendices provide further detailed information and contacts for advice and assistance.

The guidelines apply to all land uses and tenures, regardless of the size of the area concerned, and are consistent with guidelines covering pastoral land (Guidelines for clearing pastoral land, Pastoral Land Board 2001). Clearing on mining leases is guided primarily through the application of environmental controls provided under the Mining Act. Complementary Erosion and Sediment Control Guidelines and Guidelines for the Construction and Maintenance of Unsealed Roads and Access Tracks in the NT are being developed by the Department of Infrastructure, Planning and Environment.

While these guidelines provide basic information on how to clear in an environmentally responsible manner, detailed advice and assistance should be sought from the relevant government agencies listed on page 54.

Land owners and managers are responsible for managing their land. These guidelines are designed to help owners and managers meet their responsibilities when clearing, planning to clear or considering purchase of a property which will require clearing.

Mandatory Clearing Approvals

Approval to clear is legally required in certain circumstances (page 8).

The use of these guidelines, and/or the development of a Clearing Plan (page 17), do not replace those requirements, or any conditions that may be applied to clearing through other legislation.
Why use these guidelines?

Protect assets
Minimise the potential for property damage.

Reduce costs
Reduce costs associated with annual and long-term maintenance.

Protect the environment
Prevent land degradation, damage to water bodies and loss of biodiversity.

Speed up approvals
Showing that clearing will be undertaken in accordance with these guidelines will speed the application process, where formal approval is necessary.

Avoid penalties
Avoid potential penalties for causing land degradation.

Seasonal Conditions can vary dramatically
2 Impacts of clearing

To date (2001), less than 1.0% of the Northern Territory has been cleared for all development including urban, infrastructure, agricultural and mining.

Inappropriate clearing of native vegetation has contributed to land degradation and loss of biodiversity in other parts of Australia.

The Northern Territory has the opportunity to ensure that clearing for urban, agricultural and industrial development is planned and implemented to avoid land degradation and protect the Territory’s unique biodiversity.

Well planned and executed clearing is necessary for the growth of towns and industries and development of the Northern Territory’s social and economic environment.

Inappropriate clearing, however, can contribute to land degradation and loss of biodiversity by:

- damaging or destroying significant vegetation communities and native wildlife habitats;
- damaging or destroying corridors for the movement of native wildlife;
- increasing the risk of erosion by exposing the soil to wind and water and concentrating and channelling water;
- reducing water quality;
- creating conditions suitable for the invasion or spread of weeds;
- disturbing the natural cycling of nutrients (such as phosphorus and nitrogen) within the environment.

Some of these impacts are important not only at the site of clearing, but also in the broader catchment.

Poor clearing practice can contribute to a decline in public amenity, by affecting scenic and recreational values.
In the national context, vegetation clearance has contributed to an increase in the greenhouse gas, carbon dioxide. Greenhouse gases trap the earth’s radiation and warm the air. Recent increases in the amount of greenhouse gas means that more heat is being trapped, which in turn has contributed to a change in the earth’s climate.

For all these reasons, clearing needs to be limited to what is sensible and necessary for further economic development.

_Cleared land can be become a weed haven without proper management._
3 Land clearing policy

All clearing should be undertaken in accordance with land capability and without causing degradation or any loss of regional biodiversity values.

Land capability and biodiversity are explained in more detail below and further information is available from NT Government departments (page 54).

A prospective buyer should make themselves aware of planning objectives and controls and land capability and biodiversity issues prior to purchase of a property to determine compatibility with their intended land use.

Where specific approval to clear is required, applications will be considered in light of appropriate responses to the issues outlined in this document.

Where any clearing results in soil erosion, rehabilitation may be directed under the Soil Conservation and Land Utilization Act. In some circumstances, illegal clearing may also result in penalties being imposed under the Planning Act.

Melaleucas are often indicative of wet areas.
Prior approval for clearing must be sought for land within:

- the Litchfield Shire; and
- Pastoral Leases across the Territory.

Clearing may be prohibited in areas subject to declarations under the:

- *Heritage Conservation Act*;
- *Northern Territory Aboriginal Sacred Sites Act*;
- *Soil Conservation and Land Utilization Act*;
- *Territory Parks and Wildlife Conservation Act*; and the
- Highway Control Plan.

Clearing may also be controlled through the assessment of developments under Northern Territory legislation including the *Planning Act* and the *Environmental Assessment Act*.

The Federal *Environmental Protection and Biodiversity Conservation Act* may also be invoked by the Commonwealth if a development is likely to have environmental impacts of national significance.

*It is the responsibility of the land owner or manager to ensure that all mandatory approvals for clearing are obtained.*

Should approval not be obtained before clearing occurs, penalties can be applied. If soil erosion results, the *Soil Conservation and Land Utilization Act* may be invoked to direct rehabilitation at the owner’s expense.
4.1 Litchfield Shire

A Development Permit must be sought from the Development Consent Authority prior to the removal of more than 50% of native vegetation on any allotment covered by the Litchfield Area Plan 1992.

The Litchfield Area Plan 1992 is a Development Provision of the NT Planning Scheme and covers all areas within the Litchfield Shire.

An application for a Development Permit must be lodged with Development Assessment Services of the Department of Infrastructure, Planning and Environment. The application should include a Clearing Plan (page 17) and demonstrate how these and other relevant guidelines are to be followed. Applicants are encouraged to discuss their plans with appropriate Government agencies prior to lodgement and well in advance of the intended time of clearing.

The Litchfield Area Plan 1992 was originally formulated with a view to the protection of public amenity. In some cases, the 50% rule has not been effective in the protection of natural resources, as there is no recognition that one area of land may be more significant than another. Applications to clear are therefore assessed by a Vegetation Clearing Committee of the Development Consent Authority.

In most cases, relevant Government departments also assess development applications and a site inspection may be required. A report is made to the Development Consent Authority including a recommendation on whether the application should be approved and any special conditions that may need to be imposed.

Land owners in the Litchfield Shire are currently permitted to clear up to 50% of their allotment without approval. Clearing must not result in soil erosion or water quality problems on adjoining or down stream allotments.

4.2 Pastoral Leases

The clearing of vegetation on Pastoral Leases must be done in accordance with the Clearing Guidelines for Pastoral Land (Pastoral Land Board 1993) and only with the prior approval of the Pastoral Land Board. Further information about how to develop and lodge an application can be sought from the Pastoral Branch of the Department of Infrastructure, Planning and Environment (page 55).
4.3 Other legislative controls

Sacred sites

Clearance certificates for works on or surrounding Aboriginal sacred sites must be sought from the Aboriginal Areas Protection Authority, which will advise if there are any issues requiring attention as part of the clearing process.

Heritage and archaeological sites

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 from the Minister for Lands and Planning must be sought before any such place is disturbed.

All prehistoric archaeological places are provided with ‘blanket’ protection under the Heritage Conservation Act and written permission from the Minister for Lands and Planning must also be sought before any disturbance occurs. Relatively undisturbed areas that have not been previously surveyed may need to be surveyed.

Soil conservation

Restricted Use Areas, Areas of Erosion Hazard or areas over which a Soil Conservation Order has been placed under the Soil Conservation and Land Utilization Act, cannot be cleared without the prior approval of the Commissioner for Soil Conservation. Approval to clear may be granted with certain conditions.

Essential habitats and harvest of vegetation

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 Executive Director of the Parks and Wildlife Commission NT.

Permission for the commercial harvest of vegetation, or the non-commercial harvest of protected plant species, must also be sought from the Executive Director of the Parks and Wildlife Commission NT under the Territory Parks and Wildlife Conservation Act. All orchids and cycads are protected species.
Highway Control Plan

The Highway Control Plan generally prohibits (except with the consent of the Minister for Lands and Planning) the removal of native vegetation from land within 100 m of the road reserve (or if there is no reserve, the centreline) of all roads to which the control plan applies. Clearing for fencelines, firebreaks, access points and buildings is exempted.

Seek advice...

Irrespective of whether formal application and approval is necessary, people intending to clear should seek advice and assistance on how to plan the operation and avoid unforeseen problems.

Roadside soil erosion.
5 Land Capability

Land capability is the ability of land to accept a type or intensity of use permanently, or for specified periods under specific management, without permanent damage.

Land capability is assessed by considering:

- land resource attributes such as soils, slope, and drainage;
- the intended use of that land;
- the activities or inputs required to achieve that use;
- the risk of damage to the land, (both on-site or off-site); and
- the inter-relations between each of the above.

It is necessary to select areas for clearing by carefully assessing land capability and the limitations and constraints, which it may impose on the proposed development.

Land should only be cleared if the risk of degradation is low and the resultant area is capable of being used for the purpose for which it was intended. Limitations or constraints include:

- slope;
- erodible soils;
- waterlogging or seasonal inundation;
- rock outcrop; and
- off-site impacts, such as alteration to drainage in neighbouring properties.

There are some environments, which should not be cleared under any circumstances, and others in which advice should be sought from the relevant experts before clearing is undertaken. A summary of these is provided below in the section on Site Selection.
Biodiversity Protection

Biodiversity refers to the variety and variability of plants, animals and other living organisms and the ecosystems in which they occur.

There is a clear link between the retention of native vegetation and the protection of biodiversity. To reduce the impacts of clearing, it is important to protect the plants, animals and/or ecosystems which may be a particularly important component of biodiversity. This includes:

- sensitive or significant plant and animal species including rare, endangered or threatened species;
- sensitive or significant plant communities, such as mangroves, rainforests, vine thickets and those along waterways; and
- other plant communities which provide corridors for wildlife movement between habitats.

The retention and maintenance of buffer zones around areas, including any of the above, is strongly recommended.

Recommended widths for buffers around waterways and significant vegetation communities and vegetation corridors or zones are provided below in the section on Site Selection.
summary

Impacts of clearing
Inappropriate clearing can contribute to land degradation and loss of biodiversity.

Land Clearing policy
Clearing should be undertaken in accordance with land capability and without causing land degradation or any loss of regional biodiversity values.

Mandatory clearing approvals
Approval to clear must be sought in certain circumstances.

Land capability
Assess constraints
Develop within capabilities

Biodiversity protection
Protect sensitive or significant plant and animal species and communities.
Leave buffers
PART B
Planning
Clearing plans
Site selection
Set aside time before clearing to gather relevant information, talk to experts, and make decisions about how to minimise environmental impacts.

**Is the operation going according to plan?**

- Partially completed clearing operations can be susceptible to weed invasion and soil erosion.

- The ability to complete clearing as planned is critical to ensuring that all environmental protection measures are undertaken before degradation occurs.

- All aspects of the development or intended land use must therefore be fully considered before clearing commences.

- If the clearing operation cannot be completed as planned, it is important that appropriate measures are put in place to prevent land degradation.

Planning is required to:

- identify issues and problem areas at an early stage; and

- avoid areas likely to cause ongoing maintenance or management problems.

Land capability and biodiversity protection require careful consideration.

Aspects of the clearing operation such as site selection, operational techniques (including timing, felling and ongoing management) and the need for erosion and sediment control measures need to be considered in the planning stage.

A key step in planning is the development of a written Clearing Plan. In some cases this is required by law, but in all cases, it is strongly recommended.
Develop a Clearing Plan if...

- There is a legal requirement to do so (page 8).

OR THE AREA CONTAINS ANY OF THE FOLLOWING...

- Drainage lines, watercourses (rivers, creeks), wetlands or seepage areas
- Seasonally waterlogged areas
- Slopes greater than 5%
- Erosion-prone soils
- Sensitive or significant vegetation or wildlife species and communities
- Noxious weeds

The development of a written Clearing Plan will assist in the planning process by identifying specifically what you want to do, and by speeding up any approval process.

This is a mandatory requirement for clearing on Pastoral Leases, and for clearing more than 50% of native vegetation on any allotment in the Litchfield Shire (page 9). If these mandatory requirements do not apply, the development of a clearing plan and the seeking of assistance from government agencies is still strongly recommended (see below).

A Clearing Plan should clearly identify all aspects of the clearing operation that can potentially impact the environment, and devise ways in which that impact can be minimised or avoided.

A Plan may take the form of maps and a brief report that demonstrate how these guidelines are to be followed. It should be a practical plan that can be used by all people involved in the operation.

The information on which a Clearing Plan should be based, and the recommended components, are outlined on the following pages.
# Clearing Plan

## Information Requirements & Sources

<table>
<thead>
<tr>
<th>INFORMATION</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Location Map</strong> (topographic or administrative)</td>
<td>MapsNT, DIPE</td>
</tr>
</tbody>
</table>
| **B. Sketch map of the site including:**  
  - total area to be cleared  
  - any areas previously cleared  
  - site access | |
| **C. Natural resource information:**  
  1. Soil type, slope, landform  
  - erosion prone areas  
  - length and degree of slope  
  - general description | Natural Resources, DIPE  
  Natural Resources, DIPE  
  Natural Resources, DIPE |
  2. Wildlife  
  - general description  
  - sensitive or significant species including rare, threatened or vulnerable species  
  - weeds | Natural Resources, DIPE  
  Conservation Management, DIPE  
  Resource Management, DBIRD |
  3. Wildlife  
  - significant or sensitive species and habitats, including rare, threatened or vulnerable species (e.g., bird rookeries, flying fox roosts) | Conservation Management, DIPE |
  4. Watercourses and drainage  
  - flooding potential  
  - waterlogging or seasonal inundation | Natural Resources, DIPE  
  Natural Resources, DIPE |
  5. Surface water and groundwater availability & quantity, if required for proposed use.* | Natural Resources, DIPE |
| **D. Heritage and archaeological places**  
  **sacred sites** | Heritage Conservation Branch, DIPE  
  Aboriginal Areas Protection Authority |

* A Clearing Plan that involves clearing for commercial horticultural or agricultural purposes must be accompanied by documentation that confirms the availability of a water supply of sufficient quality and quantity for the operation proposed.
# Clearing Plan

**What to include:**

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>TO INCLUDE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Reason for clearing</strong></td>
<td>A description of the final land use and total area that will ultimately be cleared.</td>
</tr>
<tr>
<td></td>
<td>Persons or organisations from which information and advice has been sought.</td>
</tr>
<tr>
<td>2. <strong>Site selection</strong></td>
<td>The size and location of any buffers for waterways or public amenity and native vegetation corridors and zones.</td>
</tr>
<tr>
<td></td>
<td>Other areas which will not be cleared.</td>
</tr>
<tr>
<td></td>
<td>Areas in which advice has been sought on how to clear safely.</td>
</tr>
<tr>
<td></td>
<td>Access to and from the site.</td>
</tr>
<tr>
<td></td>
<td>Location of proposed infrastructure.</td>
</tr>
<tr>
<td>3. <strong>Operational techniques</strong></td>
<td>The timing of all stages of the operation.</td>
</tr>
<tr>
<td></td>
<td>Felling techniques to be used including debris removal and sucker control.</td>
</tr>
<tr>
<td></td>
<td>Ongoing management</td>
</tr>
<tr>
<td>4. <strong>Erosion and sediment control</strong></td>
<td>The design and location of measures to be implemented.</td>
</tr>
</tbody>
</table>
Decisions regarding the location and extent of clearing should be based on:

- Land capability;
- Biodiversity protection; and
- The ability to complete clearing within the time and budget allocated. Land degradation can result if clearing is not completed as planned.

The retention of buffers and native vegetation corridors is strongly recommended.

8 Site selection

8.1 “No –Go” & “clear with care” areas

There are certain areas which should not be cleared at all or which should only be cleared if advice has been sought relating to how impacts can be minimised. Guidelines regarding these areas are provided opposite.

Special circumstances

In some cases, clearing is undertaken in legally gazetted or otherwise pre-determined sites. Road alignments, for example, are often pre-determined and cannot feasibly be altered. Clearing for firebreaks is required by law and must be undertaken. The control of noxious weeds is also legally required and may require clearing.

In such circumstances, particular attention must be paid to when and how clearing is undertaken. Temporary and/or permanent soil conservation structures may be required and guidelines for erosion and sediment control will apply.
NO – GO AREAS

Do not clear...

- Drainage lines, watercourses, wetlands or seepage zones
- Sensitive or significant vegetation communities such as rainforest, vine thicket or closed forest
- Areas not immediately required for the intended use
- Areas afforded protection under various legislation such as:
  - essential habitats
  - heritage and archaeological places
  - Aboriginal sacred sites and
  - restricted use areas, areas of soil conservation hazard and areas over which a soil conservation order is in place.

CLEAR WITH CARE

Seek advice before clearing...

- Erosion-prone soils
- Previously eroded areas
- Areas undergoing rehabilitation
- Seasonally waterlogged soils or seepage areas (see page 27)
- Areas infested with noxious weeds
  (Legal requirements apply to controlling the growth or spread of noxious weeds.)
- Buffers to watercourses
  (See page 24 for recommended buffer widths. Field inspections are strongly recommended.)
- Slopes over 0.5%
  (This threshold is higher for some land uses. See page 38).

For advice and assistance, contact the relevant agency.
Details are provided on page 54.
8.2 Buffers and corridors

Waterways

Vegetation within and/or surrounding waterways is known as riparian vegetation.

Riparian vegetation:

- maintains bank stability and prevents erosion;
- maintains water quality and the health of aquatic plants and animals;
- filters sediment and restricts the spread of chemical pollutants and fertilisers; and
- provides habitat for wildlife and corridors for their movement throughout the country.

The retention of buffers on either side of a waterway is strongly recommended.

The recommended width of such buffers depends on the size and character of a waterway. This can vary from well-defined watercourses, such as creeks or rivers, to less well-defined drainage lines, seepage areas and wetlands.

![Small creeks and rivers are essential to the health of the environment.](image-url)
Stream order

More well-defined waterways or “watercourses” are commonly classified according to a hierarchy of stream order (Appendix B).

Smaller watercourses may be first- or second-order streams, while rivers will be fifth- or sixth-order streams.

The order of a stream should determine the size of the buffer but a minimum of 20 metres is necessary. The buffer width should be measured from the primary bank.

The primary bank lies at the outer edge of the waterway.

The table below provides a summary of recommended buffer widths for defined watercourses of various stream orders and for less well-defined waterways such as wetlands and drainage lines.

Drainage lines

Drainage lines collect and safely channel runoff into more significant waterways or water bodies. Disturbance of drainage lines can have serious consequences in terms of flooding and erosion both on- and off-site.

Drainage lines often have no obvious channels and can be difficult to define, especially during the drier months of the year.

Certain types of vegetation indicate wet or seasonally inundated areas and seepage zones (see page 27). Such areas are largely unsuitable for development and can extend above the Q100 flood line.

A 20 m buffer is recommended on either side of a drainage line and should be measured from the upslope edge of the seepage zone (see below).
## STREAM ORDER & RECOMMENDED BUFFER WIDTHS

<table>
<thead>
<tr>
<th>Waterway</th>
<th>Stream order</th>
<th>Buffer width</th>
<th>Measured from:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage lines</td>
<td>Not applicable</td>
<td>20 m</td>
<td>The outer edge of the seepage line or zone (see below)</td>
</tr>
<tr>
<td>Intermittent streams</td>
<td>First &amp; second</td>
<td>25-50 m</td>
<td>The primary bank of the outer stream channel where there is more than one channel or the stream is braided.</td>
</tr>
<tr>
<td>Creeks</td>
<td>Third &amp; fourth</td>
<td>100 m</td>
<td>As above</td>
</tr>
<tr>
<td>Rivers</td>
<td>Fifth and sixth</td>
<td>250 m</td>
<td>As above</td>
</tr>
<tr>
<td>Wetlands</td>
<td>Not applicable</td>
<td>200 m</td>
<td>The maximum flood level* OR the edge of the active floodplain (whichever is the wider)</td>
</tr>
</tbody>
</table>

* Defined as the official Q100 flood line or the maximum flood level according to the best available information.

### DRAINAGE LINES BUFFERS

20 METRES ON EITHER SIDE OF THE SEEPAGE ZONE
(Natural Resources Division will be pleased to assist in helping you identify these areas)
Special circumstances

Flexibility in applying these buffer recommendations may be appropriate if certain circumstances can be demonstrated:

These circumstances relate to:

- The size and shape of a property in relation to the watercourse.
  
  Buffers of the recommended width may not be feasible on very small properties.
  
  Properties on which the boundaries and the waterway and associated buffers present unmanageable parcels of land.

- The nature or character of the waterway and riparian vegetation.

  The character or form of a floodplain or wetland may require that a buffer be wider.
  
  If there is no riparian vegetation, the buffer may be smaller.

In these circumstances, decisions regarding appropriate buffer widths should be made by:

- Carefully inspecting the site; and

- Gathering information and advice regarding land capability and biodiversity.
Native vegetation corridors and zones

Viable networks of wildlife habitat will only be maintained if wide connecting corridors of native vegetation are retained.

Native vegetation corridors and zones provide:

- habitat and refuge areas for native wildlife;
- corridors for native wildlife movement;
- protection for waterways;
- buffers for restricting chemical spray drift; and public amenity.

Native vegetation corridors should be positioned on a property to enable wildlife movement to adjacent land. They can coincide with drainage lines or be positioned along boundaries to provide connection between habitats. Corridors are generally only viable if at least 100 m to 200 m wide and are therefore relevant on larger properties and in regional planning.

Smaller buffers around boundaries of 25 m to 50 m may be retained on properties less than 20 ha in size for visual amenity or the restriction of chemical spray drift and are often viable wildlife corridors if maintained.

Narrow corridors are vulnerable to wind and insect damage and weed invasion and will degenerate over time. Weed and fire management must be considered in the planning and ongoing maintenance of such areas.

PROPERTY SIZE & NATIVE VEGETATION BUFFERS

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Block size (ha)</th>
<th>RECOMMENDED* Buffer width (m)</th>
<th>MINIMUM Buffer width (m)</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual amenity</td>
<td></td>
<td></td>
<td></td>
<td>Boundary</td>
</tr>
<tr>
<td>Chemical spray</td>
<td></td>
<td></td>
<td></td>
<td>Boundary</td>
</tr>
<tr>
<td></td>
<td>&lt; 2</td>
<td>25 - 50</td>
<td>25</td>
<td>Boundary</td>
</tr>
<tr>
<td></td>
<td>2 - 20</td>
<td>50</td>
<td>25</td>
<td>Boundary</td>
</tr>
<tr>
<td>Wildlife corridors</td>
<td></td>
<td></td>
<td></td>
<td>Boundary / drainage lines</td>
</tr>
<tr>
<td></td>
<td>20 - 100</td>
<td>100</td>
<td>50</td>
<td>Boundary / Drainage Lines</td>
</tr>
<tr>
<td></td>
<td>&gt; 100</td>
<td>200</td>
<td>100</td>
<td>Boundary / Drainage Lines / habitat connection</td>
</tr>
</tbody>
</table>

*Flexibility in applying these recommendations may be appropriate where the property boundaries and associated buffers produce unmanageable parcels of land.
8.3 Practical site issues

There are a number of practical issues that should be considered in a clearing operation. These include:

- determining areas subject to waterlogging and seasonal inundation;
- interpreting slopes. Slope is a particularly important factor in soil erosion;
- clearly marking the area to be cleared; and
- managing site access.

Waterlogging and seasonal inundation

It is extremely important to be aware of the state of land to be cleared under different seasonal conditions.

In the Top End, carry out site inspections late in the wet season to, and/or get information that will, identify wet or waterlogged areas.

If inspections can only be carried out in the dry season, the presence of trees such as pandanus, grevillea, swamp mahogany, brush box and paperbarks can indicate seasonally wet conditions.

Grevillea and Pandanus are indicative of seasonally waterlogged soils.

In Central Australia a predominance of coolabah, dense stands of mulga, or perennial grasses such as silky browntops and cotton bush indicate drainage areas.

Official flood level information may be available and local anecdotal information can be useful.
Interpretation of slope

The steepness and length of slope is a particularly important factor in soil erosion. A steep slope occurs when there is a large change in height over a given distance. A long slope is one, which is sustained over a long distance, regardless of its steepness. Given the high intensity of rainfall in the Northern Territory, significant soil erosion can occur on small slopes, even down to 1% in certain conditions. It is difficult to determine these slopes by eye.

**The interpretation of slope by eye is not a reliable method and can take many years of experience.**

The detail of slope information required will depend on the size and nature of the area to be cleared 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. Advice regarding the use of any of these methods can be obtained from the Department of Infrastructure, Planning and Environment.
Flagging the site

Sites to be cleared must be well flagged to avoid confusion and unnecessary removal of vegetation.

The land owner or manager and plant operator should inspect the site together prior to clearing to confirm requirements.

Site access

Uncontrolled access to a site which is being (or has just been) cleared may have environmental impacts. Access should be managed to prevent such problems and to prevent damage to any revegetation, which may be in progress.

Poor drainage can lead to erosion.
SUMMARY

Planning

Gather information

Talk to experts

Develop a clearing plan

Clearing Plans

Clearing Plans are a mandatory requirement on Pastoral Leases and when clearing more than 50% of native vegetation on any allotment in the Litchfield Shire.

In all other cases, the development of a plan and the seeking of advice and assistance from government agencies is strongly recommended.

Site selection

Identify "no-go" and "clear-with-care" areas.

Retain buffers on either side of waterways.

Retain native vegetation corridors and zones.

Determine areas of waterlogging and seasonal inundation.
Part C

The clearing operation

Operational techniques

Erosion & sediment control
9 Operational techniques

For each step in the clearing operation:

- Minimise soil disturbance
- Avoid channelling and concentration of water
- Minimise the length of time soil is exposed to wind and water
- Avoid disturbance to areas not to be cleared

The time of year and seasonal conditions under which clearing is undertaken are critical factors in minimising environmental impact.

While the following operational guidelines will help to minimise environmental impact, the nature of the intended land use and the land capability will determine if an erosion hazard exists and structural erosion and sediment control measures are required (page 37).

Special attention needs to be paid to certain operational techniques when clearing for subdivisions and linear developments. See Part D (page 41) for further advice.

9.1 Timing

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 optimum. This avoids the need for regrowth control, which reduces costs and minimises soil disturbance.

Decisions regarding 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

Soil moisture conditions primarily determine the best time of year for clearing. If the soil is too wet, machinery efficiency will be impaired by bogging and track slip. This disturbs the soil unnecessarily and increases the potential for erosion. If the soil is too dry, machinery wear and fuel usage is increased, tree trunks tend to break, and sucker regrowth is more likely.
Moisture conditions must allow a clean pull of timber to prevent the snapping of trunks and reduce the potential for regrowth and the need for follow-up work.

**Recommended times**

Given natural seasonal and climatic variabilities across the NT, the most appropriate time to clear will depend on geographic location and seasonal conditions.

Experience, local knowledge and advice from the relevant experts should be used to work within the recommendations provided below.

Refer to Subdivisions (page 42) and Linear Developments (page 45) for recommended clearing times for such developments.

---

**Recommended clearing times**

**Broadacre clearing**

**Top End**
Depending on the season, the best times are likely to occur:

- early in the wet season following first rains but before the monsoon arrives (November/December);
  (make sure soil is protected throughout the rest of the season)

- late in the wet season (March/April); or

- early in the dry season (May).

**Central Australia**
The best conditions are likely to occur:

- after rainfall, once moisture conditions are suitable for safe machinery operation.

Clearing at any other time may necessitate the use of erosion and sediment control measures.
9.2 Felling

The scale and nature of the final land use mainly determine how felling is undertaken. Environmental impacts vary according to the methods of felling. These impacts should be considered and minimised.

Clear felling

Careful timing and technique is extremely important in clear felling operations. Large areas of soil are exposed at the one time and heavy machinery significantly disturbs the soil. The potential for impact is high and structural soil conservation works may be required.

Strip clearing

Strip clearing involves the clearing of broad lines of vegetation along the contour leaving intervening strips of native vegetation (buffers). Buffers reduce the speed of stormwater runoff and the potential for erosion. Strips must be appropriately spaced, accurately surveyed to follow the contour, have good ground cover and prevent the downslope concentration of runoff.

<table>
<thead>
<tr>
<th>STRIP CLEARING</th>
<th>ADVANTAGES AND DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td><strong>Disadvantages</strong></td>
</tr>
<tr>
<td>• Land in higher slope categories can be cleared, reducing the amount of soil conservation works required.</td>
<td>• May reduce the productive capacity of the overall area to an unacceptable level.</td>
</tr>
<tr>
<td>• Buffers provide shelter for domestic animals, and if of a sufficient size, corridors and habitat for native wildlife (page 26).</td>
<td>• Buffers can present weed, pest and fire management problems</td>
</tr>
<tr>
<td>• Staged development can reduce erosion potential and overall costs.</td>
<td>• Changed circumstances may later require the removal of buffers necessitating the use of soil conservation works in higher slope areas.</td>
</tr>
<tr>
<td>• Buffers can provide wind protection for crops and reduce chemical spray drift.</td>
<td></td>
</tr>
</tbody>
</table>

The clearing operation 34
Selective clearing

Selective clearing requires less soil disturbance and can be achieved using chemicals, chainsaws or machinery. Sucker regrowth can be a problem.

Felling in smaller areas is sometimes undertaken with a chainsaw and involves little soil disturbance. Sucker regrowth is common.

Debris removal

Minimise soil disturbance by:

- pushing debris with a stick rake, rather than a blade; and
- using tines rather than blades to flatten windrows.

Avoid channelling and concentration of runoff by:

- working along the contour; and
- removing windrows immediately following construction or maintenance

Windrows, which cannot be removed, should be aligned at right angles to the contour (up and down the slope), or in a manner appropriate for the safe disposal of runoff.

In some cases, such as in the rehabilitation of borrow pits, vegetation can be respread over the area during rehabilitation. This should be done in a manner, which does not concentrate runoff.

Sucker control

Reduce soil disturbance by using a blade plough rather than a disc plough, if further cultivation is not essential to the intended use. The use of disc ploughs should especially be avoided in wet conditions.

Chemical control can be used as an alternative to mechanical control. This has the advantage of minimising further soil disturbance, depending on the intended final land use. Advice on chemical sucker control can be obtained from the Department of Business, Industry and Resource Development.
9.3 Ongoing management

Following clearing, minimise the potential for land degradation:

- Work along the contour

- Establish and maintain a good vegetation cover or use other appropriate surface protection measures

- Maintain drainage and erosion and sediment control works

Working machinery along the contour minimises the risk of water channelling and concentrating downslope. This is particularly important during wet conditions.

Therefore:

- plant crops along the contour.

- drive vehicles or heavy machinery along the contour to prevent the concentration of runoff along wheel ruts.

Minimise the length of time that soil is exposed to wind and water:

- establish and maintain good vegetation cover, or use other appropriate surface protection measures (such as mulch, heavy plastic or geotextile), as soon as development is complete;

- manage and maintain improved pastures;

- control and manage weed infestations:
  . only clean machinery should enter and leave the site;
  
  . be particularly aware of weeds which are seeding;
  
  . obtain weed information from the Department of Business, Industry and Resource Development; and
  
  . be aware of legal requirements to control the growing, spread and eradication of noxious weeds.
10 Erosion & sediment control

Prevention is better (and cheaper) than cure!

Structural erosion and sediment control measures should be used if it is necessary to clear land, which presents an erosion hazard.

Such measures include contour banks, cross drains, drop structures, flumes, sediment traps and basins and buffer strips.

The type, extent and permanency of measures required will depend on:

- soil type;
- slope;
- proposed land use; and
- the seasonal conditions under which soil is likely to be exposed.

As a general rule, erosion and sediment control measures are recommended on all cleared land with slopes greater than 1%.

The following table provides examples of slope thresholds over which structural erosion and sediment control measures are recommended for various land uses. Strip clearing and buffers (pages 22, 26, 34) may increase the thresholds over which works are recommended. Soil type must be considered.

It must be noted that erosion can occur on slopes less than 1% given the right conditions.
SLOPE THRESHOLD GUIDELINES FOR SOIL CONSERVATION WORKS*
FOR VARIOUS LAND USES*.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Pasture improvement</th>
<th>Annual agricultural cropping</th>
<th>Tree cropping</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOPE</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Once pastures are established, grazing must be managed to ensure adequate cover.</td>
<td>Provided that minimum till is used.</td>
<td>With a well established and maintained ground cover.</td>
</tr>
</tbody>
</table>

* Thresholds are provided as examples only. Each site needs to be assessed in terms of soil type, slope, proposed use and the season during which soil is exposed. See page 28 for information on determining slope.

Planning for sucker control is necessary.
SUMMARY
Operational techniques

Minimise soil disturbance
Avoid channelling and concentration of water
Minimise soil exposure to wind and water
Avoid disturbance to areas not to be cleared

Remember:
Seasonal conditions are critical!

Ongoing management

Work along the contour
Maintain good vegetation cover or other appropriate surface protection measures
Maintain drainage and erosion and sediment control works.
Native vegetation in the Top End
Part D
Special Cases

Subdivisions

Linear developments
11 Subdivisions

In addition to the principles and operational techniques previously described, special attention should be paid to the following points when clearing for subdivision developments.

11.1 Site selection

Overall site

Select well-drained sites above peak flood levels.

Pay particular attention to drainage across the catchment in which the subdivision is proposed. Consider potential off-site impacts on water flow both into and out of the site. Think of the neighbours!

Consider the on-site impacts of existing drainage.

Do not locate boundaries or access tracks across sensitive areas.
(Refer to land capability and biodiversity protection.)

Internal layout

Consider drainage into and out of individual blocks.

Make allowance for drainage easements and plan for their subsequent management.

Retain poorly drained land, or land subject to flooding, within a single block.

Retain land steeper than 10% within a single block.

Do not locate boundaries across sensitive areas.
(Refer to land capability and biodiversity protection.)

Consider potential building sites and ensure suitable access is available.
11.2 Operational techniques

Consider selective clearing rather than clear felling.

Stage operations to minimise the area exposed at any one time.

Restrict construction traffic to defined, protected areas.

**Recommended clearing times**

**Subdivisions**

**Top End**
Depending on the season, the best times are likely to occur:

- late in the wet season (March/April);
- early in the dry season (May); or
- when subsequent development can be undertaken as soon as possible and in dry conditions.

**Central Australia**
The best conditions are likely to occur:

- after rainfall, once moisture conditions are suitable for safe machinery operation.

Clearing at any other time may necessitate the use of erosion and sediment control measures.
11.3 Erosion and sediment control

- Determine requirements for erosion and sediment control measures and in particular, ensure drainage works are protected.

- Avoid the use of open unlined drains, as they tend to be highly erodible.

- Stabilise and revegetate construction access tracks and hardstand areas as soon as development is complete.

Refer to the *Erosion and Sediment Control Guidelines* available from the Department of Infrastructure, Planning and Environment.

11.4 Ongoing management

- Ensure the drainage network is kept functional and non-eroding.

*Erosion should be controlled.*
12 Linear developments

Linear developments include roads, tracks, fencelines, boundary lines, firebreaks, pipelines and exploration lines.

They are particularly prone to erosion as:

- water can be concentrated and channelled in one direction; and
- this concentration is often directed downslope and over long distances.

Pay particular attention to:

- slope;
- soil type;
- drainage; and
- revegetation (or other form of soil surface protection) as soon as construction is complete.

12.1 Planning

Developments across drainage lines and waterways can be difficult to construct, maintain and rehabilitate. Fire control is also hard across rough terrain. As a general rule, impacts tend to be higher at sites where the environment makes construction difficult. Rehabilitation of these sites will also tend to be more problematic.

The cleared line should only be as wide as required for the intended purpose, bearing in mind any firebreak regulations, which may be in place.

Use the same alignment for a number of purposes wherever possible. For example, roads may double as suitable firebreaks.

Erosion and sediment control measures will be required to provide for the regular and safe disposal of water. These should be planned and constructed either prior to, or during construction. It is particularly important that water does not concentrate along the alignment.
Site selection
Linear developments

Wherever possible, locate linear developments:

- on high ground;
- on stable, "hard" country (such as gravelly soils or spinifex plains);
- along the crest of broad gentle rises, ridge lines and/or catchment boundaries; or
- along the contour, where it is not possible to follow crests.

Use natural resource information (Appendix A) to determine appropriate boundaries. Be prepared to 'give and take' where boundaries cannot be located where originally intended.

Clearly flag the alignment – mistakes can be costly.

Recommended clearing times
Linear developments

Top End
Depending on the season, the best times are likely to occur:

- late in the wet season (March/April);
- early in the dry season (May); or
- when seasonal conditions enable rapid revegetation.

Central Australia
The best conditions are likely to occur:

- after rainfall, once moisture conditions are suitable for safe machinery operation.

Clearing at any other time may necessitate the use of erosion and sediment control measures.
12.2 Operational techniques

Pay particular attention to:

- the removal of windrows;
- the amount of soil disturbance caused by various attachments used on heavy machinery; and
- techniques used for the removal of debris.

Windrows

Windrows concentrate water, increase the potential for erosion, and should be removed following construction and maintenance.

Windrows, which cannot be removed, should be aligned down the slope (at right angles to the contour) or in a manner, which is appropriate for the safe disposal of runoff.

Machinery

Use a stick rake rather than a blade to fell vegetation.

Do not flat blade as this removes topsoil, which could result in channel formation along the cleared line.

If flat blading is the only option, use erosion control works to divert water flow from the development.

Depending on the final land use, an alternative to grading after the initial clearing may be to slash as low as possible and rake and remove excess material. Ongoing maintenance may need to be considered in these circumstances.

Debris removal

Push debris with a stick rake to either side of the alignment and burn or remove to prevent the concentration of runoff. This may not be necessary in more arid, less densely vegetated areas.

For underground linear developments such as pipelines or cables, vegetation may be carefully respread over the alignment to discourage water concentration.
12.3 Ongoing management

Minimise vehicle and machinery movements in wet conditions.

Maintain erosion and sediment control works.

Ensure that any subsequent works do not result in the formation of soil or vegetation windrows.

*Windrows often lead to erosion by concentrating flow down the road.*
Further Reading


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 Lands, Planning and Environment (1999), *Environmental guidelines for reclamation in coastal areas*, Environment and Heritage Division.

Fulton V (draft), *Guidelines for the construction and maintenance of unsealed roads and access tracks in the Northern Territory*, Department of Lands, Planning and Environment, Natural Resources Division, Darwin, NT.


Pastoral Land Board (1993), *Guidelines for clearing pastoral land*. Darwin, NT.

Sedman J (draft), *Resource management guidelines for the Northern Territory: soil erosion and sediment control*, Department of Lands, Planning and Environment, Natural Resources Division, Darwin, NT.
A range of information can be used in development of a Clearing Plan. This includes topographic, cadastral and land unit maps, aerial photography, and satellite imagery. Examples of these are provided below. The scale, availability and cost of products will vary widely and will be suitable for different purposes. Before seeking such information, clarify:

- the boundaries of the area; and
- the scale at which the information is required.

### Topographic Map
(1:50,000)

### Cadastral Map
(1:25,000)
Aerial Photograph
(1:20,000)

Land unit map
with cadastral layer
(1:25,000)
(Showing landforms, soils and vegetation associations)

Satellite image
Landsat thematic mapper
(1:50,000)
APPENDIX B

STREAM ORDER

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

The smallest watercourses in a catchment are first-order streams. Such watercourses have no tributaries.

All watercourses* with no tributaries are first order streams. Stream order only increases when two streams of the same order join. 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 (see below).

Stream order can be determined from a topographic map as shown in the example on the opposite page. Bennett Creek in the Litchfield Shire flows into the Elizabeth River as a fourth-order stream.

---

* A watercourse has well-defined beds and banks, as distinct from a drainage line, which does not form a well-defined channel.
Stream order example – Bennetts Creek, Litchfield Shire
(1: 50, 000 topographic map)
## APPENDIX C

### ADVICE & ASSISTANCE*

<table>
<thead>
<tr>
<th>INFORMATION</th>
<th>AGENCY &amp; LOCATION</th>
<th>PHONE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOPOGRAPHIC &amp; CADASTRAL MAPPING, AERIAL PHOTOS</strong></td>
<td>MapsNT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Darwin</td>
<td>8999 7032</td>
</tr>
<tr>
<td></td>
<td>First floor, Nichols Place, Cnr Cavenagh &amp; Bennett Streets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alice Springs</td>
<td>8951 5316</td>
</tr>
<tr>
<td></td>
<td>AFT Building, 21 Gregory Terrace</td>
<td></td>
</tr>
<tr>
<td><strong>LAND &amp; WATER RESOURCES</strong></td>
<td>DIPE, Natural Resources</td>
<td></td>
</tr>
<tr>
<td>(land unit mapping)</td>
<td>Palmerston</td>
<td>8999 4455</td>
</tr>
<tr>
<td>(Soil conservation)</td>
<td>3rd, 4th floor, Goyder Centre, 25 Chung Wah Terrace</td>
<td></td>
</tr>
<tr>
<td>(Land capability advice)</td>
<td>Katherine</td>
<td>8973 8100</td>
</tr>
<tr>
<td></td>
<td>Randazzo Building, 16 Katherine Terrace</td>
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*Appendices 56*
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DIPE Department of Infrastructure, Planning and Environment
DBIRD Department of Business, Industry and Resource Development

*Information is also available on the NT Government's web site: www.nt.gov.au.*