2CRU AND MUIRHEAD VEGETATION & WEED MANAGEMENT PLAN

D17_0020_2CRU ISSUE D 26/02/25

CLOUSTON associates

a division of BW Beveridge Williams

DHA Defence Housing Australia

2CRU AND MUIRHEAD
VEGETATION & WEED MANAGEMENT PLAN

DHA
Property Provisioning Group, NT
Defence Housing Australia
Level 1, Building 4
631 Stuart Highway
BERRIMAH NT 0828

CLOUSTON Associates - a division of Beveridge Williams
Landscape Architects • Urban Designers • Landscape Planners
Level 1 Briggs St • Darwin • NT 0801
PO Box 118 • Darwin • NT 0801
Telephone (08) 8941 2450 • Facsimile (08) 8981 8230
Email • darwin@clouston.com.au
Web • www.clouston.com.au

D17-0020 • Issue D • 26th February 2025

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INTRODUCTION

The 2CRU and Muirhead North development sites are to become a master planned community located to the north of Darwin bordered by Casuarina Coastal Reserve and the Buffalo Creek Management Area. 2CRU is an 83 hectare parcel of land but it is intended that approximately 22 hectares of land will be rezoned for conservation and transferred to the NT Government for incorporation into the Casuarina Coastal Reserve. Muirhead North is a 51 hectare parcel of land which includes over 4 hectares of Conservation area round the Monsoon Rainforest to the east of the site and a vegetated buffer to the north-east boundary that is to be protected and restored as Gouldian Finch habitat. The proposed development by Defence Housing Australia incorporates a mix of residential housing, small retail and tourism opportunities, and open space for recreation.

OBJECTIVE

The objectives of the Vegetation & Weed Management Plan (VWMP) are to establish an ongoing works program that will:

- Effectively control the weed species present within the development areas.
- Maintain and manage those areas of remnant vegetation within the development area that will remain largely undisturbed as part of the proposed works, with a focus on uncontrolled access, erosion and weeds.
- Utilise cool burns to protect areas of remnant bush and to control weeds. This integrated approach will reduced the need for broad scale weed spraying while supporting natural regeneration.
- Maintain and manage construction work and activities within and adjoining the remnant vegetation to limit negative impacts associated with water, erosion and weeds
- Identify and define design parameters, species selection and general landscape maintenance activities required to minimise environmental risks to remnant vegetation arising from the proposed development.

Effective maintenance and management is required from the on-set of the project and will continue for the duration of the project up until final handover to the relevant authorities and land owners. The long term health and viability of the remnant bush as a valuable community resource providing recreational and environmental services is dependent on an ongoing commitment to vegetation management beyond the life of this project.

GENERAL SCOPE

All management and control works identified in the VWMP are to be carried out by suitably qualified and experienced personnel. This includes:

- Weed Vegetation Management – experienced bushland managers
- Cool Burns - Certified and approved controlled fire contractors
- Monitoring and Review – Registered Landscape Architects (CLOUSTON) & experienced bushland managers
- General subdivision construction, including lots, service infrastructure and parkland - experienced contractors with demonstrable Environmental Management Plans and Site Management Plans that reflect and comply with this VWMP.

Provide evidence of selected personnel experience and training relevant to this contract. Such as Chemical Application Certification, Weed Identification Training and Native Vegetation Identification Training.

AREA OF WORKS

The area of works is shown on the attached drawings – refer Appendix A and B.

Conservation Areas

These are areas of largely undisturbed areas of natural bush that displays healthy species diversity, minimal weed infestation and limited access via tracks (usually subject to some level of erosion). The proposed master plan identifies these areas to be retained as natural bush, with minor improvements comprising walking/ cycling tracks, interpretation and similar low impact recreational developments. Vegetation rehabilitation and cool burns will be undertaken as required to support targeted weed control. The VWMP will address these areas.

Public Open Space

These are areas that will be developed as the primary recreational resource as well as providing landscaped areas for visual outlook and cooling for the development. Typically such areas comprise a combination of active and passive recreational activities and may include small pockets of natural retained bush. In these cases, the bush is modified to enhance safety and visibility, reduce fire risk and minimise risks associated with tree fall and limb drop. The area will display reduced species diversity. The VWMP manages risks and threats to remnant vegetation in these areas.

Drainage Areas

These areas provide stormwater infrastructure for the development and comprise extensive landscaped areas that are occasional inundated and carry stormwater. The VWMP focuses on managing weeds in this area that can then become a risk to downstream areas including remnant vegetation.

Residential Development

These areas comprise the residential lots, other development sites and associated roads. The VWMP establishes construction parameters and maintenance activities that will minimise possible weed impacts from these areas on remnant vegetation.

Heritage Sites

The heritage listed bunker and existing 'Konfrontasi' heritage sites are to be protected and retained. The VWMP will address these areas.

Existing access and New Infrastructure

These are areas that contain major service infrastructure that are currently onsite or are new works within remnant bushland (eg stormwater drains and detention basins). Existing access areas run along the boundaries of the sites with the adjoinging properties and reflect previous military use on the site. They have previously been heavily infested with weeds and pose significant environmental risks to the remnant vegetation and conservation areas. The VWMP identifies weed control in these locations as a priority to ensure protection of remnant bush areas free of weeds. New infrastructure will be treated in an appropriate manner and may include restoration/ rehabilitation or general landscaping as part of the public open space.

EXISTING SITE CONDITIONS

Remnant Vegetation

Heritage Bunker

Gamba Grass and Erosion

SITE MANAGEMENT

Site management is the contractors/developers responsibility and will be undertaken in line with the Erosion & Sediment Control Plan (ESCP) prepared for each stage of works. As each stage of the development is implemented, the following actions are to be applied throughout the construction phase to minimise the establishment and spread of weeds.

SITE MANAGEMENT	
Description of Activities	Responsibility
Controlled access – no vehicle or construction access permitted into areas of remnant vegetation and retained natural bush. These areas are to be fully fenced and all access denied. The only exception will be bushland managers/ regenerators or other approved landscape contractors.	Project Manager / Construction Contractor
Site Clearing to comply with: • Areas and individual plants to be protected are to be highlighted and protected prior to commencing clearing operation. Use bunting, fencing and/ or flagging tape. • Any clearing works within remnant vegetation areas (eg for services, fencing, pathways and the like) to occur in a manner that minimises disturbance and compaction to the natural ground. Wherever possible, retain the native grass and groundcover layer • Clearing is to be limited to maximum 3m from the edge of any proposed construction works • Grubbings from tree and shrub removal are to be stockpiled and used as part of the sediment and erosion control where suitable (refer to notes below)	Project Manager / Construction Contractor
Stockpiling and storage of materials (soil, mulch etc) – stockpiled soil (site and imported) is a primary source for weeds. Soil is to be managed to minimise weed risks including inclusion of cover crop or geotextile cover, herbicide treatment as and if weeds occur. Topsoil stockpiles are also to be managed in accordance with the Sediment and Erosion Control notes below. Organic material arising from site clearing operations is to be stored in stockpiles/ windrows clear of other construction activity. Windrows may be used as an additional buffer along the edge of remnant vegetation and retained bush areas. Larger stockpiles of organic material are recommended where the mulch is to be used as a composted, soil conditioner. Where it will be reused as surface mulch, smaller windrows are recommended.	Project Manager / Construction Contractor
Vehicle & equipment hygiene controls are to be implemented to prevent the spreading of weeds from and to site. The following are to be followed: • Operations staff are to be train to be able to identify and recognise declared weeds relevant to the site. • Operators are to clean and inspect all vehicles and equipment for seeds prior to commencement of works. • Areas where weeds are present are to not be traversed through. Where this can not be avoided, vehicles and machinery are to be cleaned prior to moving onto weed free areas. • Any vehicle working in areas of weeds must be fully cleaned before leaving the site. • Where weeds are present, they should be treated prior to seed set and ongoing weed management implemented. • Movement of weed infested material into or out of the construction site is not permitted.	Project Manager / Construction Contractor

WEED MANAGEMENT

Weed management will be an ongoing activity and a critical component of the landscape maintenance works. Effective weed management requires integration of a multitude of activities described within this VWMP, including site management, cool burns, vegetation management and monitoring. It is noted that allowing land to become infested with a declared weed is an offence under the Weeds Management Act.

The vegetation management contractor's experience, knowledge and discretion shall dictate the preferred methodology appropriate for the particular site. Cool burns are to be incorporated where appropriate as part of an integrated weed management approach.

Manual weed removal shall employ low impact weed management strategies to avoid disturbing existing and establishing vegetation and habitat. Removal work shall ideally be undertaken prior to the seeding period of the high seeding weed species found on site. If any work is undertaken within this period the seeds should be bagged and disposed of off site.

If applying herbicides, spraying must be undertaken in suitable conditions and left for the recommended period of time. The type of herbicide shall be appropriate for the site and conditions and consider impacts on downstream aquatic systems and risk of overspray effecting desirable species. Directions are to be followed and all precautions strictly adhered to. When applying any herbicide use a brightly coloured marker dye in the solution to mark areas that have been treated to ensure cover and reduce the risk of overspray.

Throughout the development program, the extent of weed cover is to comply with the Performance Benchmark table.

The Northern Territory Weed Management Handbook shall be referenced prior to any works being conducted. Recommended methodologies for specific species and situations shall be implemented in accordance with the handbook for this site (refer to Appendix D).

WEED MANAGEMENT	
Description of Activities	Responsibility
Timing of activities – regular monitoring of all areas is required to ensure weed outbreaks are quickly identified and dealt with. This would typically be at minimum fortnightly from November to May and monthly from June to October.	Vegetation Management Contractor
Use of Herbicides – herbicides are an effective means of controlling the main problem weeds that may be found on site – Mission Grass (annual and perennial), Gamba Grass, Hyptis and Coffee Bush. Different weed species have optimum times for treatment, as identified in the NT Weed Management Handbook (refer Appendix C). For the common weeds identified above, this falls between December to March, however, subject to weather conditions this can extend both earlier and later. Other declared weeds such as Neem, will be identified and treated in line with the recommendation in the handbook. Herbicides are most effective and least costly when applied to small actively growing plants. A minimum 2 follow up treatments at 3 - 4 week intervals after the initial treatment will greatly assist the work effort in the following year.	Vegetation Management Contractor

WEED MANAGEMENT

WEED MANAGEMENT	
Other non chemical control methods – these include seed head removal, hand grubbing and mowing/ slashing. Seed head removal and hand grubbing are best applied to small, isolated patches where wholesale spraying may open up the area to further weed infestation. All seed heads need to be removed and disposed of off-site. In the case of Hyptis, the entire plant should be removed. The entire plant root mass is to be excavated, excess soil shaken off and the plant placed so that it cannot re-root. Mowing and slashing can only be used in grassed areas. It will not eliminate the weed, but if undertaken regularly and prior to seed set will allow other desirable species to out compete the weeds and/or more effective herbicide treatments. All equipment used in weed infested areas is to be thoroughly cleaned prior to moving to new sites.	Vegetation Management Contractor
Burning – this can occur in parallel with the other control methods outlined above. Any proposed burning must be carefully planned and is best designed in consultation with NT Weeds Branch personnel and will require approvals/ permits from Northern Territory Fire and Rescue Service. Burning may be used to reduce large weed infestations to allow better access and targeted herbicide treatment. Small, cool burns can also be helpful to reduce Mission Grass seed loads at the end of the wet season. Fire can also reduce overall weed volume to allow more targeted herbicide treatments. Care should be taken to ensure the heat updrafts do not assist spreading seed and does not threaten self generating native plants.	Project Manager / Vegetation Management Contractor (subject to relevant approvals)
Off-site weed sources – the project site is at risk from numerous off-site weed sources. When identified by the contractor, Defence Housing Australia will liaise with Northern Territory Weeds Branch, relevant Government Departments and landowners to minimise such risks. Defence Housing Australia is not responsible for weed management outside their project area.	Project Manager (liaison) / Vegetation Management Contractor (identification)
Gamba Grass Control Requirements – within the development area, Gamba Grass is to be controlled in accordance with the requirements of the NTG Department of Environment, Parks and Water Security Weeds Management Plan Gamba Grass 2020 – 2030. Specifically, as outlined in Table 3 Class B Zone – Land parcels (3-140Ha) Control growth and spread: 3.1 - Establish and maintain a gamba grass free buffer of 15m in width along the inside of the land parcel boundaries, around infrastructure7, and on both sides of tracks and roads. The buffer must be established by chemical, mechanical or physical means, and must be done prior to seeding each year. 3.3 - Undertake annual gamba grass control activities and weed spread prevention activities to ensure gamba grass free areas remain gamba grass free. 3.4 - Undertake annual gamba grass control activities so gamba grass is reduced.	Vegetation Management Contractor

FIRE MANAGEMENT

The 2CRU development area and the remnant vegetation at Muirhead North pose a fire risk for the residential developments, infrastructure and surrounding bushland areas. Effective fire management actions are required to minimise these risks and assist with vegetation management in the natural bush areas.

FIRE MANAGEMENT		
Description of Activities	Application	Responsibility
Fire breaks and access – fire breaks and good access will greatly reduce the extent of any burn that may occur. They will also assist implementation of controlled burns if required by allowing small, mosaic type burns. All property boundaries, including road verges and parks adjoining remnant vegetation will include a minimum 4.0m firebreak in accordance with legislation. Proposed footpaths and trails within remnant vegetation areas should have a clearance width suitable for fire vehicle access. The path itself does not need to be this full width, but there should be no trees or large shrubs within a 2.5 – 3.0 metre corridor. Vehicle control at entry points will need to consider fire vehicle access.	Remnant Vegetation	Project Manager
Controlled Burning – this covers hazard reduction, cool burns and weed management as described in the preceding section. Any proposed burning must be carefully planned and will require approvals/ permits from Bushfires NT. Bushfires NT and NT Fire and Rescue Services can assist in hazard reduction burns.	Remnant Vegetation edges to conservation areas, future development areas not yet constructed	Vegetation Management Contractor

MANAGEMENT, MONITORING AND REVIEW

Having adopted and implemented the VWMP, it will be necessary to undertake monitoring and review to ensure that management activities are achieving positive outcomes in terms of weed control. Throughout the project life, a 6 monthly report is to be prepared outlining:

- Weeds identified on site and control methods utilised,
- Occurrence, time and extent of uncontrolled fires,
- Occurrence, time, extent and purpose of controlled burns,
- Any instances and details of unauthorised access to remnant vegetation, including instances of dumping,
- Any issues in implementing the VWMP and recommendations for resolving these, including off-site impacts that cannot otherwise be controlled.

The overall success of the VWMP is to be evaluated at the end of the project. The determining factor of the success of the works will be the maintenance of a native plant cover characteristic of a pre-development remnant landscape, the removal of all Gamba Grass and the effective control of other weeds.

PERFORMANCE BENCH MARKS			
AREA	JULY 2025	JULY 2026	JULY 2027
Gamba Grass in Bushland Areas, along boundaries (15m width), land adjoining bushland areas, all access tracks (15m both sides) and stockpile areas.	Fully controlled prior to seeding.	Fully controlled prior to seeding.	Fully controlled prior to seeding.
General Weed Cover in Bushland Areas	<2%	<2%	<2%
General Weed Cover in Disturbed Areas	<5%	<5%	<5%

MANAGEMENT SCHEDULE		
ACTIVITY	MINIMUM FREQUENCY	RESPONSIBILITY
Weed Management	Fortnightly (wet season) and considering the life cycle of species	D/VMC
Fire Management	Twice yearly as required (early and late wet season)	D/VMC
Monitoring and review report	April and October each year	D/VMC/PM

D Defence Housing Australia
VMC Vegetaion Management Contractors
PM Project Manager (DHA or their representative)

APPENDIX A
OVERALL CONCEPT PLAN

NOTES

(1) This plan was prepared for the purpose and exclusive use of DEFENCE HOUSING AUSTRALIA as an Investigation into the Development Potential of the land described in the plan and is not to be used for any other purpose or by any other person or corporation.
JFP URBAN CONSULTANTS PTY LTD accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this plan in contravention to the terms of this clause or clauses 2, 3, 4, 5, 6 or 7 hereof.

(2) The contours on this plan are approximate and are suitable only for the purpose of this application. The accuracy of the contours has not been verified and no reliance should be placed upon such contours for any purpose other than for the purpose of this application.

(3) JFP takes no responsibility for any changes to the design concept that may arise as a consequence of the detailed vegetation assessment undertaken in the future. To increase certainty JFP recommends the appointment of suitable vegetation professionals to complete the vegetation assessment as soon as practical.

(4) This plan shall be read in conjunction with the JFP preliminary planning assessment prepared in relation to the site.

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(6) Information sourced from third-parties has been utilised in the preparation of this plan.
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LEGEND

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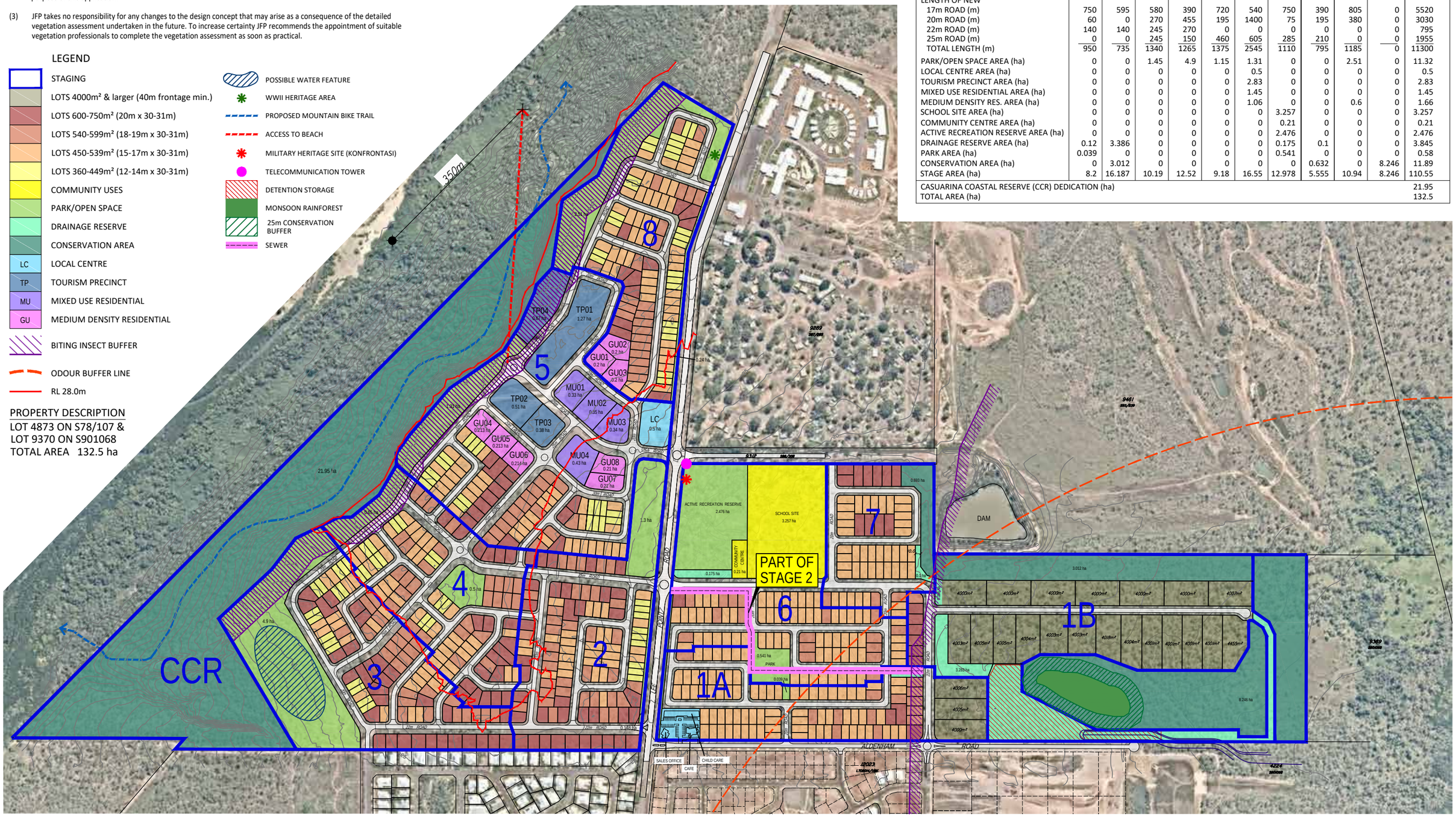
- LOTS 540-599m² (18-19m x 30-31m)
- LOTS 450-539m² (15-17m x 30-31m)
- LOTS 360-449m² (12-14m x 30-31m)
- COMMUNITY USES
- PARK/OPEN SPACE
- DRAINAGE RESERVE
- CONSERVATION AREA
- LC — LOCAL CENTRE
- TP — TOURISM PRECINCT
- MU — MIXED USE RESIDENTIAL
- GU — MEDIUM DENSITY RESIDENTIAL
- BITING INSECT BUFFER
- ODOUR BUFFER LINE
- RL 28.0m
- POSSIBLE WATER FEATURE
- WWII HERITAGE AREA
- PROPOSED MOUNTAIN BIKE TRAIL
- ACCESS TO BEACH
- MILITARY HERITAGE SITE (KONFRONTASI)
- TELECOMMUNICATION TOWER
- DETENTION STORAGE
- MONSOON RAINFOREST
- 25m CONSERVATION BUFFER
- SEWER

PROPERTY DESCRIPTION
LOT 4873 ON S78/107 &
LOT 9370 ON S901068
TOTAL AREA 132.5 ha

STATISTICS	STAGE 1A	STAGE 1B	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	STAGE 8	BALANCE	TOTAL
RESIDENTIAL LOTS											
4000m² & larger	3	20	0	0	0	0	0	0	0	0	23 (3%)
600m²-800m²	3	6	36	31	21	13	1	11	11	0	133 (17%)
540-599m²	13	1	36	24	28	15	17	3	23	0	160 (21%)
450-539m²	77	0	29	21	34	35	67	42	49	0	354 (47%)
360-449m²	0	0	9	16	14	18	0	0	25	0	82 (11%)
Commercial	1	0	0	0	0	0	0	0	0	0	1 (1%)
TOTAL	97	27	110	92	97	81	85	56	108	0	753 (100%)
COMMERCIAL SUPER LOTS	0	0	0	0	0	14	0	0	3	0	17
TOTAL LOTS	97	27	110	92	97	95	85	56	111	0	770
LENGTH OF NEW											
17m ROAD (m)	750	595	580	390	720	540	750	390	805	0	5520
20m ROAD (m)	60	0	270	455	195	1400	75	195	380	0	3030
22m ROAD (m)	140	140	245	270	0	0	0	0	0	0	795
25m ROAD (m)	0	0	245	150	460	605	285	210	0	0	1955
TOTAL LENGTH (m)	950	735	1340	1265	1375	2545	1110	795	1185	0	11300
PARK/OPEN SPACE AREA (ha)	0	0	1.45	4.9	1.15	1.31	0	0	2.51	0	11.32
LOCAL CENTRE AREA (ha)	0	0	0	0	0	0.5	0	0	0	0	0.5
TOURISM PRECINCT AREA (ha)	0	0	0	0	0	2.83	0	0	0	0	2.83
MIXED USE RESIDENTIAL AREA (ha)	0	0	0	0	0	1.45	0	0	0	0	1.45
MEDIUM DENSITY RES. AREA (ha)	0	0	0	0	0	1.06	0	0	0.6	0	1.66
SCHOOL SITE AREA (ha)	0	0	0	0	0	0	3.257	0	0	0	3.257
COMMUNITY CENTRE AREA (ha)	0	0	0	0	0	0	0.21	0	0	0	0.21
ACTIVE RECREATION RESERVE AREA (ha)	0	0	0	0	0	0	2.476	0	0	0	2.476
DRAINAGE RESERVE AREA (ha)	0.12	3.386	0	0	0	0	0.175	0.1	0	0	3.845
PARK AREA (ha)	0.039	0	0	0	0	0	0.541	0	0	0	0.58
CONSERVATION AREA (ha)	0	3.012	0	0	0	0	0	0.632	0	8.246	11.89
STAGE AREA (ha)	8.2	16.187	10.19	12.52	9.18	16.55	12.978	5.555	10.94	8.246	110.55
CASUARINA COASTAL RESERVE (CCR) DEDICATION (ha)											21.95
TOTAL AREA (ha)											132.5



OVERALL CONCEPT PLAN AE

LEE POINT ROAD, LEE POINT, DARWIN
DEFENCE HOUSING AUSTRALIA

APPENDIX A

SCALE: 1:7000 @ A3
DATE: 6nd November 2024

APPENDIX B
2024-2025 WORKS

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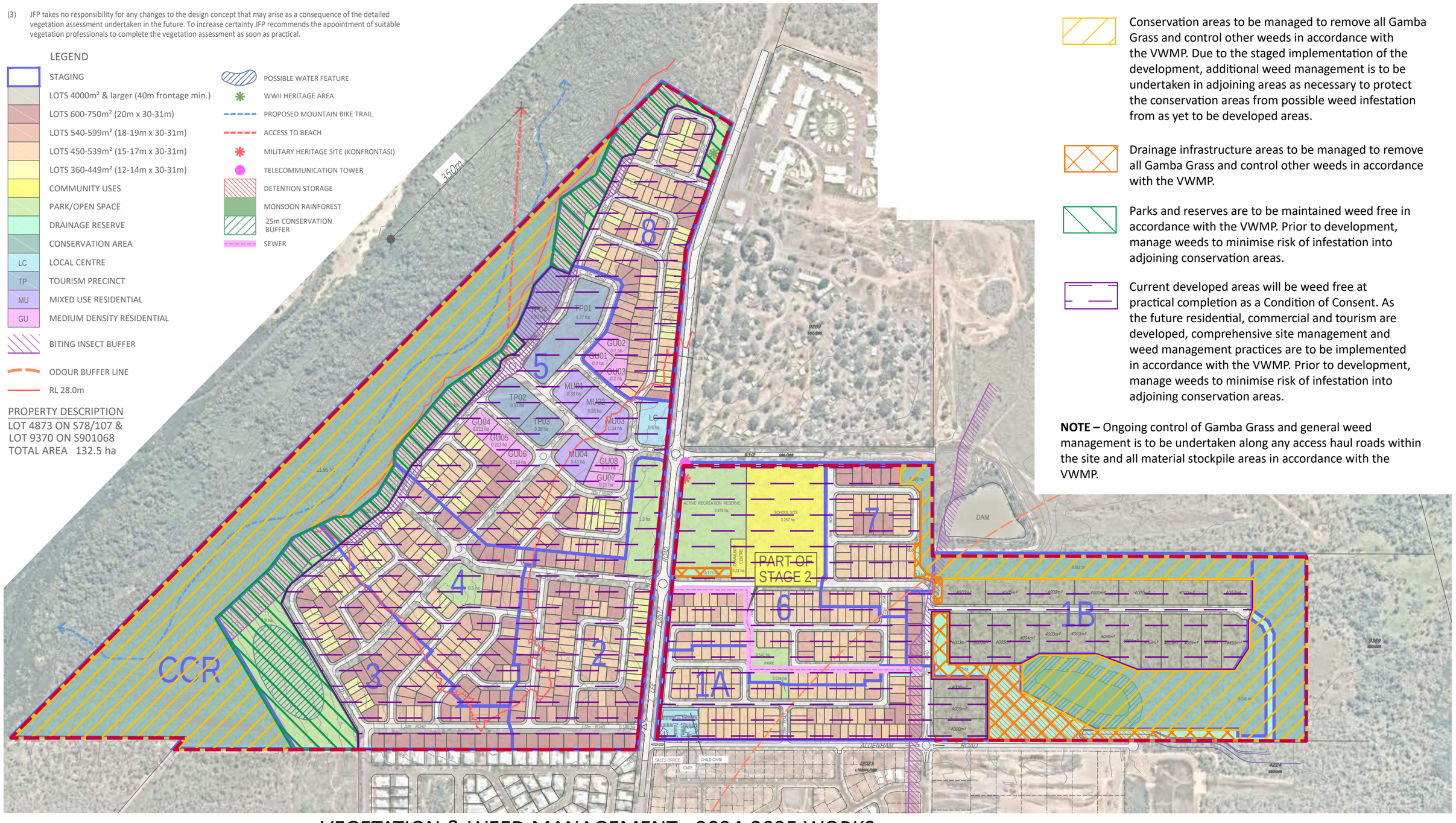

Maintain a 15m wide corridor to all site boundaries free of Gamba Grass and control all other weeds in accordance with the VWMP. As appropriate, liaise with Weeds branch and adjoining property owners to limit spread of weeds from adjoining sites. Extent of boundary buffer will adjust as the site is developed.

Conservation areas to be managed to remove all Gamba Grass and control other weeds in accordance with the VWMP. Due to the staged implementation of the development, additional weed management is to be undertaken in adjoining areas as necessary to protect the conservation areas from possible weed infestation from as yet to be developed areas.

Drainage infrastructure areas to be managed to remove all Gamba Grass and control other weeds in accordance with the VWMP.

Parks and reserves are to be maintained weed free in accordance with the VWMP. Prior to development, manage weeds to minimise risk of infestation into adjoining conservation areas.

Current developed areas will be weed free at practical completion as a Condition of Consent. As the future residential, commercial and tourism are developed, comprehensive site management and weed management practices are to be implemented in accordance with the VWMP. Prior to development, manage weeds to minimise risk of infestation into adjoining conservation areas.

NOTE – Ongoing control of Gamba Grass and general weed management is to be undertaken along any access haul roads within the site and all material stockpile areas in accordance with the VWMP.

VEGETATION & WEED MANAGEMENT - 2024-2025 WORKS

LEE POINT ROAD, LEE POINT, DARWIN
DEFENCE HOUSING AUSTRALIA

APPENDIX B

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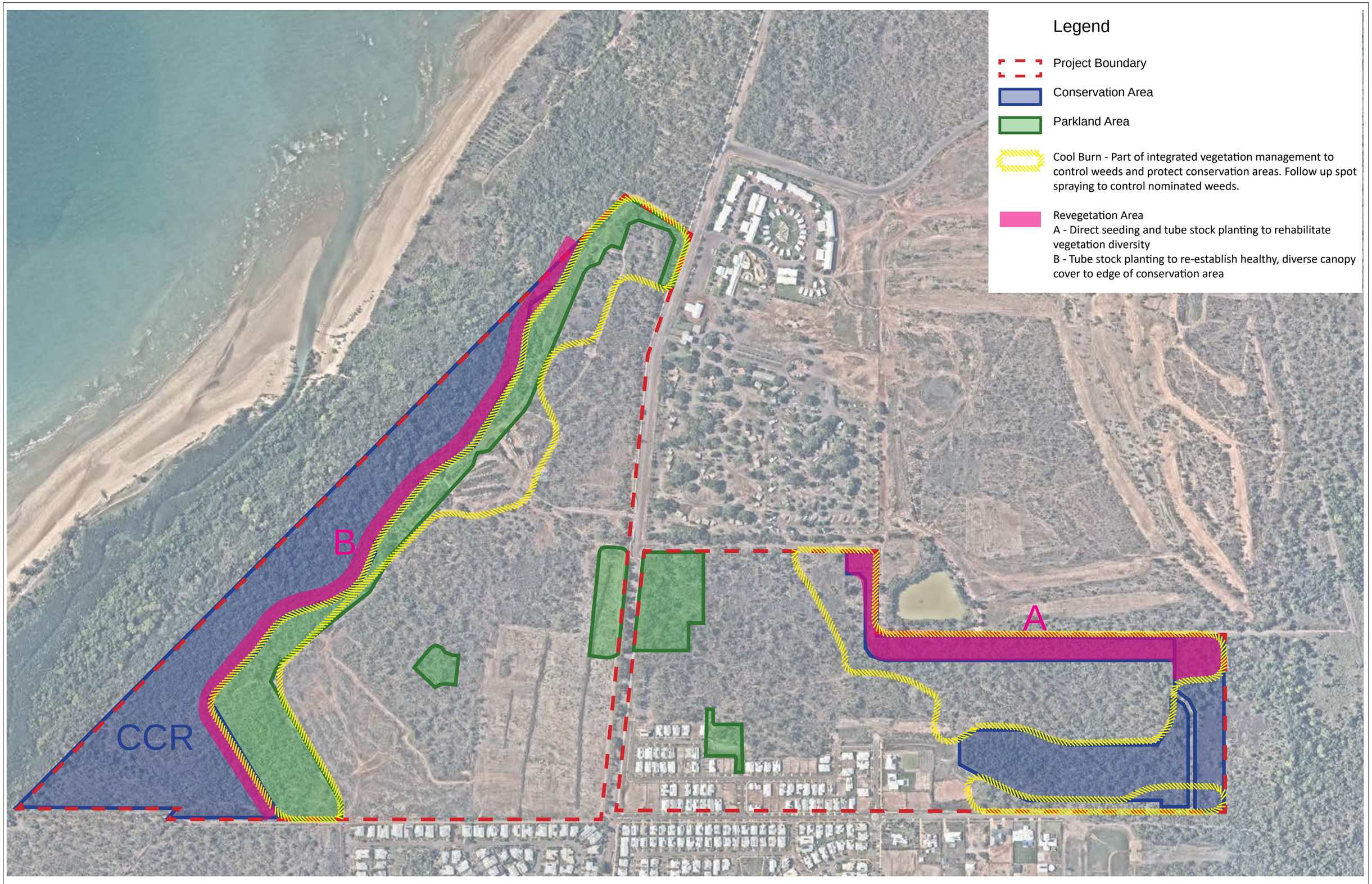

COOL BURNS AND REVEGETATION - 2024-2025 WORKS

LEE POINT ROAD, LEE POINT, DARWIN
DEFENCE HOUSING AUSTRALIA

APPENDIX B

SCALE: 1:7000 @ A3
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APPENDIX C
WEED MANAGEMENT GAMBA PLAN 2020-2030

Weed Management Plan

Gamba Grass 2020-2030 (2024 Revision)

NORTHERN TERRITORY GOVERNMENT

Document title	Weed Management Plan Gamba Grass 2020 – 2030 (2024 Revision)
Contact details	Department of Environment, Parks and Water Security
Approved by	The Minister for Environment, Climate Change and Water Security
Date approved by Minister	8 January 2024
Date gazetted	18 January 2024

Compiled by:

Snappy Gum Consulting and the Weed Management Branch on behalf of the:

Northern Territory Gamba Grass Weed Advisory Committee

Rangelands Division
Weed Management Branch
Department of Environment, Parks and Water Security
PO Box 496
Palmerston NT 0831

Phone 08 8999 4567
Email weedinfo@nt.gov.au
Web nt.gov.au/weeds

ISBN: 978-1-74350-260-0

Recommended citation: Northern Territory Government (2024). Weed Management Plan for Gamba Grass 2020 – 2030 (2024 Revision), Department of Environment, Parks and Water Security, Darwin.

This plan can be downloaded from nt.gov.au/gamba

Acknowledgment
The Weed Management Branch acknowledges the time invested by the Gamba Grass Weed Advisory Committee, land managers, landholders and all key stakeholders to inform and guide the development of this revised plan.

Photo credits from cover page: Inspecting gamba grass (Weed Management Branch), Gamba grass spraying (Weed Management Branch), Aerial view of gamba grass fire (David Muller), Gamba grass fire (Natalie Rossiter-Rachor).

Contents

Glossary	
Active management	The control and monitoring of a weed infestation to meet strategic goals.
Active management phase	The phase of a management response that involves active control and survey for the target weed. When no plants are detected for at least 12 months, the response moves into the monitoring phase.
Containment	The aim of preventing or reducing the spread of invasive species, e.g. by preventing invasions into new areas and eradicating any species that are found outside a defined area or beyond a defined line (Panetta 2016).
Control	To implement actions that reduce the impacts of a weed including physical, mechanical, chemical and biological control. Fire is also a useful management tool that can be used to reduce the impact of weeds.
Declared weed	A plant declared to be a weed under section 7 of the *Weeds Management Act 2001*.
Destroy	End the existence of a weed plant or weed infestation so no regrowth occurs.
Easement	A right annexed to land (the dominant land) to use other land (the servient land) in a particular manner or to prevent that other land from being used in a particular manner but does not include a right to take the soil or produce of other land (as defined by the *Law of Property Act 2000*).
Eradicated	A weed infestation can be considered eradicated when there is sufficient evidence that there are no remaining live plants or remaining propagules (e.g. seed).
Eradication	The elimination of every single individual (including seeds and other propagules) of a species from a defined area in which recolonisation is unlikely to occur (Panetta 2016).
Eradication status	The status of a weed control program for weed infestations that should be targeted for eradication. There are four status categories 1) unmanaged 2) active management phase 3) monitoring phase 4) eradicated.
Gamba grass free buffer	An area free of gamba grass.
Mature plant	A plant that has evidence of flowering or seeding; or is of sufficient size to be judged capable of flowering or seeding.
Monitoring phase	The phase of a management response that involves searching for any regrowth or seedlings after all plants have been controlled. The monitoring phase commences when no regrowth or new plants have been detected in the area for at least 12 months (Panetta 2007). The monitoring phase continues for at least 12 months and for the life of the seed bank.
Owner / occupier	"Owner" refers to the holder of an estate in fee simple, while "occupier" must refer to someone having exclusive possession, occupation, use or enjoyment of the land. Example where an entity would not be an owner or occupier: the holder of an easement would not be classed as an owner or occupier as they do not have exclusive possession, occupation, use or enjoyment of the land.
Outlier	Any weed infestation in the Class A zone and / or any isolated plants at significant distance from another infestation in the Class B zone.
Parcel compliance score	A score that combines presence, density and spread risk of gamba grass for a land parcel. An example of the parcel compliance score is available at nt.gov.au/gamba.
Regrowth	The regeneration of established plants following disturbance or control.
Road	See section 5(1) of the *Control of Roads Act 1953* and section 270 of the *Local Government Act 2019*.
Stockpile	An accumulation of materials such as dirt or gravel.
Track	Refers to the main access into a property.
Transport Corridor	Consists of: • A road as defined by the *Control of Roads Act 1953* and the adjoining road reserve (area between the boundary of another property and the road) or • A road defined by the *Local Government Act 2019* and the adjoining road reserve. • A railway corridor as defined by the *Australasia Railway (Special Provisions) Act 1999*.

1. Overview

1.1. Introduction

This weed management plan forms part of a strategic approach to gamba grass (*Andropogon gayanus*) management in the Northern Territory with the aim being to reduce the risk and damage caused by gamba grass, and the destructive fires it fuels, to the natural environment, life, property and infrastructure.

Weed management plans are statutory documents designated under section 10 of the *Weeds Management Act 2001* (the Act) that can be developed for declared weeds in the Northern Territory. This plan establishes the legal requirements and management actions to be undertaken by all owners and occupiers of land and all persons in the Northern Territory. Conducting land management practices in accordance with this plan will secure compliance with the requirements of the Act.

The Weed Management Plan Gamba Grass 2020 – 2030 was developed in 2020 by the Gamba Grass Weed Advisory Committee, convened under the Act, and the Weed Management Branch through a collaborative approach. The process involved consideration of lessons learned from implementation of the first 10 year plan, key stakeholder and community perspectives, and knowledge regarding distribution and management status of gamba grass, alongside the experience and expertise of committee members.

Goals and objectives, detailed in Section 2, have been determined to deliver the aim of this plan. Management requirements for all persons, land owners and occupiers are detailed in Sections 3 and 4, which aim to achieve the overall goals of the plan. Strategic actions for implementation by the Northern Territory Government in collaboration with relevant community and industry organisations are detailed in Section 6. Overall roles, responsibilities and penalties for non-compliance are outlined in Appendix A.

This 2024 review constitutes the first review of this plan. The review was undertaken again by the Weed Management Branch in consultation with the Gamba Grass Weed Advisory Committee. Public comment on the review was sought in an April – May 2023 Have your Say Survey. Survey results can be found online, where permission was provided, at:
https://depws.nt.gov.au/__data/assets/pdf_file/0010/1287802/gamba-grass-survey2023.pdf

A summary of all changes made through this review can be found in Appendix B of this plan.

Annual monitoring and reporting against the measures included in Section 6 will continue to occur to track performance against the plan. This will improve the likelihood of success by providing the opportunity to identify and address challenges so that improvements can be implemented in a timely manner. The Gamba Grass Weed Advisory Committee will continue to have an ongoing role in monitoring progress of this plan to ensure independent oversight of its delivery.

This plan is not intended as a technical guide for the management of gamba grass. Section 5 of this document includes a list of publications by the Weed Management Branch that provides technical guidance and other useful information.

1.2. Legislative status of gamba grass

Gamba grass has been assessed as a very high risk weed in the Northern Territory using the NT Weed Risk Management System, due to its impact (and potential for further impact) on the Northern Territory's natural environment, economy and cultural values.

It is declared under the Act as a Class A (to be eradicated) and Class B (growth and spread to be controlled) weed in different zones. The different zones represent a defensible balance between the prioritised requirement to eradicate high risk infestations located on the periphery of the range of the species, where feasibility of eradication remains high (Class A), and the lower feasibility of eradication associated with

large established infestations (Class B). Figure 1 shows the delineation of the Class A and Class B zones (declared in gazettal notice No. G14 9 April 2014).

Figure 1 Gamba grass management zones A and B

1.3. Distribution in Northern Territory

Gamba grass covers approximately 532,900 hectares[1] in the Darwin and Katherine regions of the Northern Territory. The largest and most dense infestations are located throughout the Darwin region, in the Class B management zone. Infestations in the Katherine region are smaller and are considered eradicable. Figure 2 shows a broad overview of the known distribution of gamba grass in the Northern Territory.

According to the Northern Territory Weeds Strategy 2021-2026, gamba grass is a priority weed for strategic control (including eradication of outliers) in both the Darwin and Katherine weed management regions. It is of no concern at present in either Tennant Creek or Alice Springs.

Current and detailed distribution data can be obtained online by visiting the Northern Territory Government's NR Maps, though the NTG Open Data Portal, or by submitting a request to the Weed Management Branch.

There are knowledge gaps regarding the distribution of gamba grass in both the Class A and Class B zones. A priority of this plan is to address this with development and implementation of a mapping and monitoring plan and ensuring community contribution of gamba grass distribution data. The information obtained through implementation of this plan will enable a more strategic approach to gamba grass management.

[1] 1.5 million hectares was previously reported as the approximate area covered by gamba grass in the NT. This area can be attributed back to 2008 and the calculation method is unknown. Henceforth the approximate area covered by gamba grass in the NT will be calculated by intersecting known gamba grass points with a 1km grid and if the 1km grid has gamba grass that 1km grid will be considered to have gamba grass cover.

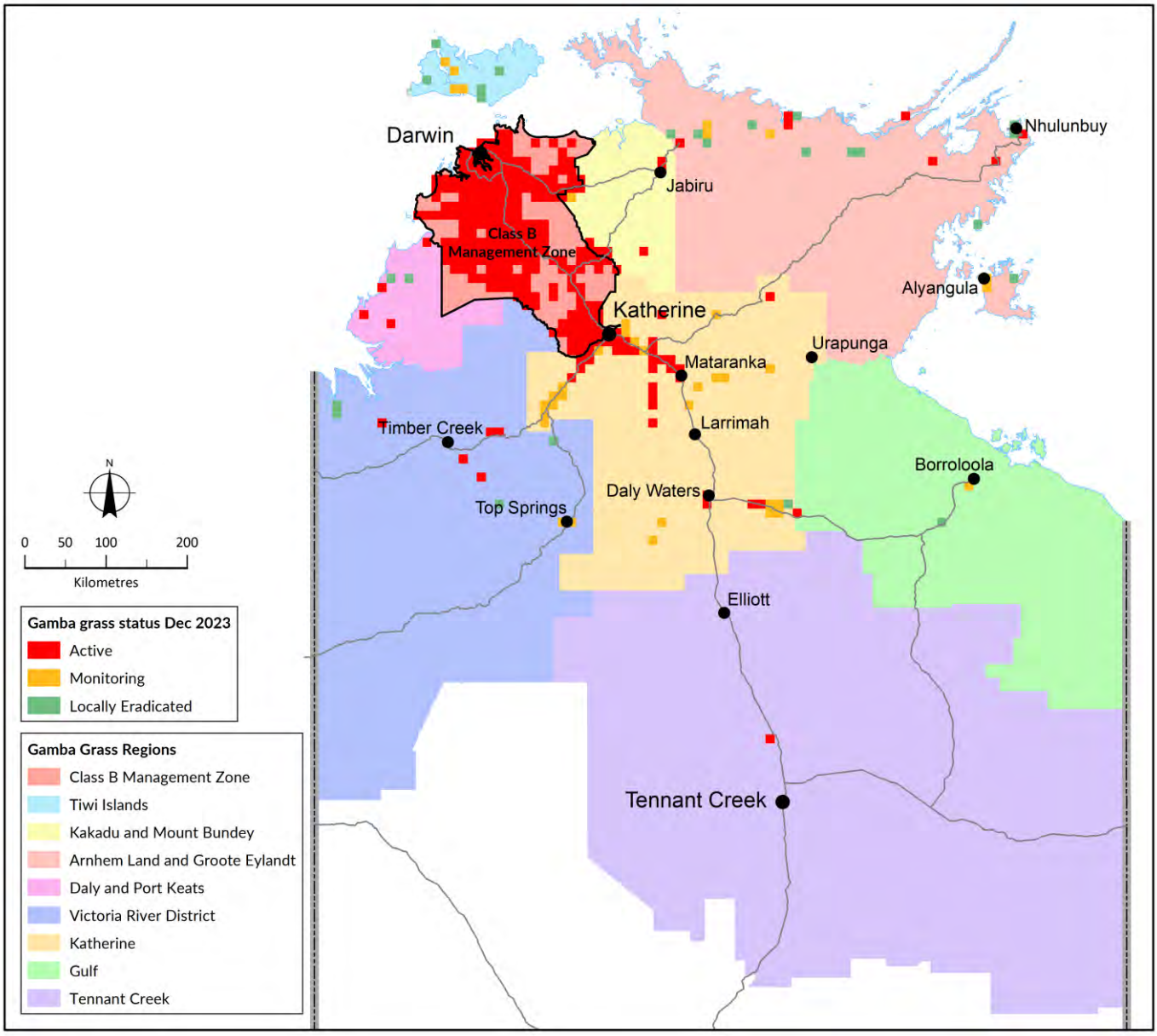

Figure 2 Gamba grass distribution across the Northern Territory as of 2023 using 0.1 degree squared grids (~10 x 10 km). The 10km grid status in the Class A zone is shown across the gamba grass eradication regions and is based on the most conservative value (i.e. active is more conservative than monitoring) of all the 1 ha Gamba Grass Management Units within each 10 km grid. In the Class B zone a 10km grid that contains gamba grass is marked as active as gamba grass eradication is not being tracked across this zone (Weed Management Branch September 2023)

2. Aim, goals and objectives

2.1. Aim

To reduce the risk and damage caused by gamba grass, and the destructive fires it fuels to the natural environment, life, property and infrastructure.

2.2. Goals and Objectives

Goal 1 Eradicate gamba grass from the Class A zone

Objectives:

1a. Understand the distribution of gamba grass in the Class A zone.
1b. By July 2023, all gamba grass in the Class A zone is under an active eradication program and all gamba grass plants have been destroyed (unless under permit).
1c. By July 2026, all gamba grass in the Class A zone is eradicated (unless under permit).
1d. By July 2026, a review of the permit system pertaining to gamba grass is completed.
1e. Review the Class A and B zone boundaries to improve the protection of areas in the Class B management zone that are free of gamba grass.

Goal 2 Contain and control gamba grass by actively managing infestations across the Class B zone and preventing spread into new areas

Objectives:

2a. Reduce seed production.
2b. Implement weed hygiene measures to reduce gamba seed spread.
2c. Reduce gamba grass outliers at a land parcel and landscape scale.
2d. Prevent gamba grass spreading into clean areas.
2e. Reduce gamba grass abundance and density in the Class B zone.
2f. Reduce gamba grass presence around landholder infrastructure.
2g. Understand the distribution of gamba grass in the Class B zone.

Goal 3 Protect priority environmental and cultural assets from the impacts of gamba grass

Objectives:

3a. Identify key environmental and cultural assets at risk of being impacted by gamba grass and incorporate into relevant Weed Management Branch, stakeholder and land manager regional plans, strategies and compliance programs.

Goal 4 Increase community capacity and willingness to participate in gamba grass management

Objectives:

4a. Engage with the community and obtain a high level of public support for gamba grass management action resulting in an increase in voluntary compliance with gamba grass management requirements.
4b. Ensure adequate information and knowledge on gamba grass management is available and up to date and translates into improved management approaches.

Goal 5 Implement transparent and accountable compliance, monitoring and reporting processes

Objectives:

5a. Deliver a transparent and risk-based compliance program.
5b. Collaborate with key stakeholders to undertake regular monitoring and reporting of performance against the Weed Management Plan for Gamba Grass 2020 – 2030.
5c. Ensure ongoing independent oversight of delivery of the Weed Management Plan for Gamba Grass 2020 – 2030.

3. Responsibilities of all persons

3.1. General duties by all persons

General duties under Section 9E of the Act that apply to all persons are outlined as follows:

A person has a duty to:

- Comply with any weed management plan for a declared weed, and
- Ensure that, if the person uses a declared weed, the declared weed is used in accordance with any classification of the declared weed under the Act Sections 7(4)(b), (c) or (d).

A person must not do any of the following[2]:

- Bring, or be responsible for, bringing a declared weed into the Northern Territory.
- Propagate or scatter a declared weed.
- Sell or offer to sell a declared weed or any thing that contains or carries a declared weed.
- Purchase or offer to purchase a declared weed or any thing that contains or carries a declared weed.
- Hire or offer to hire to another person any equipment, device or thing that contains or carries a declared weed.
- Hire or request to hire from another person any equipment, device or thing that contains a declared weed.
- Store, grow or use a declared weed or any thing that contains or carries a declared weed.
- Transport or carry on his or her person a declared weed or any thing that contains or carries a declared weed.

3.2. Requirements under the plan for all persons

In addition to the above, the following actions must be undertaken to secure compliance with this plan:

- Take reasonable action to ensure weeds are not spread.
- Do not drive machinery or vehicles through seeding weeds.
- Implement vehicle hygiene measures as required to ensure weeds are not spread.
- If carrying out activities with a high risk of weed spread – prepare a weed spread prevention plan in accordance with *Preventing Weed Spread is Everybody's Business* (Northern Territory Government 2015).

While land owners or occupiers are responsible for managing weeds on easements that occur on their land, any person or entity conducting activities of any description within an easement must comply with the responsibilities listed above.

[2] Except in accordance with a permit.

4. Responsibilities of owner or occupier of land

4.1. General duties for owner or occupier of land

General duties included under the Act for an owner or occupier of land in accordance with Section 9K(1) are as follows:

An owner or occupier of land has a duty to take all reasonable measures to prevent the spread of a declared weed on the land. Reasonable measures include:

- Destroying all outlier gamba grass plants and infestations as a priority.
- Ensuring that control measures used to destroy gamba grass are effective.
- Not allowing gamba grass to establish on stockpiles of any description.
- Preparing and implementing a property weed management plan on request.
- Recording gamba grass survey, control and distribution information and providing it to the Weed Management Branch upon request.

Note that burning, grading, slashing and grazing management methods do not destroy gamba grass. These methods can be useful for managing gamba grass fuel loads and minimising seed production. To destroy gamba grass these methods must be implemented in conjunction with other control methods (e.g. herbicide application, hand pulling). Any burning conducted must be done in accordance with any required permits.

An owner or occupier of land has a duty to take all reasonable measures to prevent a declared weed on the land spreading to other land. Reasonable measures include:

- Not allow gamba grass to spread into clean areas or adjoining land.
- Implement all gamba grass control as required by this plan prior to seeding.
- Not use gamba grass contaminated soil stockpiles as clean fill or topsoil.
- Prepare a weed spread prevention plan in accordance with *Preventing Weed Spread is Everybody's Business* (Northern Territory Government 2015).
- Destroy gamba grass in areas to be disturbed by machinery, vehicles or any other human means prior to flowering and seeding.
- Not move any machinery or transport materials contaminated with gamba grass seed off site or into clean areas.

If the owner or occupier of the land becomes aware of the presence on the land of a declared weed that was not previously present on the land – within 14 days after first becoming aware of the presence on the land of the declared weed, notify an officer of the presence of the declared weed.

All persons and organisations with gamba grass on land they own or occupy must comply with the minimum management requirements in Tables 1 to 6 to achieve compliance with this plan[3]. All actions in Tables 1 to 6 are to be implemented immediately from the gazettal date of 18 January 2024 unless otherwise stated.

[3] Refer to Appendix A for a full list of roles and responsibilities that apply to land owners and occupiers and land managers including the Northern Territory Government, Local Government and the Australian Government.

4.2. Requirements for land owners and occupiers by parcel size and use (updated in 2024 revision)

Adjoining land parcels owned by the same entity may be treated as one parcel for the purpose of determining the required management actions. This is to provide an achievable framework that ensures resources are strategically applied across multiple parcels in this situation.

Table 1	Class A Zone – Eradication
1.1	All gamba grass plants are destroyed.[4,5]
1.2	Detect and destroy all gamba grass regrowth prior to seeding (July 2023 – July 2025).
1.3	Monitor and destroy regrowth and any new gamba grass introductions annually.

Table 2	Class B Zone – Land parcels (<3 Ha) Control growth and spread
2.1	All gamba grass plants are destroyed.[5,6]
2.2	Detect and destroy all gamba grass regrowth prior to seeding (July 2023 – July 2025).
2.3	Monitor and destroy regrowth and any new gamba grass introductions annually.

Table 3	Class B Zone – Land parcels (3 – 140 Ha) Control growth and spread
3.1	Establish and maintain a gamba grass free buffer of 15m in width along the inside of the land parcel boundaries, around infrastructure[7], and on both sides of tracks and roads. The buffer must be established by chemical, mechanical or physical means, and must be done prior to seeding each year.
3.2	Where the Class B zone adjoins the Class A zone boundary, it is required that a gamba grass free buffer of 500m is established and maintained on the Class B zone side of the boundary, by January 2025. This buffer must be established and maintained by chemical, mechanical or physical means, and must be done prior to seeding each year.
3.3	Undertake annual gamba grass control activities and weed spread prevention activities to ensure gamba grass free areas remain gamba grass free.
3.4	Undertake annual gamba grass control activities so gamba grass is reduced.

Table 4	Class B Zone – Land parcels (>140 Ha[8]) Control growth and spread
4.1	Establish and maintain a gamba grass free buffer of 15m in width along the inside of the land parcel boundaries, around infrastructure[7], and on both sides of tracks and roads. The buffer must be established by chemical, mechanical or physical means, and must be done prior to seeding each year.
4.2	Where the Class B zone adjoins the Class A zone boundary, it is required that a gamba grass free buffer of 500m is established and maintained on the Class B zone side of the boundary, by January 2025. This buffer must be established and maintained by chemical, mechanical or physical means, and must be done prior to seeding each year.

[4] Unless under permit. Previously, applications for a permit to use a declared weed have been considered by the Minister for the use of gamba grass for grazing purposes in the Class A zone. With exception of areas under permit upon gazettal of this plan, no new permit applications will be considered.
[5] Reference to 'by July 2023' has been removed as this date has passed and this requirement has come into effect.
[6] This requirement reflects the increased risk to property and life associated with managing fires on small land parcels.
[7] Infrastructure refers to landholders' houses, sheds, bores, fences (except internal fencing).
[8] This includes all land parcels greater than 140 Ha which may include pastoral land parcels, Aboriginal Land or national parks.

4.3	Undertake annual control activities and weed spread prevention activities to ensure gamba grass free areas remain gamba grass free.

Table 5	Hay Industry
5.1	Hay production areas producing hay destined for sale or transport, must be free of gamba grass.
5.2	Do not sell hay containing gamba grass, or transport hay containing gamba grass off the land parcel[9] on which it was produced. If transporting hay within a property, where the land parcel straddles a road the vehicle must be clean prior to moving on the road.
5.3	Gamba grass cut for use on the land parcel, must be cut prior to flowering and seeding.

Table 6	Transport Corridors[10]
6.1	For all transport corridors, establish and maintain a gamba grass free buffer of 15m in width on both sides of tracks, railway lines and roads. This buffer must be established by chemical, mechanical or physical means, and must be done prior to seeding each year.
6.2	Where the Class B zone adjoins the Class A zone boundary, it is required that a gamba free buffer of 500m is established and maintained on the Class B zone side of the boundary. This buffer must be established and maintained by chemical, mechanical or physical means, and must be done prior to seeding each year.
6.3	For all transport corridors in the Class A zone: all gamba grass plants are destroyed[5].
6.4	For all transport corridors in the Class A zone: detect and destroy all gamba grass regrowth prior to seeding (July 2023 – July 2025).
6.5	For all transport corridors in the Class A zone: monitor and destroy regrowth and any new gamba grass introductions annually (after July 2025).

[9] As identified by the parcel location code and lot number.
[10] For transport corridors Table 6 is applicable. Tables 1 to 5 do not apply.

5. Further Resources

The Weed Management Branch have developed a number of resources to assist with the management of gamba grass, preventing weed spread, developing property weed management plans and outlining weed data collection practices. These resources are summarised below.

- Gamba grass fact sheet - Provides information on gamba grass identification, impacts, habitat, distribution and management.
- Weed management guide: gamba grass (*Andropogon gayanus*) - Provides advice on how to manage gamba grass on your land parcel.
- Northern Territory weed management handbook - Developed to provide detailed information about weed control in the Northern Territory. Weed control option tables are included in this handbook that detail herbicide recommendations and optimum treatment times for most problem weeds. Other control methods, which can assist in weed management, have also been described.
- Preventing weed spread is everybody's business - Describes simple spread prevention techniques that are able to be applied by all Territorians, including land managers and business operators, with a view to protecting our valuable and diverse resources from the impacts of weeds.
- Regional weeds strategies - In the Northern Territory, there are regional strategies for the Darwin, Katherine, Tennant Creek and Alice Springs weed management regions. Together, they comprise the Northern Territory Weeds Strategy.

  Regional strategies identify significant weeds and weed issues in a region. They are developed in consultation with key stakeholders including regional weed reference groups and are informed by outputs from the Northern Territory Weed Risk Management System.
- Weed data collection manual - Describes how to, and what information to collect when undertaking weed mapping and surveys.
- Weed data collection – a field guide for collecting weed data in the Northern Territory - Provides a step by step guide about the weed data collection process.
- Weed ID deck - Weed identification flip-book. Contains photos and written descriptions to assist with identification.
- Planning for better weed management - This is a guide on how to plan for efficient and cost effective weed control on your land parcel.

Copies of these resources can be obtained online at www.nt.gov.au or by contacting the Weed Management Branch via email: weedinfo@nt.gov.au or phone: 08 8999 4567.

6. Actions, monitoring and evaluation

The Northern Territory Government recognises the significance of gamba grass impacts and the associated management complexities. Achieving the aim, goals and objectives of this plan will require action at a range of levels, involving a great deal of effort, commitment and investment by land managers, the Northern Territory Government, community and industry.

A number of strategic actions, additional to the actions listed in Sections 3 and 4 which relate to individuals and land owners and occupiers, have been identified to support delivery of the plan. These strategic actions are detailed in tables 7 to 11 below as they relate to each goal.

These tables also detail the indicators and measures that will be reported on annually to assess performance against the plan, to determine whether the stipulated actions are contributing towards the identified outcomes at a Territory level. This annual reporting will be made publicly available.

The Weed Management Branch, in conjunction with the Gamba Grass Weed Advisory Committee, will be responsible for compiling and reviewing the annual reports and will monitor the results to determine progress against the objectives, ensure ongoing relevancy and community support, and to apply an adaptive approach to changing conditions.

This plan has been drafted using the best information available at the time of writing. Should new information become available which should be included in, or influence the structure and content of this plan, it may be incorporated as a revision.

Table 7. Goal 1 - Eradicate gamba grass from the Class A zone				
Objectives	Strategic actions	Who	Performance Indicators	Performance Measures
1a. Understand the distribution of gamba grass in the Class A zone.	By July 2021, design a mapping and monitoring program for the Class A zone.	Weed Management Branch (WMB)	By July 2022, the extent of gamba grass has been assessed for land parcels identified in the monitoring and mapping program.	A generalised map of distribution or gamba grass presence confidence is publicly available. Annual measurement of gamba grass in hectares using available spatial data and eradication status information.
	By July 2021, commence the mapping program in the Class A zone.	WMB / land owner / occupiers		
	By July 2022, complete the mapping program and continue monitoring in the Class A zone.	WMB/ land owner / occupiers		
1b. By July 2023, all gamba grass in the Class A zone is under an active eradication program and all gamba grass plants have been destroyed (unless under permit)	Individuals, land owners and occupiers implement required actions as per Section 4.	Land owners and occupiers	By July 2023, all known land parcels with gamba grass in the Class A zone are classified as b) active management. By July 2025, all known land parcels with gamba grass in the Class A zone are classified as c) monitoring phase. By July 2026, all known land parcels with gamba grass in the Class A zone are classified as d) eradicated[11].	A register is maintained by WMB of all known land parcels with gamba grass in the Class A zone according to their current eradication status: a) unmanaged b) active management c) monitoring phase d) eradicated Summary data of a, b, c and d is produced. Annual summary data produced showing progress toward eradication.
1c. By July 2026, all gamba grass in the Class A zone is eradicated (unless under permit).	Assess eradication status for land parcels.	WMB		
1d. By July 2026, a review of the permit system pertaining to gamba grass is completed.	Existing permits that allow grazing of gamba grass in the Class A zone are reassessed to ensure they are appropriate.	WMB Gamba Grass Weed Advisory Committee (WAC)	Review of permit system is completed as it pertains to gamba grass.	Annual reporting on gamba grass grazing permit conditions and compliance. Outcomes of the July 2026 review are made publicly available.
1e. Review the Class A and B zone boundaries to improve the protection of areas in the Class B management zone that are free of gamba grass.	By July 2026, review the Class A and Class B zones to ensure the Class A zone captures areas that are free of gamba grass and where eradication is considered feasible.	WMB WAC	By July 2026, revised Class A and B zones are declared if recommended by the review process.	Gamba grass management zones review discussion paper is produced through consultation with relevant stakeholders, including the WAC. Updated Class A and B zone map is produced if zones are amended.

[11] For more information on active management, monitoring phase, and eradication status, see glossary.

Table 8. Goal 2 – Contain and control gamba grass by actively managing infestations across the Class B zone and preventing spread into new areas				
Objectives	Strategic actions	Who	Performance Indicators	Performance Measures
2a. Reduce seed production. 2b. Implement weed hygiene measures to reduce gamba grass seed spread. 2c. Reduce gamba grass outliers at a land parcel and landscape scale. 2d. Prevent gamba grass spreading into clean areas. 2e. Reduce gamba grass abundance and density in the Class B zone. 2f. Reduce gamba grass presence around landholder infrastructure.	Land owners, occupiers and all users of land implement required actions as per Sections 3 and 4.	Land owners, occupiers and all users of land	An annual compliance program is developed and implemented to assess compliance with this plan and compliance action is taken against properties not complying.	Proportion of assessed land parcels that: a) Are already compliant at time of initial assessment and no follow up action is required. b) Voluntarily meet management requirements after being informed of non-compliance. c) Had compliance action taken due to non-compliance. Annual summary of a, b and c produced including the total number and area of parcels assessed as a proportion of the area of the Class B management zone.
			By July 2024 and annually afterwards there is an improvement in gamba grass management as evidenced by an improvement in parcel compliance score.	Proportion of land parcels that have had multiple year compliance assessments and: a) Compliance score has improved indicating reduced gamba density. b) Compliance score is unchanged indicating no reduction in gamba density. c) Compliance score has worsened indicating increased gamba density. Annual summary of a, b, and c produced.
			Reduction in area affected by gamba grass in target areas.	Gamba grass presence measured annually (1km grid map showing the area affected by gamba grass).
2g. Understand the distribution of gamba grass in the Class B zone.	The WMB are to undertake an annual assessment of land impacted by gamba grass. A mapping and monitoring program is developed for the Class B zone.	WMB	Increased understanding of priority areas for future mapping in the Class B zone.	Aerial survey of gamba grass within the Class B zone (pending funding). Key areas of gamba grass improvement are reported on annually including metrics for the following: a) area sprayed b) the number of properties sprayed c) tenure types. Categorised list of priority areas that require gamba grass mapping is produced.

Table 9. Goal 3 - Protect priority environmental and cultural assets from the impacts of gamba grass				
Objectives	Strategic actions	Who	Performance Indicators	Performance Measures
3a. Identify key environmental and cultural assets[12] at risk of being impacted by gamba grass and incorporate into relevant Weed Management Branch, stakeholder and land manager regional plans, strategies and compliance programs.	By December 2022, key environmental and cultural assets[12] at risk of being impacted by gamba grass have been identified with stakeholder input.	WMB Non-Government Organisations Landholders and occupiers	By December 2022 a list has been developed of key environmental and cultural assets[12].	By January 2023, a list of priority assets identified is made publicly available (with exclusion of certain sacred sites if necessary).
	Identified key environmental and cultural assets[12] have been prioritised in WMB and stakeholder planning processes.	WMB and landowners and occupiers with environmental and cultural assets	Key environmental and cultural assets[12] are prioritised in landholder management programs including regional plans.	An annual summary is produced to demonstrate progress towards protection of key environmental and cultural assets[12]. An annual map is produced with gamba grass overlayed across key environmental and cultural assets[12] for target locations[13].

[12] Environmental and cultural assets as outlined in the WMB Regional Weed Management Strategies.
[13] This performance measure requires stakeholders to be working towards collecting data (e.g. presence, absence and treatment) so more informed maps can be produced over time.

Table 10. Goal 4 - Increase community capacity and willingness to participate in gamba grass management				
Objectives	Strategic Actions	Who	Performance Indicators	Performance Measures
4a. Engage with the community and obtain a high level of public support for gamba grass management action resulting in an increase in voluntary compliance with gamba grass management requirements.	By July 2021, develop a communications plan to raise awareness of gamba grass management requirements and available support. Engage with the community. Education and awareness activities are implemented to encourage compliant behaviours.	WMB	Public knowledge of gamba grass impacts and management requirements has increased. Changes in active management and voluntary compliance levels.	Delivery of the communications plan, including participation in public events. The number of people participating in the Gamba Action Program has increased. Annual review and update of communications plan. Annual summary data produced as per Goals 1 to 3.
	By July 2023, complete a social marketing study (subject to funding) to identify community perceptions, needs and barriers regarding gamba grass management.	WAC lead in conjunction with Non-Government Organisations	Better understand community perceptions, needs and barriers regarding gamba grass management.	Development and completion of the social marketing study by 2023. Post study completion, and delivery of strategies that incorporate study outcomes to increase uptake of gamba grass management in the community.
	Improve landholder capacity for reporting gamba grass points in the Class A zone.	WMB	Public reporting to WMB on gamba infestations in the Class A zone.	Uptake of NT WeedMate. Presence / absence of gamba grass in the Class A zone is being reported to the WMB for a) all historical gamba grass points; and b) new sightings.
	Development of an efficient tool (subject to funding) to encourage public reporting of gamba grass sightings and management effort. Promote the report gamba tool to encourage public reporting of problem gamba grass in the Class B zone.	WAC lead in conjunction with Non-Government Organisations	Public reporting of problem gamba grass.	The number of reports being made of problem gamba grass via the gamba reporting tool at nt.gov.au/gamba
	Establish and support cross tenure working groups to ensure coordinated management of gamba grass across different land tenures.	WMB	An increase in coordinated management effort.	Promote active working groups achieving effective gamba grass management across tenures.
4b. Ensure adequate information and knowledge on gamba grass management is available and up to date, which translates into improved management approaches.	Research is undertaken that supports improved gamba grass management outcomes by addressing identified research gaps.	WMB Research partners WAC	The Gamba WAC reviews annually key knowledge gaps that need to be addressed to improve gamba grass management outcomes. Feedback to be sought annually to inform knowledge gaps.	Key knowledge gaps are reported on annually including: a) further research or work needed to address these knowledge gaps, and b) any progress being made to address these knowledge gaps.
	Promote research activities and updated management recommendations.	WMB and Research partners	Land manager awareness of improved management approaches	Research outcomes that can improve gamba grass management outcomes are a) made available to the public; and b) reported on annually. Integration of research outcomes into core business activities.
	Delivery of gamba grass forums with a focus on celebrating gamba grass successes and educating the community / land mangers on how to manage gamba grass and identifying other needs.	WAC in conjunction with relevant stakeholders	Capacity to manage gamba grass effectively has increased.	Delivery of gamba grass forums (every 2 to 3 years) to celebrate gamba grass successes, provide education and identify needs.
	Collaborate with other jurisdictions: a) to identify funding options for production of a National Best Practice Gamba Grass Manual by December 2022. b) On the production of a National Best Practice Gamba Grass Manual by early 2024.	WMB	Pathway is identified to produce National Gamba Grass Best Practice Manual. Collaborate with other jurisdictions on the production of the National Best Practice Gamba Grass Manual by early 2024.	Progress is made towards development of National Gamba Grass Best Practice Manual. Delivery of National Best Practice Gamba Grass Manual by early 2024.

Table 11. Goal 5 – Implement transparent and accountable compliance, monitoring and reporting processes				
Objectives	Strategic actions	Who	Performance Indicators	Performance Measures
5a. Deliver a transparent and risk-based compliance program.	A risk-based compliance program is developed. The compliance program is promoted to the community. The compliance program is implemented annually.	WMB	Responsiveness to public enquiries.	Proportion of public enquiries responded to regarding the compliance process.
			Public awareness of the parcel compliance rating system.	Number of online downloads of the parcel compliance rating system, annually.
			Application of the parcel compliance rating system.	Annual summary of outcomes as per Goal 1 - 3.
5b. Collaborate with key stakeholders to undertake regular monitoring and reporting of performance against the Weed Management Plan for Gamba Grass 2020 – 2030.	By 30 September each year, deliver an annual report which addresses all performance indicators.	WMB WAC	Regular, transparent, and meaningful reporting that is effectively promoted to the public.	Public release of an annual report reviewed by the WAC that addresses performance indicators and measures within this plan. Annual online feedback undertaken to inform annual report.
	Effectively communicate key outcomes of the annual report to the community.	WMB	Community awareness.	Number of mechanisms used to promote the key outcomes of the annual report.
5c. Ensure ongoing independent oversight of delivery of the Weed Management Plan for Gamba Grass 2020 – 2030.	Ongoing collaboration with the WAC regarding implementation of this plan.	WMB	Retention of the WAC.	WAC are communicating with their represented stakeholders on performance of the Weed Management Plan for Gamba Grass 2020 – 2030 and acting on feedback received from stakeholders.

7. References

Northern Territory Government (2015). *Preventing weed spread is everybody's business*., Darwin, NT. Available at https://denr.nt.gov.au/__data/assets/pdf_file/0011/257987/preventing-weed-spread.pdf.

Panetta, F.D (2007). Evaluation of weed eradication programs: containment and extirpation. *Diversity and Distributions*, *13*(1): 33-41. https://doi.org/10.1111/j.1472-4642.2006.00294.x

Panetta, F. D (2016). Environmental weed risk screen for Victoria: background and development. A report prepared for the Department of Environment, Land, Water and Planning, Vic. https://www.environment.vic.gov.au/__data/assets/pdf_file/0022/49171/WESI-Env-weed-risk-screen-report-Jan-2016_ONLINE.pdf

Appendix A – Legal obligations and penalties for non-compliance

Roles and responsibilities

Everyone has a role in the management of declared weeds.

Owners or Occupiers of Land: All owners or occupiers of land (public and private) are responsible for managing declared weeds on their land as per the Act and relevant statutory weed management plans, including this plan, the Weed Management Plan for Gamba Grass 2020 – 2030, 2023 Revision.
Northern Territory Government agencies have responsibility to manage declared weeds on land under their care and control including vacant Crown land, NT-managed National Parks and reserves and major road reserves.
Local Government: Local governments have responsibilities to manage declared weeds on land they occupy or own including local road reserves.
Australian Government have responsibilities to manage declared weeds on land under their care and control including Commonwealth lands, including Defence land and Kakadu and Uluru Kata Tjuta National Parks.

Penalties for offences under the Act

A weed management officer can instruct an owner or occupier of land outlining reasonable measures that must be taken for the control or eradication of a declared weed species within a specified timeframe. Not complying with the instruction is an offence and may involve financial penalty.

The Northern Territory Government has the capacity to prosecute for non-compliance with the Act or this weed management plan. Owners or occupiers of land should be aware of the following penalties that can apply to the following non-compliances of the Act:

- Section 9 (general duties) of the Act can incur a range of penalties from 77 to 770 penalty units[14] for an individual and between 385 to 3850 penalty units[14] for a body corporate.
- Section 28(1) (an order) can incur a penalty of up to 100 penalty units[14].
- Section 14B(4) (a direction) can incur a penalty of 10 penalty units[14] for an individual and 50 penalty units for a corporation.
- Section 15C (weed control notice) can incur a range of penalties from 77 to 1540 penalty units[14] for an individual and between 385 to 7700 penalty units[14] for a body corporate.

The amount of the penalty unit[14] changes each year and as of July 2023, a penalty unit[14] was $176.

Permits

Historically, applications for a permit to use gamba grass under section 28F of the Act (whereby a person may apply to the Minister for a permit to use a declared weed) were considered by the Minister. The Minister has determined that with exception of areas under permit upon gazettal of this plan, no new permit applications to utilise gamba grass for grazing purposes will be considered in the Class A zone. Permits to utilise gamba grass for grazing purposes are subject to a range of conditions, which are audited for compliance on an annual basis.

[14] Click on the link for current penalty unit value.

Appendix B – Summary of changes made during 2024 review

Glossary:

- Roads definition removed from footnotes and added to glossary.
- Definition of transport corridor updated in the glossary to clarify the area of the 'road reserve' and to specify the railway corridor is defined by the *Australasia Railway (Special Provisions) Act 1999*.

Section 2.2:

- Goal 2 has had an additional objective added as follows, "*Objective 2g Understand the distribution of gamba grass in the Class B zone*". This objective seeks to better understand the distribution of gamba grass in the class B zone, noting this will not to be to the same level as what is required for the Class A (eradication) zone.
- Objective 4c has been removed and incorporated with objectives 4a and 4b. This is because, "*Objective 4c increasing voluntary compliance with gamba grass management requirements*' is the outcome that objectives 4a and 4b seek to achieve.

Section 3.1 and 4.1:

- General duties have been updated to reflect the legislative changes introduced to the Act on 09/01/2023.

Section 4.2:

- Requirements 1.1, 2.2 and 6.3 have been updated to remove 'by July 2023' as this date has now passed and this requirement has come into effect.
- Requirement 2.1 has been removed. From July 2023 onwards all <3 Ha blocks in the Class B zone are required to destroy all gamba grass. Therefore the requirement for a 15m buffer is no longer applicable.
- Requirements 3.1, 3.2, 4.1, 4.2 and 6.1 have been updated to improve the readability of the requirements.
- Requirement 3.3 has been updated to two new requirements to require that blocks between 3 – 140 Ha undertake annual gamba grass control activities and weed spread prevention activities to ensure that gamba grass free areas remain gamba grass free as well as undertaking annual gamba grass control activities so gamba grass is reduced.
- Requirement 4.3 has been updated to remove 'monitoring' as it is not feasible to assess whether or not monitoring has been undertaken.
- Requirement 5.1 has been updated to remove reference to a '40 m gamba grass free buffer around hay production areas' to an outcome focused requirement. I.e. the land owner or occupier will be required to decide what is necessary to ensure hay destined for sale remains free of any gamba grass.
- Requirement 5.2 has been updated to refer to 'road' instead of 'public road'.
- Requirement 6.2 has been updated to improve the readability of this requirement and remove reference to January 2022 as this date has now passed and this requirement has come into effect.
- Requirement 6.5 has been updated to add the date 'after July 2025' as this is the applicable date for this requirement.

Table 8. Goal 2 – Contain and control gamba grass by actively managing infestations across the Class B zone and preventing spread into new areas

- Removal of performance measure, "*An increase each year in the number of assessed land parcels that have implemented management requirements and percentile of properties assessed that are compliant e.g. 80% compliant.*" This performance measure has been replaced with "*An annual compliance program is developed and implemented to assess compliance with this plan and compliance action is taken against properties not complying*." This update has been made to clarify the intent around this performance indicator.
- The addition of a new objective "*Understand the distribution of gamba grass in the Class B zone*." Strategic actions, performance indicators and performance measures have been included for this strategic objective. This additional requirement reflects the work being undertaken by the WMB to assess and understand the distribution of gamba grass in the Class B zone (for example, the aerial survey for gamba grass of the Darwin rural area in May 2023). This requirement also reflect the need to better understand the distribution of gamba grass across the Class B zone and therefore requires a mapping and monitoring program that fulfils this need, noting this program will be different to what has been developed for the Class A zone.

Table 9. Goal 3 Protect priority environmental and cultural assets from the impacts of gamba grass

- Removal of the performance indicator, "*Key environmental and cultural assets are prioritised in WMB regional plans, WMB compliance planning and stakeholder weed plans aimed at managing gamba grass*". Alternative performance indicator included, "*Key environmental and cultural assets[12] are prioritised in landholder*

management programs including regional plans". This change reflects that it is the responsibility of the land owner or occupier to manage the environmental and cultural assets on their land.

- Removal of performance measure, "*An annual assessment of regional plans and compliance programs is conducted to evaluate their success in managing the threat gamba grass poses to key environmental and cultural assets*." This has been replaced with the performance measure, "*an annual map is produced with gamba grass overlayed across key environmental and cultural assets for target locations*. The change removes the requirement for annual assessment and instead produce maps of key environmental assessments which is a more accurate measure to demonstrate progress towards managing key environmental and cultural assets.
- Update to the footnote 12 that defines environmental and cultural assets.

Table 10. Goal 4 - Increase community capacity and willingness to participate in gamba grass management

- The strategic action, "*Promote methods of reporting gamba grass distribution*" has been replaced with "*improve landholder capacity for reporting gamba grass points in the Class A zone*." The associated performance indicators and measures have also been updated. This action reflects the need to focus improving gamba grass reporting in the Class A zone as this is critical to tracking the eradication of gamba grass across this zone.
- An additional strategic action has been added, "*promote the report gamba tool to encourage public reporting of problem gamba grass in the Class B zone*". The associated performance indicators and measures have also been updated. This action reflects the focus on reporting problem gamba grass in the Class B zone.
- Removal of strategic action, "*identify and prioritise gamba grass knowledge gaps and advocate for research activity in these areas*". This has been replaced with, "*research is undertaken that supports improved gamba grass management outcomes by addressing identified research gaps*". Associated performance indicators and measures have also been updated. This update has been made to clarify this strategic action, how research gaps will be identified and reported on and how overcoming these research gaps will also be reported on.
- Performance indicators and measures have been updated for the strategic action, "*promote research activities and updated management recommendations*" to more specific measures and indicators.
- The strategic action, "*Deliver an annual gamba grass research and development community forum with a focus on celebrating gamba grass success and identifying barriers and issues to inform further research*" has been replaced with, "*delivery of gamba grass forums with a focus on celebrating gamba grass successes and educating the community / land manager on how to manage gamba grass and identifying other needs*." Performance indicators and measures have been updated for this strategic action. This update removes the requirement for an annual forum, which has not been possible to implement. Rather a forum every 2-3 years is now proposed. The focus of the forum has been also been clarified to not be about 'research and development' but rather about celebrating gamba grass successes and delivering information to help land owners or occupiers manage their gamba grass.
- An additional strategic action has been included as follows, "*collaborate with other jurisdictions on the production of a National Best Practice Gamba Grass Manual by early 2024*." This reflects the progress made on the development of a National Gamba Grass Best Practice Manual and the expected timeframes for the delivery of this manual.
- Objective 4c has been removed as a standalone objective and has been incorporated within the 4a and 4b objectives. This is because the objective 4c which focuses on 'increasing voluntary compliance' is an outcome that the plan strives to achieve through implementation of objectives 4a and 4b.

Table 11. Goal 5 – Implement transparent and accountable compliance, monitoring and reporting processes

- Update to the strategic action, "*by 30 July each year, deliver an annual report which addresses all performance indicators*" to "*by 30 September each year, deliver an annual report which addresses all performance indicators*". This strategic action has been updated to reflect the need for time to collaborate with key stakeholders in order to report against implementation of the gamba plan.

APPENDIX D
NORTHERN TERRITORY WEED MANAGEMENT HANDBOOK

Northern Territory

Weed Management Handbook

www.nt.gov.au/weeds

NORTHERN TERRITORY GOVERNMENT

About this Manual

This manual has been developed to provide detailed information about weed control in the Northern Territory.

Weed Control Option Tables are available that detail herbicide recommendations and optimum treatment times for most problem weeds. Other control methods, which can assist in weed management, have also been described.

It should be noted that this document has been designed to provide information for the control of weeds in non-crop situations.

Disclaimer

While care has been taken to ensure that the information provided was true and correct at the time of publication, changes in circumstance after the time of publication may impact on the accuracy of this information. The Northern Territory of Australia gives no warranty or assurance and makes no representation as to the accuracy of any information or advice contained, or that it is suitable for your intended use.

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Users of agricultural (or veterinary) chemical products must always read the approved label and any APVMA Permit, before using any product and strictly comply with the directions on the label and any conditions on the Permit. Users are not absolved from compliance with the directions on the label or conditions of the Permit by reason of any statement made in or omission from this publication.

Weed Management Branch

Phone: 08 8999 4567
Fax: 08 8999 4445
Email: weedinfo@nt.gov.au
Web: www.nt.gov.au/weeds

ISBN 978-1-74350-052-1

If you suspect poisoning, please contact the Poisons Information Centre Emergency on 13 11 26 (24-hour) and/or call an ambulance.

Contents

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Plates

Weeds in the Northern Territory

Weeds severely impact the Northern Territory's (NT) environmental, economic, social and cultural values.

Environmental values such as biodiversity and ecological function are impacted, through the invasion and replacement of native plant communities and wildlife habitat. Weed infestations can also harbour feral animals, and hinder their control.

Weed infestations can reduce the availability of traditional foods and other resources used by Indigenous people by displacing native plants and animals. Weeds can influence the social well being of Indigenous landowners by disrupting their spiritual and physical connections to country.

Weed populations can also result in restricted access to and recreational use of natural landscapes. Hunting, fishing, camping and bushwalking can all be affected by weeds. Weed monocultures, such as those created by mimosa, significantly diminish the aesthetic values of the natural landscape.

Weeds in the NT cost land managers millions of dollars per year, through costs of control and lost production. The following information has been taken from the *2010 Pastoral Industry Survey Northern Territory Wide*. It shows the spending, per property, in each of the major cattle producing regions of the NT.

Table 1 – Amount spent annually on weed control per property and per square kilometre

Region	Average $/property	Median $/property	Maximum $/km^2
Alice Springs	1 332	0	0.00
Barkly	38 384	15 000	2.40
Katherine	11 938	6 500	4.80
Top End	52 947	30 000	45.50
NT Wide	20 884	5 000	3.90

Legislative Responsibilities

The NT *Weeds Management Act* (The Act) applies to all owners, managers and occupiers of land, and all other land users in the NT. To view the complete Act and the Weeds Management Regulations please go to: www.nt.gov.au/dcm/legislation

Once a weed is declared in accordance with section 7 of the Act there is a requirement for all land holders, land managers and land users to comply with the declaration classification. There are three classification types in the NT, these being:

- Class A: To be eradicated.
- Class B: Growth and spread to be controlled.
- Class C: Introduction into the Territory is to be prevented.

All Class A and Class B weeds are also considered Class C. For information on the classification of individual species please refer to the Weed Control Options Tables or visit www.nt.gov.au/weeds

Weed Prevention

Both owners and occupiers of land are required to take all reasonable measures to prevent their land being infested with a declared weed.

Spread Prevention

All land users are required to prevent the spread of a declared or potential weed. This requirement applies on and off your own property.

Advising of Outbreaks

Where a declared weed is identified on land where it has not previously been, or known to have been present, the person responsible for the land must notify the Weed Management Branch (WMB) of its presence within 14 days – see contact details on the inside cover of this document.

Weed Disposal

It is illegal to transport declared weeds. You should dispose of any weed material on site. Burning will destroy vegetative plant material and also render most seeds unviable. As some hard coated seeds may survive, on-site deep burial may also be required. On site burial of seeds, and/or plant material, is an effective option if material is placed at a depth sufficient to prevent emergence of vegetative shoots or seedlings.

Compliance with a Weed Management Plan

The owner and occupier of land on which a declared weed or potential weed is present must comply with any relevant weed management plan approved by the Minister in accordance with section 10 of the Act.

At the time of printing Weed Management Plans were in force for gamba grass, mimosa, bellyache bush, cabomba, prickly acacia, chinee apple, mesquite, neem, grader grass and athel pine.

Monitoring by Government Officials

The Minister may appoint a Weed Management Officer or authorised person (‘Officer’), who is empowered to investigate suspected breaches of the Act. Officers have a number of powers under the Act, including entering and searching properties, documenting findings and, if necessary, ordering the owner or occupier of the land to control or eradicate declared or potential weeds. They are also able to order the owner or person in control of vehicle, boat or animal to remove or destroy any weed material.

Can I be Fined?

Penalties of between 77 and 770 penalty units ($11 858 and $118 580) for individuals and between 385 and 3850 penalty units ($59 290 and $592 900) for a body corporate apply for failure to comply with this plan*.

* Penalty units are determined by the Penalty Units Act. As at 1 July 2017 the Penalty Units Regulations prescribed the monetary value of a penalty unit as $154.

Strategic and Planned Approaches to Weed Management

Different levels, types and locations of weed infestation require different levels of investment, in terms of financial input, human resources and time. This document aims to assist landholders to determine the most appropriate course of action for their property. Effective management should involve:

- preventing introduction;
- preventing or suppressing reproduction, including prevention of seed production and vegetative expansion;
- preventing spread through dispersal of propagules, including seeds and viable vegetative sections;
- eradicating new/isolated outbreaks, particularly those high in the catchment and close to water sources; and
- where eradication is not possible, containing established populations.

These can be achieved by:

- developing/implementing a property management plan which complements other plans within the catchment;
- developing a budget for your weed management control;
- planning to exploit any known weakness in the weed's life-cycle or ecology;
- integrating all appropriate control methods e.g. biological, chemical, and mechanical;
- integrate weed control with other management actions e.g. managing grazing regimes, fire and feral animals;
- implementing a rehabilitation program e.g. revegetation; and
- implementing a monitoring and evaluation program.

Property Management Planning

Developing a property management plan for your property is about identifying and prioritising what needs to be achieved, within a set time frame. A plan should aim to systematically contain, reduce and in some instances, eradicate weed infestations, while protecting unaffected country. Ideally property management plans should take into consideration the weed's current distribution, the potential for spread (consider mechanisms for spread with respect to topography, proximity to water courses, proximity to access tracks/roads) and potential impacts on land use and other values such as biodiversity.

Property management plan templates are available from the Weed Management Branch (see contact details on the inside cover of this document). Weed Management Officers from the Branch, can provide assistance with the development of property management plans and can provide advice on all facets of weed management, including control techniques, biological control, legislative responsibilities, monitoring, reporting and regional planning.

Mapping

Any plan will need to address how big the problem is and where the problem is. Good plans should also take into consideration weed infestations in neighbouring areas.

The Weed Management Branch has produced the *Northern Territory Weed Data Collection Manual.* This manual describes what information to collect when mapping, controlling and monitoring weed infestations in the NT. The manual can be downloaded from www.nt.gov.au/weeds The manual is based on the national guidelines published in *A Field Manual for Surveying and Mapping Nationally Significant Weeds*.

The supply of weed data to the Weed Management Branch by individuals and groups using the manual is important to increase our knowledge of weeds within the NT. The collection of data in accordance with the *Northern Territory Weed Data Collection Manual* will result in improved and consistent data quality. Increased quality and quantity of weed infestation data across all parts of the NT is fundamental in planning and delivering strategic and coordinated weed management to protect the Territory's assets.

Coordinated Management

As weeds do not recognise property, tenure or state boundaries, it is imperative that land owners work together to coordinate a systematic management approach across catchments to contain weed spread. The responsibilities of individual land owners should be determined and clearly communicated. Complementary property management plans should be developed, administered and evaluated.

Monitoring and Evaluation

A property management plan should include realistic time frames and goals, recognising that achievements, particularly with regards to established populations, may only become evident in the long term. It is important to document weed occurrences and the control methods used so that success, or failure, can be critically analysed. Accurate records can enable a management program to be reworked or fine tuned depending on the need. Above all, continual maintenance is imperative otherwise reinfestation may only be one growing season away.

Weed Management Plans

Section 10 of the NT *Weeds Management Act* determines that the Minister may approve species specific Weed Management Plans for a range of purposes including:

- preventing entry of a species to the NT;
- managing a species within the NT; and/or
- managing a species within an area of the NT.

Weed Management Plans have been developed for a number of high priority species in the NT. Management requirements identified are consistent with those identified at the catchment, regional, NT and national levels. Information contained within this guide will assist in meeting requirements identified in statutory Weed Management Plans. Further information regarding the availability of these plans is available from Weed Management Branch.

Further Information and Resources

Detailed information regarding the management and identification of individual weed species are available from the Weed Management Branch. Examples of resources include Weed Notes, Weed Identification Tables and Best Practice Management Guides. Please visit the website www.nt.gov.au/weeds or email the Branch directly weedinfo@nt.gov.au for information.

Prevention

The easiest and cheapest form of weed control is prevention. Weeds can invade through a number of mechanisms and pathways, but invasion can be combated by applying a few basic principles:

- know what weeds are in your region and ensure they are not inadvertently brought in via items contaminated with seed (e.g. vehicles, machinery, hand tools, soil, feed, mulch and livestock);
- be able to recognise existing and potential weeds which threaten the NT. Early identification of an outbreak could save millions of dollars;
- use established roads and tracks and avoid weed-infested sites;
- if areas containing weeds are encountered, clean all equipment, vehicles and machinery prior to leaving;
- check boats, propellers and trailers before entering and leaving waterways;
- contact landowners before entering properties to see if they have any preventative measures in place;
- dispose of weed plant material and seeds by burning and/or burying at an appropriate depth;
- check the weed status of commercially available garden plants before planting on your property;
- never dispose of aquarium contents into drains or waterways; and
- control any weed infestations before they spread.

See Appendix A for information on the prevention of weed seed spread, including vehicle hygiene requirements.

Weed Control Methods

Physical Removal

Hand-pulling, although laborious, is effective for recent outbreaks prior to seed set. All root material should be removed from the soil and the plant destroyed to prevent re-sprouting. Grubbing is similar to hand-pulling but employs tools such as mattocks and spades.

Slashing by hand with a brush-cutter or using a tractor and blade can be an effective means of controlling weed growth and suppressing flower and seed development.

Chaining woody weeds can remove the roots and provide efficient rows for burning. This option is best implemented at the end of the wet season when soil moisture is sufficient to allow efficient root removal. Blade-ploughing can be used to push over some woody shrubs and sever their roots underground. The cultivation method is designed to expose the roots and then bury the plant deep enough that it cannot re-sprout.

Note: Disturbance of soil can facilitate weed growth, for this reason follow-up and regeneration work should form part of a management program. Physical removal should not be undertaken when a weed is actively producing seeds, as seeds are likely to spread and subsequently set in disturbed ground.

Control Using Fire

Fire is most effective as part of an integrated management plan.

In areas with a high fuel-load capable of sustaining a slow, concentrated fire, burning may be used to remove woody weed debris, destroy emergent seedlings and kill seeds. However it should be noted that cooler fires may actually scarify seed inducing germination.

Controlled fire can be used as part of an integrated weed control program to control grasses and non-woody species. When used as a management tool fire can kill seedlings, reduce seed production and encourage new foliage growth prior to herbicide control. Burning (or slashing) dense infestations prior to herbicide application can reduce herbicide costs, improve herbicide uptake and reduce application time. Burning can also improve access for other control methods.

Generally following an initial burn, fire should be excluded to provide other desirable plants with optimal conditions to establish and compete with any emerging weed seedlings.

Poorly managed or unmanaged fires can increase weed establishment by burning hot and fast. These fires cause minimal damage to the soil-stored weed seed bank, but can significantly damage native vegetation, hence stimulating prolific post-fire weed regeneration.

Note: Any management incorporating burning must be in accordance with the *Bushfires Act* and the *Fire and Emergency Act*. Please contact your local fire station for permits to burn if you live within a Northern Territory Fire and Rescue Service Emergency Response Area (NTFRS ERA). If you live outside a NTFRS ERA, contact your local Volunteer Fire Brigade Captain or local area Fire Warden through the Bushfires Council on Darwin 8922 0844 or Batchelor 8976 0098.

Biological Control (Biocontrol)

When an exotic weed is introduced, it arrives without the enemies and natural plant competitors that are present in its native range. Biocontrol is a method of weed management that attempts to regain the ecological balance that a weed would have in its native range. Release of biological control agents, such as insects or plant diseases, can decrease weed infestations to manageable levels, enabling other forms of control to be implemented. Biocontrol is a long-term approach and agents are only released after rigorous scientific trial and research to ensure that they will not damage native plants.
See Appendix B for additional information on specific biological control research and developments in the NT.

Chemical Control

Herbicides are commonly used for controlling weeds in both agricultural and non-agricultural situations. Numerous forms of application techniques and equipment are available to apply herbicides. The options chosen should be determined by the size of the infestation, the available resources, access and personal preferences. Detailed information on herbicide control options and correct usage procedures is included in this document.

Note: Users of agricultural (or veterinary) chemical products must always read the label and any Permit, before using the product and strictly comply with the directions on the label and any conditions of any Permit.

Integrated Weed Control

Integrated weed management combines the use of complementary weed control methods resulting in more effective, long term weed management outcomes. Integrated control requires planning, as often the timing of one control method can enhance the effect of another. An example of integrated weed management is the

- release of biological control agents to reduce vigour in a dense weed infestation **plus**
- use of herbicides to control satellite infestations of the weed elsewhere on the property **plus**
- management of a buffer zone around the dense infestation using physical/chemical control techniques **plus**
- reduction of grazing pressure in areas where weed eradication has been successful **plus**
- exclusion of grazing from areas with severe weed problems **plus**
- the implementation of preventative weed management strategies for the remainder of the property.

Land Management

Degraded or disturbed land is known to be far more susceptible to weed invasion. For this reason weed control cannot be viewed in isolation from other land management practices.

- Large feral animals, such as buffalos and pigs, can facilitate weed seed spread and germination through behaviours, such as roaming, wallowing and rooting. An effective weed management program should incorporate a feral animal control or exclusion program.
- Fire can be used as an efficient management tool for weed control or, conversely, uncontrolled fire can reduce land condition and facilitate weed establishment and spread.
- The management of clean buffer zones around affected areas can assist in managing outbreaks and containing large infestations.
- Continued maintenance of fire breaks, fence lines and roads can decrease the probability of seed spread and the development of new weed infestations.
- Appropriate stocking rates on suitable native and introduced pastures will allow maximum pasture growth to compete with weed seedlings. Weeds will flourish on over-grazed country.
- Hygiene practices are vital in order to maximise the effort of control methods. Land managers should use weed-free seed and hay, clean machinery, maintain quarantine areas for cattle which may be carrying seed and, where possible, eradicate or isolate infestation sources on the property.

Table 2 – Control Options

Infestation level	Biological	Chemical	Mechanical	Physical
Low (Canopy cover between 1% - 10%)	Not suitable.	Spot spraying by hand with a registered herbicide.	Not suitable.	Hand grubbing (remove roots and burn plant).
Medium (Canopy cover between 11% - 50%)	Release of biological control agents.	Spot spraying by hand with a registered herbicide.	Chaining, rolling, raking or back-ploughing, then burning.	Follow up control of seedlings – could include physical removal.
High (Over 50% canopy cover)	Inspect infestation to see if and what biocontrol agents are already present. If necessary, release biological control agents and monitor their progress.	Aerial spraying with a registered herbicide (provided there are no constraints against aerial spraying).	Attack with chaining, rolling or raking. Use fire to kill any regrowth and break seed dormancy.	Follow up control of seedlings – could include physical removal.

Using Herbicides Correctly

A person who uses a chemical product has a duty of care to ensure the use does not result in harm to the health of the general public, animals, the environment or domestic or export trade in agricultural produce.

The Australian Pesticides and Veterinary Medicines Authority (APVMA) register pesticides and herbicides for use in Australian States and Territories according to the provisions of the *Agvet Code Act*. In addition, the use of agricultural chemical products in the NT is controlled under the *Agricultural and Veterinary Chemical (Control of Use) Act* and regulations, including *Schedule 7 (Dangerous Poisons)* and *Restricted Chemical Product*s. Herbicides must be used according to the directions for use on the APVMA registered label.

The following demonstrates a typical product label format. **It is illegal not to follow the label's instructions.**

MAIN PANEL

SIGNAL HEADING *(poisons schedule)*
TRADE NAME/DISTINGUISHING NAME
ACTIVE CONSTITUENT(S)
(chemical ingredient, concentration and formulation)
MODE OF ACTION
(eg: Group C Herbicide – see Appendix E)
STATEMENT OF CLAIMS FOR USE
(purpose for which product is registered)
PROHIBITION AND RESTRICTION STATEMENTS *(eg: do not apply by air)*
NET CONTENTS *(volume of container)*

ANCILLARY PANEL/S

DIRECTIONS FOR USE:
Restraints

Crop Pest State Rate Comments

NOT TO BE USED FOR ANY PURPOSE OR IN ANY MANNER CONTRARY TO THIS LABEL UNLESS AUTHORISED UNDER AN APPROPRIATE LEGISLATION.

OTHER LIMITATIONS *(eg: where the herbicide can be used, who the herbicide can be used by)*

WITHHOLDING PERIOD *(minimum interval that should elapse between herbicide application and harvesting, grazing, cutting, slaughtering or the collection of milk and eggs for human consumption)*

GENERAL INSTRUCTIONS
Mixing and application – *(eg: mix only with clean water, pre-dissolve and agitate)*

COMPATIBILITY *(may provide examples of chemicals which should not be mixed together)*
PROTECTION OF WILDLIFE, FISH, CRUSTACEAN AND THE ENVIRONMENT *(eg: some chemicals may not be registered for use in specific areas, such as watercourses)*
STORAGE AND DISPOSAL *(see appendix F for information on drumMUSTER and ChemClear)*
SAFETY DIRECTIONS *(this will include necessary personal protective equipment – PPE)*
FIRST AID *(appropriate actions and contact details will be provided)*
EMERGENCY INFORMATION *(will include contact number)*
REFERENCE TO MSDS *(material safety data sheet, this supplements information on the label)*

COMPANY WARRANTY STATEMENT
COMPANY NAME, ADDRESS AND AUSTRALIAN COMPANY NUMBER
Batch No: Date of manufacture: Expiry date *(for veterinary and some agricultural products)*
Dangerous good symbol *(if required)*.

A permit allows a person or organisation to use an agricultural chemical product in a way that is not in accordance to label direction and would otherwise be in contravention of the Agricultural and Veterinary Chemical (Control of Use) Act. Applications can be made to the APVMA for permits to use a registered product in another situation, different species, higher rates of application or an application method that is not allowed. See the APVMA website for application forms and further details on minor use, emergency use and research permits, and for current minor use permits www.apvma.gov.au/index.asp

Herbicide Toxicity

A herbicide can be defined as a chemical substance used to destroy or inhibit the growth of plants, especially weeds. Herbicides need to be biologically active or toxic, to be effective against the plants that they are intended to kill. In addition to the active ingredient, herbicide formulations may contain other chemicals, such as surfactants and carriers, which may also be toxic. Herbicides can have both immediate (acute) effects and chronic (long-term) effects on the health of people who are exposed to them. Correct administration procedures must be implemented to avoid adverse health effects.

Acute Toxicity

Poisonings resulting from acute exposure to herbicides can result in a symptoms varying from fatigue, headache, sweating and dizziness to numbness, changes in heart rate, difficulty in breathing and excessive salivation. Advanced poisoning cases may result in convulsions and coma which could lead to death.

Chronic Toxicity

The effect of long-term exposure to a chemical/s is referred to as chronic toxicity. Effects of chronic toxicity due to long term herbicide exposure include:

- neurotoxic effects (toxic effects on the brain and central nervous system);
- reproductive system effects - The Australian College of Occupational Medicine recommends that women who are pregnant, or likely to become pregnant, protect themselves against chemical exposures that may have adverse reproductive effects. Pregnant women should check herbicide label advice before spraying or using any chemicals.
- carcinogenicity (causing cancer); and
- endocrine (hormone) disruption.

Routes of Exposure

Chemicals can enter the human body through the skin, lungs, mouth and eyes. Extreme care should be taken to prevent exposure to herbicides, the following should be considered:

- The exposure risk is highest when handling the concentrated version of a product. The most hazardous phase of application is mixing and loading the concentrated product.
- A respirator may be required when mixing/loading or applying herbicides in an enclosed space (such as a shed), if the herbicide is highly volatile and liable to be breathed as a vapour (such as 2,4-D ester) and if application carries the risk of inhaling the spray mist. The herbicide label should be checked for any personal protection requirements.
- Ingestion or swallowing is a risk to users who don't wash their hands after handling chemicals, particularly before eating and drinking. Smoking during chemical preparation and application is not recommended for this reason.

The acute or immediate toxicity of herbicide is required by law to be communicated in the Poisons Schedule (or poison warnings) which appear on the label of a product. Herbicides are classified into four categories on the basis of their potential toxicity to the user. Each schedule has a corresponding signal heading, which appears in large contrasting lettering on the label of the herbicide product. The Poison Schedule will largely determine the safety directions and first aid instructions that appear on the label. **If you suspect poisoning, contact the Poisons Information Centre, emergency phone 13 11 26 (24-hour) and/or call an ambulance.**

Table 3 – Poisons Schedule

Poison schedule	Toxicity	Signal Heading
Unscheduled	Very low toxicity	No heading required
Schedule 5	Slightly toxic	Caution
Schedule 6	Moderately toxic	Poison
Schedule 7	Dangerous	Highly toxic poison

Re-entry Intervals

Once applied, herbicides can remain on sprayed plants in the form of foliar aerosol particles. These residues can readily be dislodged and absorbed through the skin. The re-entry interval is the time that must lapse between applying the herbicide and re-entry into the sprayed area in order to avoid post application exposure. Re-entry intervals appear on the labels of products that have been subject to a technical review by the APVMA. If a re-entry period is not specified on the label, the general rule is to wait 24 hours after application or until the plants are dry, whichever is the longer. Re-entry in the prescribed timeframe should always be avoided if possible, and if re-entry is necessary, personal protective equipment should be worn. Sprayed areas should never be re-entered when the plants are wet i.e. from dew or light rain, irrespective of the time elapsed, unless appropriate personal protective equipment is worn.

Withholding Periods

The withholding period is the minimum mandated interval that should elapse between the last application of herbicide to any crop, pasture or animal and the harvesting, grazing, cutting, slaughtering or the collection of milk and eggs for human consumption. Observance of the withholding period stated on the registered label is a legal requirement and is part of the direction of use.

Modes of Action

Modes of action refer to how different groups of herbicides kill plants.

Plants are complex organisms with defined structures in which many vital processes occur in well ordered sequences. Plants are made up of organs (roots, leaves etc), which consist of tissues (photosynthetic, meristematic and structural tissue etc), that in turn are made up of cells. Within these cells metabolic processes such as photosynthesis, protein synthesis and respiration occur. Other processes include cell growth and differentiation, seed formation, translocation of molecules and transpiration. Herbicides are designed so that they disrupt one or more of these processes and kill the plant.

In simple terms, the following describe the various modes of action:

- growth regulators;
- amino acid synthesis inhibitors;
- lipid synthesis inhibitors;
- seedling growth inhibitors;
- photosynthetic inhibitors;
- cell membrane disrupters; and
- pigment inhibitors.

For further information see Appendix E.

Herbicide Resistance

Herbicide resistance is the ability of a plant to survive, grow and reproduce after exposure to a dose of a particular herbicide that would normally be lethal. In certain plant populations herbicide resistance may occur naturally or may be a result of genetic engineering.

Herbicide resistance may emerge as a problem due to the continual use of a particular herbicide, or group of herbicides with the same mode of action, on a population of plants. When resistant individuals within a population survive and reproduce, the population may become dominated by individuals able to survive the particular herbicide, or group of herbicides with the same mode of action.

The development of herbicide resistance can be reduced by minimising use of “high resistance risk” herbicides (e.g. group A and B herbicides), see Appendix E, and ensuring that herbicides with the same mode of action are not used repeatedly on the same population of weeds.

Herbicide Control Techniques

Foliar Spraying

Foliar spraying is the use of herbicide diluted with water, at a specific rate, and sprayed over the foliage to the point of runoff (until every leaf is wet but not dripping). Spraying should be undertaken when a plant is actively growing to maximise the effectiveness of the herbicide. Foliar spraying can be efficient and cost effective; however there may be the potential for spray drift and off-target damage. Foliar spraying can be done a number of ways, depending on the size of the weed plant and/or the infestation.

Plate 1 - Foliar spraying of gamba grass

Blanket spraying using a boom spray from a tractor or 4-wheel drive vehicle can be used to treat large areas completely infested with weeds, especially with selective herbicides. For large infestations that need targeted applications of herbicide, a hose and handgun can be used to spray solution from a herbicide tank and pump carried by a tractor or vehicle. Smaller infestations can be sprayed using a backpack spray unit. Spot spraying is used to treat individual weed plants or areas that have only small clumps of weed infestations.

Reducing herbicide spray drift

When applying herbicides the aim is to maximise the amount reaching the target and to minimise the amount reaching off-target areas. Sprayed herbicides can drift as droplets, as vapours or as particles.

- **Droplet drift** is the easiest to control because under good spraying conditions, droplets are carried down by air turbulence and gravity, to collect on plant surfaces.
- **Particle drift** occurs when water and other herbicide carriers evaporate quickly from the droplet leaving tiny particles of concentrated herbicide.
- **Vapour drift** is confined to volatile herbicides such as 2,4-D ester. Vapours may arise directly from the spray or evaporation of herbicide from sprayed surfaces.

Any herbicide can drift. The drift hazard, or off-target potential of herbicide, in particular situations depends on the following factors:

- **Volatility of the formulation applied:** volatility refers to the likelihood that the herbicide will evaporate and become a gas. Esters volatilise (evaporate) more readily than amine formulations.
- **Formulation of the product:** formulations such as emulsifiable concentrates have a tendency to produce small droplets.
- **Type of adjuvant:** non-ionic surfactants and penetrants added to the spray solution will produce smaller droplets than oils.

In areas where there is a range of land uses, there is potential for conflicts to arise. People using herbicides have a moral and legal responsibility to prevent drift and/or contamination which may impact on health, the environment or neighbouring crops.

Before Spraying

- determine the most appropriate method of application and equipment for the situation;
- always check for sensitive areas in the vicinity, such as houses, schools, crops and riparian areas;
- check for predicted weather conditions, only proceed if these are favourable;
- notify neighbours of your spraying intentions; and
- prepare to record all necessary details of the herbicide usage.

During Spraying

- always monitor weather conditions carefully and understand their effect on ‘drift hazard’;
- don’t spray if conditions are not suitable, and stop spraying if conditions change and become unsuitable;
- record weather conditions, herbicide and water rates, and operating details;
- supervise all spraying, even when a contractor is employed. Provide a map marking the areas to be sprayed, buffers to be observed, sensitive crops and areas;
- spray when temperatures are at their coolest;
- minimise spray release height (lowest possible boom height);
- use the largest droplets which will give adequate spray coverage;
- always use the least-volatile formulation of herbicide available;
- maintain a down-wind buffer e.g. keep a boom width from the downwind edge of the sprayed area; and
- if sensitive crops are in the area, use herbicide which is the least damaging.

Unfavourable Weather Conditions

Unfavourable weather conditions include:

- midday turbulence: up-drafts cause rapidly shifting wind directions (spraying should stop by 11 am);
- high temperatures, particularly when using herbicides which are highly volatile or susceptible to drift;
- low humidity;
- high humidity – this extends droplet life and can greatly increase the drift hazard of fine droplets;
- still (stable) conditions;
- high winds; ideal safe wind speeds are 7–10 km/h; and
- periods during, before or immediately after rain; excess water will reduce the effectiveness of your application.

For information on spray equipment calibration refer to Appendix C.

Rope or Wick Applicators

This method of applying herbicide consists of a wick (or rope) soaked in herbicide from a reservoir (usually attached to handle). Herbicide is pumped to the wick with 12-volt equipment. The saturated wick is used to wipe or brush herbicide over the weed. Commercially available equipment such as Weed Wand and Weed Wiper can be used to kill weeds in this way. It is sometimes necessary to provide some resistance for the wiper when the weed leaf or stem is soft. Stem swiping involves using a knife to provide resistance down the back of the stem or leaf, while wiping herbicide down the front.

Basal Bark Application

This method involves mixing an oil soluble herbicide in diesel and spraying the full circumference of the trunk or stem of the plant. Diesel helps the herbicide move through the bark. Basal bark spraying is suitable for thin-barked woody weeds and undesirable trees. Basal bark spraying is also an effective way to treat saplings, regrowth and multi-stemmed shrubs and trees. This method works by allowing the herbicide to enter underground storage organs and slowly kill the targeted weed.

The whole circumference of the stem or trunk should be sprayed or painted with herbicide solution from ground level to a height of 30 cm. It is important to saturate the full circumference of the trunk, and to treat every stem or trunk arising from the ground. It may be necessary to go higher on bigger trees.

Plate 2 - Basal bark herbicide application to young mimosa

Basal bark spraying is a very effective control method, and a good way to tackle inaccessible areas such as steep banks. It is a well targeted form of spraying, having little or no drift. This method will usually destroy difficult-to-kill weeds at any time of the year, as long as the bark is not wet or too thick for the diesel to penetrate.

Refer to the product label for further details on application. As a general rule, the larger the plant, the greater the area of bark that needs treating. The basal bark technique can become less effective in a few species once the basal diameter is greater than 5-10 cm.

ThinLine Method

This method is a form of basal barking using higher concentrations of herbicide but only for use on stems up to 5cm in diameter. Spray involves mixing an oil soluble herbicide in diesel and spraying the full circumference of the trunk or stem of the plant. The whole circumference of the stem or trunk should be sprayed or painted with herbicide solution from ground level to a height of 5 cm. It is important to saturate the full circumference of the trunk, and to treat every stem.

Stem Injection Methods

These methods involve drilling or cutting through the bark into the sapwood tissue in the trunks of woody weeds and trees. Herbicide is immediately placed into the hole or cut. The aim is to reach the sapwood layer just under the bark (the cambium growth layer), which will transport the chemical throughout the plant. It is essential to apply the herbicide immediately (within 15 seconds of drilling the hole or cutting the trunk), as stem injection relies on the active uptake by the plant to move the chemical through its tissues.

Drill and Fill Method

This stem injection method is used for trees and woody weeds with stems or trunks greater than 5 cm in circumference. This method uses a battery-powered drill to make downward-angled holes into the sapwood approximately 5 cm apart. The placement of herbicide into the hole is usually made using a backpack reservoir and syringe that can deliver measured doses of herbicide solution. Stem injection methods kill the tree or shrub where it stands, therefore only trees and shrubs that can be safely left to die and rot should be treated this way. If the tree or shrub is to be felled, allow it to die completely before felling.

Axe Cut Method

This method involves cutting through the bark into the sapwood tissue in the trunk, and immediately placing herbicide into the cut. As with the drill and fill method, the aim is also to reach the tissue layer just under the bark (the cambium layer), which will transport the chemical throughout the plant. The axe cut method can be used for trees and woody weeds with stems or trunks greater than 5 cm in circumference. Using an axe or tomahawk, horizontal cuts are made into the sapwood around the circumference of the trunk at waist height. While still in the cut, the axe or tomahawk is leaned out to make a downward angled pocket, which will allow herbicide to pool. The herbicide is then immediately injected into the pocket. Cuts should be made no farther than 3 cm apart.

This method – using an axe to make the cut – is often referred to as frilling or chipping. It is important not to entirely ringbark the trunk, as this will decrease the uptake of the herbicide into the plant.

Cut Stump

Here the plant is cut off completely at the base (no higher than 15 cm from the ground) using a chainsaw, axe, brush-cutter or machete (depending on the thickness of the stem or trunk). The herbicide solution is then sprayed or painted on to the exposed surface of the cut stump emerging from the ground, with the objective of killing the stump and the root system. It is imperative that the herbicide solutions are applied as soon as the trunk or stem is cut. A delay of more than 10 seconds for water-based herbicides and 1 minute for diesel soluble herbicides between cutting and applying the chemical will give poor results. For this reason two operators working as a team can use this method effectively. The herbicide can be applied from a backpack, or with a paintbrush, drench gun or a hand spray bottle. It is a good idea to use a brightly coloured dye in the solution to mark the stumps that have been treated. This method has the appeal of removing the weed immediately, and is used mainly for trees and woody weeds. Many species will sucker if not treated using this method.

Plate 3 – Cut stump technique – herbicide application to mimosa

Using Adjuvants, Surfactants and Oils with Herbicides

Some herbicides need assistance to spread across and penetrate the leaf surface of target weeds. An adjuvant is an additive to herbicide, intended to improve its effectiveness. Adjuvants can be classified as surfactants, crop oils, penetrants and acidifying buffering agents.

‘Wetting Agents’ or Surfactants

These are products that increase the spread of droplets, aiding the wetting of waxy or hairy leaf surfaces. The most commonly used surfactants are non-ionic, these remain on the leaf once dry and allow ‘rewetting’ after rain, permitting additional herbicide uptake.

Crop Oils

Most crop oils contain emulsifiers which allow them to mix with water. Some contain various levels of surfactants. Some claims regarding oil adjuvants include reduced rain-fast periods, more uniform droplet size (drift reduction), less spray evaporation and better penetration of herbicide into waxy leaves.

Mineral oils are usually a blend of mineral oil and non-ionic surfactant. Products such as Ad-Here® have low levels of surfactant, whilst Uptake® and Supercharge® have higher levels.

Vegetable oils contain a wide range of products. Products containing esterified vegetable oil and surfactants are the most commonly used. They have claims for superior wax-modifying characteristics and penetrating ability. They should be used strictly according to the label with selective herbicides. Hasten® is an example of this product type.

Penetrants

These are compounds that help dissolve waxy cuticles.

Acidifying Buffering Agents

These help lower the pH of the spray solution, making solutions more acidic. Most herbicides are most stable when the pH of the solution is between 6 and 7 (neutral or slightly acidic).

Compatibility Agents

Compatibility agents are materials that reduce the likelihood of antagonism from other agents in the spray solution. The most commonly used compatibility agent is ammonium sulfate. It is also used to neutralise the effect of hard water on amine formulations such as glyphosate. An example of this product is Liquid Boost®. Some products combine a number of the above roles, for instance Hot-up® contains a surfactant, a compatibility agent and oil.

There is also a range of other adjuvants that are added to herbicides during formulation to improve efficacy, increase crop safety, or improve the ease of herbicide use. These include thickeners, spreaders, stickers, anti-foamers and safeners.

Factors Affecting Adjuvant Use

Adjuvants are usually added to increase the effectiveness of herbicides. However, use of the wrong type or rate can reduce effectiveness. It should also be noted that the addition of an adjuvant can reduce herbicide selectivity. This is not an issue for fallow and pre-emergent herbicides. Hard water can lead to poor mixing of the chemical with water. This particularly occurs with emulsifiable concentrates. High levels of calcium and magnesium ions bind with amine formulations, causing them to be less soluble and therefore less effective.

Records of Use

Some users of agricultural chemical products in the NT are required to keep detailed records of use for a minimum of two years and include:

- name and address of person who used the product;
- name of the product;
- rate and amount used;
- method of application;
- expiry date of the product;
- date and time the product was used;
- exact location of where the product was used;
- date and time of when the product was used;
- type of crops, pastures or plants in the area;
- temperature and wind speed/direction;
- name of target pest or disease; and
- withholding period.

It is the land manager's responsibility to determine recording requirements.

Go to www.nt.gov.au/d/ for more information.

Disposal of Excess Chemicals and Used Chemical Containers

Empty chemical containers and any unused chemicals must be disposed of in an environmentally responsible manner. For information on how to responsibly dispose of chemicals please refer to Appendix F.

Chemical Handling Training

It is strongly recommended that all persons using herbicides complete a chemical safety training course. Chemical handling training is a legislative requirement for schedule 7 chemicals. Training in the safe and effective use of chemicals is provided by various registered training organisations. Please refer to Appendix D for information on courses relevant to chemical application in the NT. The APVMA website has further details at www.apvma.gov.au/index.asp

Weed Control Option Tables

This publication is presented only as a guide to assist in planning weed control. The following must be taken into consideration when planning your weed management program.

Users of Agricultural (or veterinary) chemical products must always read the label and any Permit, before using the product and strictly comply with the directions on the label and any conditions of any Permit. Users are not absolved from compliance with the directions on the label or conditions of the Permit by reason of any statement made in or omission from this publication.

The product trade names in this publication are supplied on the understanding that no preference between equivalent products is intended and that the inclusion of a product does not imply endorsement by the NT Government's Department of Environment and Natural Resources, over any other equivalent product from another manufacturer.

Any management incorporating burning must be in accordance with the *Bushfires Act* and the *Fire and Emergency Act*. Please contact your local fire station for permits to burn if you live within a Northern Territory Fire and Rescue Service Emergency Response Area (NTFRS ERA). If you live outside a NTFRS ERA, contact your local Volunteer Fire Brigade Captain or local area Fire Warden through the Bushfires Council on Darwin 8922 0844 or Batchelor 8976 0098.

Table 4 – Abbreviations and Terms

Abbreviations and terms	Definitions
/ha	per hectare (10 000m^2)
mL / l	millilitres per litre
m^2	metres squared
g / kg	grams per kilogram
g / l	grams per litre
WMB	Weed Management Branch
Various trade names	A number of products can be purchased that contain this active ingredient for control of this weed.
Various trade names and formulations	A number of products can be purchased that contain this active ingredient, some with different concentration formulations, registered for control of this weed.

Note: Rates are given for water unless otherwise stated

Athel pine – *Tamarix aphylla (Class A, Class B and Class C - refer to www.nt.gov.au/weeds for details)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Fluroxypyr 200 g/L * Starane 200***** Plus other registered products	1 L / 100 L	**Seedling** Foliar spray – < 50 cm tall
Fluroxypyr 333 g/L * Starane™ Advanced Plus other registered products	600 mL / 100 L	**Seedling** Foliar spray – < 50 cm tall
Triclopyr 600 g/L * Garlon™ 600 Plus other registered products	1 L / 100 L 1 L / 60 L (diesel)	**Juvenile – 50 cm - 2 m in height** Foliar spray Cut stump/basal bark/foliar spray application

Non-chemical applications: Seedlings can be removed by hand.
Large trees can be removed by ripping and bulldozing. The root system must be removed.

***Important notice** – these chemicals and rates are specified by **APVMA permit PER81696** which allows minor use of an agvet chemical product to control seedlings athel pine in non-crop areas in and near dry ephemeral waterways.
The permit expires on 30 November 2020.

Critical Use Comments: DO NOT contaminate streams, rivers or waterways with the chemical or used container.

Withholding Period: Garlon™ 600 Herbicide (or equivalent): Not required when used as directed.
Fluroxypyr products: DO NOT graze or cut for stock food for 7 days after application.

Persons who wish to prepare for use/or use the products for the purposes specified above must read, or have read to them, the permit, particularly the information included in the DETAILS OF PERMIT and CONDITIONS OF PERMIT. Contact the Weed Management Branch for further information.

Barleria – *Barleria prionitis (Class A and Class C) and Barleria lupulina*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Fluroxypyr 200 g/L Various trade names	500 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing For boom rate contact WMB

Non-chemical applications: Easily removed by hand and burnt.

Bellyache bush – *Jatropha gossypiifolia (Class A, Class B and Class C - refer to www.nt.gov.au/weeds for details)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Fluroxypyr 200 g/L Various trade names	500 mL / 100 L 3 L / 100 L (diesel)	**Seedlings and young plants (before flower) (individuals or infestation):** Foliar spray – apply when actively growing. For boom rate contact WMB **Adult (individuals):** Cut stump or basal bark
Fluroxypyr 333 g/L Various trade names	300 mL / 100 L 1 L / 100 L (diesel)	**Seedlings and young plants (before flower) (individuals or infestation):** Foliar spray – apply when actively growing. For boom rate contact WMB **Adult (individuals):** Cut stump or basal bark
Fluroxypyr 400 g/L Various trade names	250 ml / 100 L	**Seedlings and young plants up to flower (individuals or infestation):** Foliar spray – apply when actively growing.
Metsulfuron-methyl 600 g/kg Various trade names	10 g / 100 L	**All growth stages (individuals or infestation):** Foliar spray - apply when actively growing, non-ionic wetting agent required. For broadscale application contact WMB
Aminopyralid 375 g/kg + Metsulfuron-methyl 300 g/kg Stinger™	20 g / 100 L	**All growth stages (individuals or infestation):** Foliar spray - apply when actively growing, wetting agent required: Pulse Penetrant (200 mL/100 L) For broadscale application contact WMB
Triclopyr 240 g/L + **Picloram 120 g/L** Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm stem diameter **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Aminopyralid 4.47 g/L + Picloram 44.7 g/L Vigilant™ II	Neat	**Adult (individuals or infestation):** Cut stump - direct application

Contact the Weed Management Branch for more information on controlling large infestations of bellyache bush.

Non-chemical applications: Individual plants can be removed by hand, however slashing or mulching is more efficient for larger infestations. Mechanical control prior to flowering/seeding will reduce spread, whereas implementation during the dry season, when plants are moisture stressed, will result in a higher kill rate of mature plants. In either instance, follow up control for regenerating plants and seedlings will be necessary. Fire can be used as part of an integrated control program to kill young bellyache bush seedlings and improve access for other control methods, however multiple burns may be required to kill mature infestations. Follow up control may require hand removal.

'How to spray bellyache bush' videos
To view "how to spray' bellyache bush videos, visit: **www.nt.gov.au/weeds** then click on A-Z list of weeds in the NT, Bellyache bush in the table, then find them under the Technical Resources tab.

Brazilian pepper – *Schinus terebinthifolius (Class A, Class B and Class C - refer to www.nt.gov.au/weeds for details)*


Photo credit Rod Ensbey

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	350 mL / 100 L	**Seedling (individuals and infestations under 2 m):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Triclopyr 300 g/L and Picloram 100 g/L Various trade names	350 mL / 100 L	**Seedling (individuals and infestations up to 2 m):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Triclopyr 600 g/L Various trade names	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 5 cm stem diameter **Adult (individuals or infestation):** Cut stump > 5 cm stem diameter
Fluroxypyr 333 g/L Starane™ Advanced	1.8 L / 100 L (diesel) 1.8 L / 100 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter, treat up to 45 cm from ground **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Triclopyr 240 g/L + **Picloram 120 g/L** Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Picloram 20 g/Kg Tordon™ granules	35 to 45 g / m^2	Apply granules over an area extending from the main stem to 30 cm outside the dripline to cover the main part of the root system

Non-chemical applications: Mechanical control or burning can be used to improve access to infested areas for follow up chemical control.

*It is noted that basal barking can be effective on trees of larger diameter. Basal barking, being less labour intensive than cut stumping, may be a preferable option for sparse or remote infestations. Cut stump applications may be the best management option for trees in urban/landscaped situations where the dead tree material will be removed to retain aesthetics.

Burrs – Bathurst burr – *Xanthium spinosum (Class B and Class C)* and Noogoora burr – *Xanthium strumarium (Class B and Class C)*

Bathurst burr

Noogoora burr

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	180 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Fluroxypyr 333 g/L Various trade names	45 mL / 100 L **or** 450 mL / ha (boom)	**Seedling (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	15 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
MCPA 340 g/L + Dicamba 80 g/L Various trade names	190 - 270 mL / 100 L **or** 2.8-4 L / ha (boom)	**Seedling or adult (individuals or infestation):** Foliar spray – use higher rates on larger plants

Non-chemical applications: Mow, slash, grub and burn plants to prevent burr formation. Biocontrol options are available.

Cabomba – *Cabomba* spp. *(Class A and Class C)*

*** Report this plant to the Weed Management Branch immediately if found**

The Territory Government currently manages the only known cabomba infestation which is limited to a small, isolated section of the Darwin River. A quarantine order remains in place for this area. For further details go to www.nt.gov.au/cabomba

Caltrop – *Tribulus cistoides and Tribulus terrestris (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L **or** 1.1-2.4 L / ha (boom)	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Metsulfuron-methyl 600 g/kg Various trade names	10 g / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing, wetting agent required

Non-chemical applications: Grub plants out by hand and burn.

Candle bush – *Senna alata (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L	320 mL / 100 L	**Seedling (individuals or infestation) + adult (infestation):** Foliar spray – Uptake® Spraying Oil required For boom rate contact WMB
Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals or infestation):** Basal bark < 10 cm stem diameter treat up to 30 cm from ground Cut stump > 10 cm stem diameter

Non-chemical applications: Isolated plants can be dug out and roots removed.

Castor oil plant – *Ricinus communis (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling (individuals or infestation) + adult (infestation):** Foliar spray – apply when actively growing For boom rate contact WMB
Triclopyr 600 g/L Various trade names	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals or infestation):** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter

Non-chemical applications: Individual plants or small infestations may be removed by hand-pulling.

Chinee apple – *Ziziphus mauritiana (Class A and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	350 mL / 100 L	**Seedling (individuals and infestations):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Triclopyr 300 g/L and Picloram 100 g/L Various trade names	350 mL / 100 L	**Seedling (individuals and infestations under 2 m):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Triclopyr 600 g/L Various trade names	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 5 cm stem diameter **Adult (individuals or infestation):** Cut stump > 5 cm stem diameter
Fluroxypyr 333 g/L Starane™ Advanced	1.8 L / 100 L (diesel) 1.8 L / 100 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter, treat up to 45 cm from ground **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Triclopyr 240 g/L + **Picloram 120 g/L** Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Picloram 20 g/Kg Tordon™ granules	35 to 45 g / m^2	Apply granules over an area extending from the main stem to 30 cm outside the dripline to cover the main part of the root system

Non-chemical applications: Mechanical control or burning can be used to improve access to infested areas for follow up chemical control. *Basal barking can be effective on trees of larger diameter. Basal barking, being less labour intensive than cut stumping, may be a preferable option for sparse or remote infestations. Cut stump applications may be the best management option for trees in urban/landscaped situations where the dead tree material will be removed to retain aesthetics.

Coffee bush – *Leucaena leucocephala*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	350 mL / 100 L	**Seedling (individuals and infestations):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Triclopyr 300 g/L and Picloram 100 g/L Various trade names	350 mL / 100 L	**Seedling (individuals and infestations under 2 m):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Fluroxypyr 333 g/L Starane™ Advanced	1.8 L / 100 L (diesel) 1.8 L / 100 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter, treat up to 45 cm from ground **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Triclopyr 240 g/L + **Picloram 120 g/L** Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Picloram 20 g/Kg Tordon™ granules	35 to 45 g / m^2	Apply granules over an area extending from the main stem to 30 cm outside the dripline to cover the main part of the root system
Glyphosate Various trade names	ratio 1:1 of water	**Seedling or adult (individuals or infestation):** Cut stump

Non-chemical applications: Mechanical control or burning can be used to improve access to infested areas for follow up chemical control. *Basal barking can be effective on trees of larger diameter. Basal barking, being less labour intensive than cut stumping, may be a preferable option for sparse or remote infestations. Cut stump applications may be the best management option for trees in urban/landscaped situations where the dead tree material will be removed to retain aesthetics.

Coffee senna – *Senna occidentalis (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 25 g/L + Triclopyr 200 g/L + Picloram 100 g/L Tordon DS ™ Tordon™ Regrowth Master	375 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing, non-ionic wetting agent required
Dicamba 500 g/L Various trade names	500 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray, wetting agent may be required
Triclopyr 300 g/L + Picloram 100 g/L Various trade names	200 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – non-ionic wetting agent required: do not apply to podding plants
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	200 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – non-ionic wetting agent required: do not apply to podding plants For boom rate contact WMB

Non-chemical applications: Can be controlled by handpulling and grubbing.

Common and creeping lantana – *Lantana camara and Lantana montevidensis (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Fluroxypyr 200 g/L Various trade names	500 mL – 1 L / 100 L **or** 3 L / ha (boom)	**Seedling or adult (individuals or infestation):** Foliar spray – use higher rate on plants over 1.2 m, apply when actively growing
Fluroxypyr 333 g/L Starane™ Advanced	300–600 mL /100 L	**Seedling or adult (individuals or infestation):** Foliar spray – use higher rate on plants over 1.2 m, apply when actively growing
Triclopyr 300 g/L + Picloram 100 g/L Various trade names	350–500 mL (750) / 100 L **or** 3 L / ha (boom)	**Seedling (individuals and infestation)** Foliar spray – use higher rate on plants > 1 m (highest for harder to kill varieties), apply when actively growing, non-ionic wetting agent required
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	350–500 mL (750) / 100 L **or** 10 L / ha (aerial)	**Seedling (individuals and infestation)** Foliar spray – use higher rate on plants > 1 m (highest for harder to kill varieties), apply when actively growing, non-ionic wetting agent required
Triclopyr 240 g/L + Picloram 120 g/L	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm stem diameter **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Triclopyr 600 g/L Various trade names	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals)** Basal bark < 5 cm stem diameter **Adult (individuals or infestation)** Cut stump > 5 cm stem diameter

Non-chemical applications: Stick-raking, bulldozing, ploughing and grubbing. Fire can be used prior to mechanical or herbicide control or as follow-up.

Devil's claw – *Martynia annua (Class A and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
MCPA 340 g/L + Dicamba 80 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Small plants can be removed by hand, larger plants can be slashed close to the ground.

Flannel weed – *Sida cordifolia (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L 1.8 L / ha (boom)	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	15 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Fluroxypyr 200 g/L Various trade names	500 mL – 1 L / 100 L **or** 3 L / ha (boom)	**Seedling or adult (individuals or infestation):** Foliar spray – use higher rate on plants over 1.2 m, apply when actively growing
Fluroxypyr 333 g/L Starane™ Advanced	300 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing up until flowering

Non-chemical applications: Repeated slashing and vigorous pasture competition.

Fountain grass – *Cenchrus setaceus (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Small infestations should be removed by hand or by using a mattock. Ensure the entire root is removed.

Gamba grass – *Andropogon gayanus (Class A, Class B and Class C - refer to www.nt.gov.au/weeds for details)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Effective chemical control of gamba grass relies on spraying the entire plant. For optimal uptake of the herbicide and high mortality rates gamba grass should be sprayed when actively growing and young (leaves should be at least 40 cm long). Spraying plants prior to reaching full height will reduce time and herbicide requirements. Gamba grass is still sensitive to herbicide when flowering. Once gamba grass is seeding and the leaves are drying out herbicide will not be effective.

Non-chemical applications:

Physical: Individual plants can be removed by hand or by using a mattock. Ensure the entire root mat is removed. Excess soil should be shaken or kicked off root system to ensure regrowth does not occur from the root mat.

Burning: Burning will not kill gamba grass, low intensity fires, undertaken in the Wet season, can remove rank growth improving access for slashing or spraying. Plants may need to be treated with herbicide prior to burning to create enough dry matter to carry a fire. Fire may have the ability to carry seed in hot air currents, therefore avoid using fire as a control method while plants are seeding. Check with the Bushfires NT or NTFRS about permit requirements prior to lighting any fires.

Slashing: Slashing will not eradicate gamba grass, but it can reduce the biomass, prevent seeding, create an opportunity for more desirable species to establish and provide improved access to control by other means. Slash young plants prior to seed production from January to March. Ensure equipment and machinery is cleaned prior to moving to new sites.

Grazing: In areas within the Class B declaration zone gamba grass may continue to be used in established pasture areas, however there is a requirement to disallow any further spread. Gamba being used as a pasture should be grazed with enough stock to keep grass height below 90 cm. Above this height tussocks may be avoided by stock and allowed to produce vast quantities of seed. After lightly grazing pasture in the early wet season, a stocking density of 4-5 head per hectare is required to control growth for the remainder of the wet season. Increase grazing pressure if the grass nears 90 cm. Gamba grass is not recommended for cattle production on smaller properties as it requires high stocking densities to keep it low and palatable.

Grader grass – *Themeda quadrivalvis (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Identification of grader grass before seeding can be difficult. Small infestations should be controlled manually, preferably before seeding, and burnt on site. There is only a short window of opportunity to control grader grass as seed heads can appear within 5-6 weeks of germination, with mature seed being present after 10 weeks. If seed is present, burn it inside a drum to generate enough heat to kill the seeds. In the event that grader grass goes to seed before control, recording the location of infestations will enable early control during the next growing season. For large infestations contact the Weed Management Branch for options.

Hyptis – *Hyptis suaveolens (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	15 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Manually remove all plant material; slash to encourage competition from desirable species.

Khaki weed – *Alternanthera pungens (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
MCPA 340 g/L + Dicamba 80 g/L Various trade names	350 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray

Non-chemical applications: Grub at least 5 cm of the root; vigorous pasture competition.

Lion's tail – *Leonotis nepetifolia (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	200 mL / 100 L	**Seedling (individuals and infestation)** Foliar spray – when actively growing, wetting agent required

Non-chemical applications: New infestations should be removed manually prior to seeding.

Mesquite – *Prosopis* spp. *(Class A and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	200 mL / 100 L	**Seedling (individuals and infestation):** Foliar spray – non-ionic wetting agent required - do not spray plants bearing pods
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/Ls Various trade names	350 mL / 100 L	**Seedling (individuals and infestation):** Foliar spray – non-ionic wetting agent required - do not spray plants bearing pods
Triclopyr 240 g/L and Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals or infestation):** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter

Non-chemical applications: Hand grubbing for light infestations or small, dense areas. Blade ploughing or other mechanical control aimed at removing as much of the root system as possible.

Mexican poppy – *Argemone ochroleuca (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
MCPA 340 g/L + Dicamba 80 g/L Various trade names	350 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray

Non-chemical applications: Remove by hand grubbing. Take extra precautions to stop seed spread if removal is required once the plants are already seeding.

Mimosa – *Mimosa pigra (Class A, Class B and Class C - refer to www.nt.gov.au/weeds for details)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

	JAN	FEB	MAR	APR	MAY	JUN
FOLIAR SPRAY	JUL	AUG	SEP	OCT	NOV	DEC

	JAN	FEB	MAR	APR	MAY	JUN
BASAL BARK	JUL	AUG	SEP	OCT	NOV	DEC

	JAN	FEB	MAR	APR	MAY	JUN
PELLET GRANULAR	JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Tebuthiuron Various trade names	1 g / m^2	**Seedling or adult (individuals or infestation):** Granulated herbicide - ground applied Do not use within 30 m of desirable trees or apply to continuous area > 0.5 ha Do not use if fire is eminent Apply when there is soil moisture or prior to rain
Fluroxypyr 400 g/L Comet™	150 ml / 100 L 1.5 L / 60 L water / ha (aerial)	**Seedling or adult (individuals or infestation):** Ground foliar application when actively growing. Wetting agent BONZA required - 500 ml / 100 L **Seedling or adult (infestations):** Aerial control - Foliar application when actively growing. Wetting agent BONZA required - 1 L / Ha
Fluroxypyr 333 g/L Starane™ Advanced	180 mL / 100 L 1.8 L / 60 L water / ha (aerial) 1 L / 100 L	**Seedling or adult (individuals or infestation):** Ground foliar application when actively growing Wetting agent Uptake® required - 500mL / 100 L **Seedling or adult (infestations):** Aerial control - Foliar application when actively growing. Wetting agent Uptake® required - 1 L / Ha for all Starane™ formulations **Adult (individuals or infestation):** Basal bark
Metsulfuron-methyl Various trade names	60 g / 60 L water / ha (aerial)	**Seedling or adult (infestations):** Aerial control - Foliar application when actively growing. Non-ionic wetting agent required 100 mL / 100 L
Dicamba 500 Various trade names	2-2.4 L / 60 L water / ha (aerial) 400 mL / 110 L	**Seedling or adult (infestations):** Aerial control – Foliar application when actively growing. Use the wetting agent LI700® **Seedling or adult (individuals or infestation):** High volume foliar application or spot spray when actively growing. Thoroughly wet all leaves and stems of the plant
Glyphosate Various trade names	ratio 1:1 of water	**Seedling or adult (individuals or infestation):** Cut stump

Non-chemical applications: Hand grubbing for single plants or small outbreaks, ensure removal of the root system. Bulldozers can clear debris post-chemical control and fire can be used to kill surface seed or at least break the dormancy stage. Biocontrol options available.

Mission grass - annual – *Cenchrus pedicellatus* formerly *Pennisetum pedicellatum*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Annual mission grass can be controlled by slashing prior to seeding (repeated slashing may be required). Adult plants will not persist to the following year.

Mission grass - perennial – *Cenchrus polystachios (Class B and Class C)* formerly *Pennisetum polystachion*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Small infestations can be hand pulled. Slashing can prevent seed formation. Regrowth can then be treated with herbicide.

Mossman River grass – *Cenchrus echinatus (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Cultivation, pulling by hand or burning off before plants reach seed set.

Neem – *Azadirachta indica (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	350 mL / 100 L	**Seedling (individuals and infestations under 2 m):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Triclopyr 300 g/L and Picloram 100 g/L Various trade names	350 mL / 100 L	**Seedling (individuals and infestations up to 2 m):** Foliar spray, apply when actively growing + non-ionic wetting agent required
Triclopyr 600 g/L Various trade names	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 5 cm stem diameter **Adult (individuals or infestation):** Cut stump > 5 cm stem diameter
Fluroxypyr 333 g/L Starane™ Advanced	1.8 L / 100 L (diesel) 1.8 L / 100 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter, treat up to 45 cm from ground **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Triclopyr 240 g/L + **Picloram 120 g/L** Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling (individuals):** Basal bark < 15 cm* stem diameter **Adult (individuals or infestation):** Cut stump > 15 cm stem diameter
Picloram 20 g/Kg Tordon™ granules	35 to 45 g / m^2	Apply granules over an area extending from the main stem to 30 cm outside the dripline to cover the main part of the root system

Non-chemical applications: Mechanical control or burning can be used to improve access to infested areas for follow up chemical control.

*It is noted that basal barking can be effective on trees of larger diameter. Basal barking, being less labour intensive than cut stumping, may be a preferable option for sparse or remote infestations. Cut stump applications may be the best management option for trees in urban/landscaped situations where the dead tree material will be removed to retain aesthetics.

Olive hymenachne – *Hymenachne amplexicaulis (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	11 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Note: The Weed Management Branch hold a permit for aerial application of glyphosate on olive hymenachne. If you would like to consider aerial spraying olive hymenachne, contact the Weed Management Branch on 8999 4567 for information.

Non-chemical applications: Heavy grazing in the dry season can decrease seed production. Mechanical or physical removal is ineffective due to highly effective vegetative reproduction from small fragments. The use of heavy earth moving machinery to remove hymenachne from drains has met with some success in north Queensland. Aim to reduce plant bulk prior to wet season flooding and drown it. For large infestations contact WMB.

Paddy's lucerne – *Sida rhombifolia (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	15 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Fluroxypyr 200 g/L Various trade names	1 L / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Fluroxypyr 333 g/L	600 mL / 100 L **or** 2.4 L / ha (boom)	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Grub plants out. Slashing before flowering will prevent seed production temporarily and produce new growth for spraying.

Parkinsonia – *Parkinsonia aculeata (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Grazon™ Extra	350 mL / 100 L **or** 3 L / ha	**Seedling (individuals and infestation)** Foliar spray – avoid spraying if plants are stressed or bearing pods – Uptake Spraying Oil required Foliar spray – plants up to 2 m or 2 years old - Uptake Spraying Oil required
Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling or adult (individuals or infestation)** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter
Tebuthiuron 200 g/kg	1.5 g / m^2	**Seedling or adult (individuals or infestation):** Granulated herbicide - ground applied Do not use within 30 m of desirable trees or apply to continuous area > 0.5 ha Do not use if fire is eminent Apply when there is soil moisture or prior to rain

Non-chemical applications: Blade-ploughing, stick-raking, bulldozing and chaining can be effective if the root layer is removed from the soil. Cultivation of pasture or native vegetation after mechanical control will help to prevent re-sprouting and seedling establishment. Fire destroys seed in the soil surface and can be used as a follow-up to remove seedlings after other control efforts. Fire may also be used to manage mature trees. Hand grubbing for single plants or small outbreaks, ensure removal of the root system. Biocontrol options are available with Uu establishing slowly in some areas.

Parthenium weed – *Parthenium hysterophorus (Class A and Class C)*

*** Report this plant to the Weed Management Branch immediately if found**

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	10 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
MCPA 340 g/L + Dicamba 80 g/L Various trade names	350 mL / 100 L **or** 5.2 L / ha (boom)	**Seedling or adult (individuals or infestation):** Foliar spray
Metsulfuron-methyl 600 g/kg Various trade names	10 g / 100 L	**Seedling or adult (infestations):** Foliar spray – apply when actively growing

Landholders are urged not to attempt to control or dispose of parthenium themselves. Contact the Weed Management Branch for assistance.

Pond apple – *Annona glabra (Class A and Class C)*

*** Report this plant to the Weed Management Branch immediately if found**

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	15 mL / 1L	**Seedling (individuals or infestation):** Foliar spray - apply when actively growing
Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling or adult (individuals or infestation)** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter
Fluroxypyr 200 g/L Various trade names	1.5 L / 100 L (diesel) 1.5 L / 100 L (diesel)	**Adult (individuals or infestation):** Basal bark < 10 cm stem diameter, treat up to 45 cm from ground Cut stump > 10 cm stem diameter
Fluroxypyr 333 g/L Starane™ Advanced	900 mL / 100 L	**Adult (individuals or infestation):** Basal bark < 10 cm stem diameter, treat up to 45 cm from ground

Landholders are urged not to attempt to control or dispose of pond apple themselves. Contact the Weed Management Branch for assistance.

Prickly acacia – *Vachellia nilotica (Class A and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Fluroxypyr 200 g/L Various trade names	750 mL / 100 L	**Seedling (individuals or infestation) + adult (infestation):** Foliar spray - Uptake® Spraying Oil required
Fluroxypyr 333 g/L Starane™ Advanced	450 mL / 100 L	**Seedling (individuals or infestation) + adult (infestation):** Foliar spray - Uptake® Spraying Oil required
Metsulfuron-methyl 600 g/kg Various trade names	10 g / 100 L	**Seedling (individuals or infestation) + adult (infestation):** Foliar spray – apply when actively growing, need wetting agent
Hexazinone 250 g/L Various trade names	4 mL / spot 1 spot for each metre in height	**Seedling (individuals or infestation) + adult (infestation):** Spot application - apply at the base of plant
Tebuthiuron 200 g/kg Various trade names	1.5 g / m^2	**Seedling (individuals or infestation) + adult (infestation):** Granulated herbicide: ground applied – do not use within 30 m of desirable trees or apply to single continuous area > 0.5 ha Use higher rate on dense growth or heavy clay soils
Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals or infestation):** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter
Fluroxypyr 333 g/L Starane™ Advanced	900 mL / 100 L (diesel) 900 mL / 100 L (diesel)	**Adult (individuals or infestation):** Basal bark < 10 cm stem diameter, treat up to 45 cm from ground Cut stump > 10 cm stem diameter
Triclopyr 600 g/L Various trade names	1 L / 120 L (diesel) 1 L / 120 L (diesel)	**Adult (individuals or infestation)** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter

Non-chemical applications: Before seed pods have dropped: hand grubbing (small plants), cutting the root < 30 cm below the soil surface (blade ploughing), stick-raking and chaining (larger plants or infestations) can be effective. Fire is useful for mass seedling control if there is a sufficient fuel load.

Prickly pears & rope cacti – *Opuntia* spp.

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Triclopyr 600 g/L Garlon™ 600	800 mL / 60 L (diesel)	**Seedlings, juvenile, adults (individuals or infestations):** Foliar spray entire plant surface, ensuring all plant surfaces are completely covered with spray-mix to the point of runoff. Avoid spraying plants that appear stressed.
Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel)	**Seedlings, juvenile, adults (individuals or infestations):**Foliar spray entire plant surface, ensuring all plant surfaces are completely covered with spray-mix to the point of runoff. Avoid spraying plants that appear stressed.

Rat's tail grass – *Sporobolus* spp.

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	1.5 L / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Flupropanate Taskforce™	200 ml / 100 L	**Seedling or adult (individuals or infestation):** Read label as the aim is to spray the ground rather than the plant.

Non-chemical applications: Slashing can trigger seed production in rats tail grass varieties. Slashing can also be a major seed transport mechanism. To stop seed production, rats tail grass would need to be slashed approximately every two weeks before seed matures.

Rubber bush – *Calotropis procera* (Class B South of 16°30'S latitude and Class C)

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Triclopyr 300 g/L + Picloram 100 g/L Conqueror® **+ Aminopyralid 8 g/L** Grazon™ Extra	750 mL / 100 L (water) 500-750mL / 100 L (water)	**Seedling (individuals or infestation):** Foliar spray. Check label for recommneded adjuvant product. More effective on plants <2m as thorough coverage on all leaves is required.
Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 10 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals and infestation):** Basal bark < 5cm stem diameter. Spray all stems. Spray to point of runoff. ThinLine up to 5cm stem diameter Cut stump > 5cm stem diameter
Tebuthiuron (200g/kg) Graslan *Pending registration. Please check with Weed Management Branch for status confirmation.*	1.5-2g/m^2	**Seedling or adult:** Application to black clay soils in conjunction with seasonal rainfall. Spread granules according to density of the infestation.
Fluroxypyr (333g/L) Starane™ Advanced	3 L / 100 L (diesel)	**Adult:** Cut stump method for plants up to 10cm diameter and 3m high.

Non-chemical applications: This plant is difficult to eradicate as the deep roots survive almost any treatment. Maintenance of a dense pasture sward will assist in preventing invasion.

Rubber vine – *Cryptostegia* spp. (Class A and Class C)

*** Report this plant to the Weed Management Branch immediately if found**

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Triclopyr 300 g/L + Picloram 100 g/L Various trade names	350 - 500 mL / 100 L	**Seedling (individuals and infestation) + adult (infestation):** Foliar spray – use higher rates on stands > 1.5 m when flowering, spray leaves and stems to the point of run-off and apply to base
Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals or infestation):** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter
Triclopyr 600 g/L Various trade names	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals or infestation):** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter
Tebuthiuron 200 g/kg Various trade names	1.5 g / m^2	**Seedling or adult (individuals or infestation):** Granulated herbicide - ground applied Do not use within 30 m of desirable trees or apply to continuous area > 0.5 ha. Do not use if fire is eminent Apply when there is soil moisture or prior to rain

Non-chemical applications: Fire can destroy seeds, seedlings and adult plants with sufficient fuel loads. Blade or disk ploughing can be effective and will open up dense infestations for access. Slashing reduces vigour but may not kill plant.

Saffron thistle – *Carthamus lanatus (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L **or** 1.1 - 2.4 L / ha	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing Foliar spray – use lower rate on seedlings
Glyphosate 360 g/L Various trade names and formulations	15 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Improved perennial or native pastures will prevent establishment. Avoid heavy grazing as it will encourage growth. Slashing shortly before flowering can also effectively prevent seed production – but not too early as plants can re-sprout and produce new flower heads.

Salvinia – *Salvinia molesta (Class B and Class C)*

Non-chemical applications: Remove small infestations by hand, ensuring all of the plant is removed and destroyed. Biocontrol options are available.

Sicklepod – *Senna obtusifolia (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Aminopyralid 25 g/L + Triclopyr 200 g/L + Picloram 100 g/L Tordon™ Regrowth Master	375 mL / 100 L	**Seedling or adult (individuals and infestation):** Foliar spray – apply when actively growing, non-ionic wetting agent required
Dicamba 500 g/L Various trade names	500 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray, wetting agent may be required
Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L Various trade names	200 mL / 100 L **or** 3 L / ha (boom)	**Seedling or adult (individuals and infestation):** Foliar spray – non-ionic wetting agent required: do not apply to podding plants

Non-chemical applications: Slashing can reduce old plants to a manageable size. Slashing should always be done prior to seed set, preferably when plants are flowering. Rotary hoeing or discing infested areas and immediately sowing with improved pastures can be effective, if the grasses are well managed. Avoid grazing paddocks containing sicklepod or senna, especially when mature seed is present. A constant, dense sward of grass will exclude sunlight and help to maintain soil moisture.

Snake weeds – *Stachytarpheta* spp. *(Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray - apply when actively growing
Fluroxypyr 200 g/L Various trade names	750 mL / 100 L	**Seedling (individuals or infestation):** Foliar spray - Uptake® spraying oil required
Fluroxypyr 333 g/L Starane™ Advanced	450 mL / 100 L	**Seedling (individuals or infestation)** Foliar spray - Uptake® spraying oil required

Non-chemical applications: Slash before seed set and re-establish pasture grass for competition.

Spinyhead sida – *Sida acuta (Class B and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray - apply when actively growing
Metsulfuron-methyl 600 g/L Various trade names	10g / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray - apply when actively growing, wetting agent required
Fluroxypyr 200 g/L Various trade names	1 L / 100 L	**Seedling (individuals or infestation):** Foliar spray - Uptake® spraying oil required
Fluroxypyr 333 g/L Starane™ Advanced	900 mL / ha + Uptake 1 L / ha	**Seedling (individuals or infestation)** Foliar spray - Uptake® spraying oil required Boom application - apply when actively growing

Non-chemical applications: Repeated slashing and cultivation; vigorous pasture competition. Biocontrol options are available.

Thornapples – *Datura ferox (Class A and Class C), Datura* spp. *(Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
2, 4-D amine 625 g/L Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation)** Foliar spray - apply when actively growing
Glyphosate 360 g/L Various trade names and formulations	15 mL / 1L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
MCPA 340 g/L + Dicamba 80 g/L Various trade names	350 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray
Fluroxypyr 200 g/L Various trade names	1 L / 100 L	**Seedling (individuals or infestation):** Foliar spray - Uptake® spraying oil required
Fluroxypyr 333 g/L Starane™ Advanced	450 mL / ha (boom)	**Seedling (individuals or infestation)** Foliar spray - Uptake® spraying oil required Boom application - apply when actively growing

Non-chemical applications: Easily removed by hand, collect and burn mature seeds.

Thatch grass – *Hyparrhenia rufa (Class A and Class C)*

OPTIMUM TREATMENT TIMES
darker colour indicates preferred treatment times

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	OCT	NOV	DEC

Chemical and concentration	Rate	Weed growth stage, method and comments
Glyphosate 360 g/L Various trade names and formulations	2 L / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 450 g/L Various trade names and formulations	1.6 L / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing
Glyphosate 540 g/L Various trade names and formulations	1.4 L / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray – apply when actively growing

Non-chemical applications: Small infestations can be hand pulled. Slashing can prevent seed formation. Regrowth can then be treated with herbicide.

Water hyacinth – *Eichhornia crassipes (Class A and Class C)*

*** Report this plant to the Weed Management Branch immediately if found**

If you think you may have seen water hyacinth or have this weed on your property do not attempt to control it, contact the Weed Management Branch for assistance.

Water mimosa – *Neptunia plena and N. oleracea (Class A and Class C)*

*** Report this plant to the Weed Management Branch immediately if found**

If you think you may have seen water mimosa or have this weed on your property do not attempt to control it, contact the Weed Management Branch for assistance.

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Websites

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- Australian Weeds Strategy, A national strategy for weed management in Australia, www.weeds.org.au/docs/The Australian Weeds Strategy.pdf.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO): www.csiro.au – search ‘weeds’
- Co-operative Research Centre for Tropical Savannas: savanna.cdu.edu.au - search ‘weeds’
- Invasive Plants and Animals Committee http://www.pestsmart.org.au/connect/ipac/
- *Northern Territory Weeds Management Act* www.nt.gov.au/dcm/legislation/current.htmL
- Weed Identification Tool: www.weeds.org.au/ntmap.htm
- Weed Management Branch, Department of Environment and Natural Resources: www.nt.gov.au/weeds
- Weeds of National Significance (WoNS): www.weeds.org.au/natsig.htm

Acknowledgements

Some sections of this manual have been directly reproduced, with permission, from the NSW Noxious and Environmental Weed Handbook (3rd edition) 2007 by Rod Ensbey and Annie Johnson.

Appendix A – Preventing Weed Seed Spread

Vehicle Hygiene

Vehicles, including quad bikes, boats and farm machinery can easily spread weed seed if a high level of vigilance is not maintained. Ideally a strict inspection regime should be implemented before and after all travel, especially when travelling to areas known to be infested with weeds.

It should also be noted that many plants have developed special adaptations to facilitate their spread. Many have hooks or burrs which catch readily in clothing, footwear or in animal hair, so people and animals should be checked prior to moving into clean areas.

The checklist below can be used as a guide to establish a checking program for your property.

Before Travel

- Before travelling check clothing and shoes are free of mud and seeds.

Inside the Vehicle

- Check the foot wells and mats to make sure that no weed seed has fallen off your shoes.

Engine

- Check radiator and grill.

Around the Vehicle

- Check along wheel trims, mud flaps, tyres and tray of the vehicle for mud and weed seed.

Quad Bikes/Machinery

- Check around the wheels and where mud or weed seed may be caught.

Underneath the Vehicle

- Check the undercarriage and guards to ensure that there is no mud or weed seed.

Washing Down Procedures

- Establish a designated location to wash down your vehicle.
- Monitor plants growing in this area.
- Control all weed growth immediately.

Rubber bush seeds are easily transported.

Burrs stuck to sock.

Mimosa seed pods.

Bellyache bush fruit and flowers.

Rat's tail grass seeds.

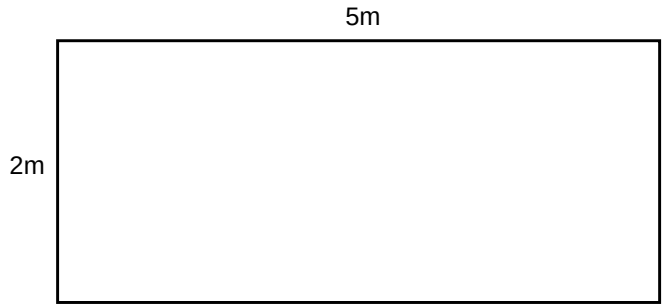
Appendix B –
Research and Development of Biological Control Agents in the NT

Weed	Agent	Type of agent	first released	plant part attacked	Established?
Mimosa (*Mimosa pigra*)	*Acanthoscelides puniceus*	beetle	1983	mature seed	yes
	Acanthoscelides quadridentatus	beetle	1983	mature seed	no
	Chlamisus mimosae	beetle	1985	leaves and stems	yes
	Neurostrota gunniella	moth	1989	pinnae and tips	yes
	Carmenta mimosa	moth	1989	large stems	yes
	Coelocephalapion aculeatum	weevil	1992	flower buds	no
	Coelocephalapion pigrae	weevil	1994	flower buds and leaves	yes
	Phloeospora mimosae-pigrae	fungus	1995	leaves , stems and pods	no
	Chalcodermus serripes	weevil	1996	green seed and tips	yes
	Diabole cubensis	fungus	1996	leaves	yes
	Sibinia fastigiata	weevil	1997	green seed and flowers	no
	Malacorhinus irregularis	beetle	2000	Leaves, roots and nodules	yes
	Macaria pallidata	moth	2002	leaves	yes
	Leuciris fimbriaria	moth	2005	leaves	yes
	Nesaecrepida infuscata	beetle	2007	roots and leaves	yes
Bellyache bush (*Jatropha gossypiifolia*)	*Agonosoma trilineatum*	bug	2003	fruit	no
Parkinsonia (*Parkinsonia aculeata*)	*Eueupethicia cisplatensis*	moth	2013	leaves	yes
	Rhinacloa callicrates	bug	1989	leaves and flower buds	no
	Mimosestes ulkei	beetle	1995	seed	no
	Penthobruchus germaini	beetle	1995	seed	yes
Salvinia (*Salvinia molesta*)	*Cyrtobagous salviniae*	weevil	1981	leaves, roots	yes
Sida (*Sida acuta*)	*Calligrapha pantherina*	beetle	1989	leaves	yes
	Eutinobothrus sp.	weevil	1997	stems	no
	Eutinobothrus pilosellus	weevil	1997	stems	no
Noogoora Burr (*Xanthium strumarium*)	*Epiblema strenuana*	moth	1982	stems	yes
	Puccinia xanthii	fungus	~1975	leaves	yes

Appendix C – Calibrating Spray Equipment

Hand gun calibration

1. Mark out an area 5 m x 2 m = 10 m^2 = **1/1000th** of 1 hectare (representative of the area to be treated)



2. Time taken in **seconds** to spray **10 m^2**
3. Measure output in litres/seconds taken to spray 10 m^2
4. Multiply **output x 1000** = L/ha

Boom sprayer calibration

1. Record **output** from each nozzle for 1 minute (replace if flow rate varies ± 10% or if spray pattern is visually faulty)
2. Record total **spray output** (add **output** for all nozzles) as **litres per minute**
3. Measure effective **spray width** and record in metres
4. Determine actual ground speed by timing in seconds the **time taken** to travel **100 metres**

$$\text{* Actual ground speed} = \frac{\textbf{100 metres} \times 3.6}{\textbf{Time taken} \text{ (seconds)}} = \text{km/h}$$

Note: 3.6 is a conversion factor to convert seconds to hours

5. Determine **water application rate** by using steps 2-4

$$\textbf{*Water application rate} = \frac{\textbf{spray output} \text{ (L/minute)} \times 600}{\textbf{spray width} \text{ (m)} \times \textbf{ground speed} \text{ (k/h)}} = \text{L/hectare}$$

Appendix D - Courses Relevant to Chemical Application in the NT

Charles Darwin University

Chemical training courses offered:

- AHCPMG301A Control weeds (may be run in conjunction with the AQF3 SMARTtrain Accreditation course)
- AHCPMG201A Treat weeds (may be run in conjunction with AQF2 Apply chemicals course)
- AHCPMG202A Treat plant pests, diseases and disorders - self paced or on request
- AHCPMG302A Control plant pests, diseases and disorders - self paced or on request
- HLTFA301C First Aid course - on request

The following courses meet requirements for some pest control or ground spray application licenses:

- RTC3401 Control weeds
- RTC2401 Treat weeds
- RTC3404 Treat pest and disease
- RTC2404 Control pest and disease
- RTC2704A First Aid course

Chainsaw operations course - many companies are using chainsaws and chemicals together for bush clearing or woody weed control.

- Operate chainsaws - (2 days) - basic chainsaw skills.
- Tree felling course - (2 days) - more advanced for controlled felling of trees.

Please contact Charles Darwin University directly for current information on courses offered on (08) 8946 7513 or email hort_aqua@cdu.edu.au

Appendix E – Modes of Action

Modes of Action (Barrett, M. and Reed, G., 1997)

Resistance Risk	Mode of Action Group	Typical Actives
High	A - Inhibitors of acetyl co-enzyme A Carboxylase (lipid synthesis, cell membranes)	diclofop-methyl clethodim fluazifop-P haloxyfop propaquizafop sethoxydim
	B - Inhibitors of acetolactase synthase (ALS) (amino acid synthesis)	chlorsulfuron halosulfuron-methyl imazapyr metsulfuron-methyl triasufuron iodosulfuron
Moderate	C - Inhibitors of photosynthesis at photosystem II	atrazine diuron fluometuron prometryn
	D - Inhibitors of tubulin formation	pendimethalin trifluralin
Low	E - Inhibitors of mitosis	Carbetamide Triallate bensulide
	F - Inhibitors of carotenoid biosynthesis	norflurazon
	G - Inhibitors of chlorophyll biosynthesis	oxyfluorfen
	H - Inhibitors of protein synthesis	thiobencarb
	I - Disruption of plant hormone action	2,4-D 2,4-DB dicamba triclopyr fluroxypyr MCPA picloram
	J - Inhibitors of fat synthesis	flupropanate
	K - Herbicides with diverse sites of action	metolachlor MSMA
	L - Inhibitors of photosynthesis at photosystem I	diquat paraquat
	M - Inhibitors of aromatic amino acid synthesis	glyphosate glyphosate-trimesium
	N - Inhibitors of glutamine synthetase	glufosinate-ammonium

In Australia, the letters (A, B, C etc) are used to identify the different Mode of Action groups whereas overseas, the numbers (1, 2, 3 etc) are used.

Appendix F – Appropriate Disposal of Chemicals and Containers

drumMUSTER

To solve the problem of what to do with used, non-returnable chemical containers, Croplife Australia, the NFF (National Farmer's Federation), the Veterinary Manufacturers and Distributors Association (VMDA) and local governments developed the national collection and recycling scheme, drumMUSTER.

drumMUSTER is Australia's most extensive environmental program for the collection and recycling of agricultural and veterinary chemical containers.

Contact 1800 008 707 for further information. As more collection sites are set up, you can check on the locations through the drumMUSTER website : WWW.drummuster.com.au

From 1 February 1999, land managers and farmers have paid a 4c per litre or kilogram levy on non-returnable chemical containers, with capacities greater than 1 L or 1 kg, which funds drumMUSTER and ChemClear programs.

The levy funds local government to:

- pay staff to inspect returned containers;
- process the returned containers; and
- publicise local collection sites and times;
- provide collection services for the ChemClear program.

Since drumMUSTER's inception in late 1998, drumMUSTER has collected and recycled more than 23 million empty agvet chemical containers and transformed them into practical items such as fence posts, wheelie bins and road signs. Once councils enter into an agreement with drumMUSTER, land managers are able to deliver cleaned (that is, triple or pressure-rinsed) containers to designated collection points run by participating councils.

At these collection points, the delivered containers are inspected and either accepted or rejected.

Check the drumMUSTER website www.drummuster.com.au for the location of collection points in the Northern Territory.

Since the inception of the ChemClear program in 2003 more than 397 tonnes of unwanted chemical has been collected and disposed of in an appropriate manner.

For more information on ChemClear visit : www.chemclear.com.au

Cleaning Containers for Collection

When rinsing, the personal protective equipment specified on the label for application and/or mixing and loading the pesticide should be worn. This is because the chemical remaining in a container is the concentrate - the most toxic form of the chemical.

To triple-rinse containers:

- remove the cap, invert the container and allow it to drip drain into the mixing tank for 30 seconds;
- add rinse water 20%;
- replace cap and shake vigorously for 1 minute;
- remove cap, Invert and drip drain into mixing tank for 30 seconds;
- repeat twice; and
- wash cap separately and leave off the container to allow it to dry.

Triple-rinsing is only suitable for small containers up to 20 L. Rinsing is most effective immediately after using the chemical. The longer the residue has time to dry and cake on the inside of the container, the more difficult it is to remove. This is the reason for rinsing during mixing and loading. If rinsing is done during mixing and loading, the rinsate can be emptied into the spray or mixing tank of the application equipment. Using the rinsate avoids the need to dispose of the container residues separately.

An alternative to manually triple-rinsing small containers is using a pressure rinsing nozzle. There are two main types. One has a rotating spray head that can be used to rinse an inverted container in the induction hopper or directly over the tank. The other has a hardened, pointed shaft to pierce drums, and the hollow shaft itself has four holes at 90 degrees to spray the water around the container.

To pressure rinse a container up to 20 L:

- remove the cap, invert the container and allow it to drip drain into the mixing tank for 30 seconds;
- ensure clean rinse water is between 35 and 60 psi;
- Insert pressure-rinsing probe, either through the container opening or through the pierced base of the container (depending upon the type of nozzle);
- Invert container over mixing tank and rinse for 30 seconds or longer if the water coining from the container neck is not clear, moving the probe about to ensure all inner surfaces are rinsed;
- wash cap in clear rinse water from container;

- turn off water, remove probe and drip drain container into mixing tank for 30 seconds; and
- leave the lid off the container to allow it to dry.

ChemCLEAR - Disposal of unwanted chemicals

ChemClear® is the national program for the collection and disposal of unwanted currently registered agvet chemicals. The objective of the program is to minimise the accumulation of unwanted agvet chemicals held in storage which may create potential risks to the environment, public health and trade.

There are two categories of agvet chemicals ChemClear® collects:

- Group 1 chemicals are currently registered products manufactured by participating companies signed to the Industry Waste Reduction Agreement. These products are collected free of charge by virtue of having been included in the drumMUSTER levy.
- Group 2 chemicals are products manufactured by non-participating companies, or, deregistered, unknown, mixed or out of date products. A per litre/kilogram fee for disposal applies.

Registrations are essential and can be made at www.chemclear.com.au or 1800 008 182.

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www.nt.gov.au/weeds