WEED MANAGEMENT PLAN

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Project Name: Nolans Rare Earth Project

REVISION HISTORY

Date	Description	Prepared	Reviewed	Approved	3rd Party Approval
July 2022	Rev 1	Michael Robinson, ESG Manager	Michael Robinson, ESG Manager	Stewart Watkins, GM Projects	
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1.0 INTRODUCTION

1.1 Background

The Project involves several key activities during construction and operations which will disturb soils and vegetation, and have potential to introduce or transfer weeds into or across the Project area and onto Aileron Station, potentially impacting on external stakeholders. This Weed Management Plan (WMP) is to be implemented during Project construction and operations to minimise the risk of spreading existing weeds and introducing new weed species. For the purposes of this management plan in accordance with the *Northern Territory Weeds Management Act 2001,* a weed is defined as:

- Declared Weed. A weed may be classified as a declared weed for the purpose of preventing the plant entering into, or managing the plant in the Territory.
- Weed of National significance (WoNS). Agreed by Australian governments based on an assessment process that prioritises these weeds based on their invasiveness, potential for spread and environmental, social and economic impacts.
- Environmental Weed. Not declared under the Act, but represent a key threatening process for conservation values as they threaten native plants by out-competing them.

See Section 2.2 below for more information about the different categories of weeds.

1.2 Purpose

The purpose of the WMP is to provide a framework for weed management across the Project site, as well as provid information which is to be used in decision making and project management, detail planning and methods of work, and provide for a record of performance. The WMP will keep weeds from being introduced to the site and the pastoral station, and from spreading between them.

The Weed Management Plan has been prepared to:

- Address the weed management planning requirements for the Project.
- List all weeds present at the Project site.
- Provide an appraisal of weed status including current legislative status in the NT.
- Identify key threats / hot spot areas within the management area.
- Identify measures to control and/or eradicate declared weeds and WoNS.
- Identify measures to minimize or avoid the spread of environmental weeds.
- Identify key responsibilities for construction and operational personnel.
- Detail a schedule for monitoring and evaluation, including review and update of the plan and procedures.

This document and its subsequent revisions form an integral part of the Project's Mining Management Plan (MMP). It is a dynamic document, a receptacle for information which is to be reviewed and updated periodically (as determined by the MMP), enabling an accurate reflection of

the current operational requirements and practices whilst allowing for responsiveness to conditions, input from stakeholders, and enabling flexibility in planning and prioritisation where required.

All referenced company policies, standards, registers, operational procedures, activity specific documents, forms and templates are stored and can be accessed from within the Arafura Resources Integrated Management System (ARMS).

1.3 Objectives

This management plan has been created to provide the necessary information to guide and mitigate the management of weeds throughout the Project area. This WMP is designed to achieve this objective through the following processes:

- Educating site personnel and providing management measures for known weeds;
- Minimising the spread of Declared Weeds, Weeds of National Significance (WoNS) and/or Environmental Weeds;
- Minimising the introduction of new weed species across the Project and the pastoral station;
- Controlling or eradicating existing weed populations (where appropriate); and
- Enhancing rehabilitation and landscaping success through weed management.

1.4 Relevant Legislation and Guidelines

The Project is obliged to comply with all relevant environmental legislation. A summary of key legislation and guidelines is outline in the Mine Management Plan , Section 3: Statutory Requirements.

1.5 Previous Investigations

A number of flora and vegetation assessments were completed for the Project during the Environmental Impact Statement (EIS) process (GHD 2016). A summary of these assessments is provided in Table 1.3.

Table 1—1 Summary of Investigations

Report Title	Author	Survey	Summary
Landscape Flora and Fauna Surveys of the Proposed Rare Earths Mine at Nolans Bore near Aileron, NT	Low Ecological Services	4 - 7 May 2006 21 - 24 November 2006	Recorded a total of 185 flora species within four broad land units (riparian, rocky granite hills, shallow sand plains and rocky undulating plains). None of the flora species recorded is listed as having conservation significance under the EPBC or TPWC Acts.

Report Title	Author	Survey	Summary
Nolans Rare Earth Project – Flora and Vegetation Survey	GHD	16 - 25 August 2010 6 - 7 December 2011 27 April - 3 May 2015	Flora survey techniques used were consistent with the Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping (Brocklehurst et al., 2007) and included: ▪ 78 quadrats; ▪ 99 check sites; ▪ Opportunistic collections; and ▪ Vegetation mapping. A combined total of 326 flora species were recorded within the Study area during the 2010, 2011 and 2015 survey periods. Based on the fine-scale vegetation mapping and flora sampling performed by GHD a total of 14 vegetation communities were identified within the Study area. A total of fourteen exotic species were recorded during the field survey. With the exception of Buffel Grass (*Cenchrus ciliaris*) these species generally occurred in low abundance across the Study area.

2.0 WEEDS OVERVIEW

Weeds are able to successfully establish and spread due to the absence of natural plant pests and/or plant diseases, an induced disturbance to the natural environment (such as clearing) and movement of machinery, vehicles and equipment creates ideal conditions for weed germination, growth and/or spread.

2.1 Potential Environmental Impacts

The potential environmental impacts arising from the introduction and spread of weeds within the Project area include:

- Modification of vegetation communities: weeds can prevent seed recruitment and out-compete native species for available resources. Changes to the floristics of communities can subsequently modify habitats for threatened fauna species and/or render the habitat less valuable to indigenous fauna.
- Alteration of fire regime: weeds can create additional fuel loads which can lead to hotter and/or more frequent fire which can in turn impact vegetation communities and threatened species habitat.
- Change in hydrology: weeds can be prolific in watercourses which can alter stream flow and cause erosion.
- Revegetation and landscaping success: if weeds become established and prolific in areas subject to revegetation they can out-compete other planted species and prevent the regrowth of native plants.

2.2 Categories

Weeds can be categorised according to the areas they colonise and the types of threat they pose. Several categories of weeds (noxious weeds, WoNS and environmental weeds) are recognised at a National, Territory and Local level. The weed category levels and a description of significance are provided in Table 2—1.

Table 2—1 Weed Categories

Category	Description
Northern Territory	
Class A	To be eradicated. These plants either do not occur in Northern Territory but pose a significant threat if they invade, or are present and pose a serious threat. Under the *Weed Management Act* reasonable effort must be made to eradicate these weeds.
Class B	Growth and spread to be controlled. These weeds often occur widely in the Northern Territory. They are capable of spreading further and should be prevented from doing so. To prevent their spread, continuing control measures are required. Under NT legislation reasonable attempts must be made to contain the growth and prevent the movement of these plants.

Category	Description
Class C	Introduction into the Territory is to be prevented. This category includes plants that pose an unacceptable risk of spreading into the Territory or to other parts of Australia if they were to be sold or traded in the Northern Territory and are a serious threat to another State or Territory of Australia. All schedule Class A and B weeds are considered to be Class C weeds.
National Significance	
Weeds of National Significance	To be eradicated. Weeds of national significance are recognised as having potential to significantly impact on natural values including threats to human health and safety; threats to pastoral and agricultural industries; threats to water quality and supply; threats to indigenous flora and threats to biodiversity and cultural values.
Non-indigenous	
Environmental Weed	Environmental weeds are defined as non-indigenous plant species that have invaded (or have the potential to invade) natural ecosystems and threaten (or have the potential to threaten) environmental and/or conservation assets. They can also be Australian native species that are not local (indigenous) to an area but have potential to damage the local plant community.

2.3 Weed Status

The WMP has been developed with the information gathered over the three survey periods (2010 - 2015), as such prior to the Early Contractor Involvement (ECI) stage, an up to date weed specific mapping survey will be completed across the site areas, including but not limited to pipeline areas, bores, camps, mine site, etc. This will allow for up to date information on weeds to be including prior to implementation of the WMP during construction.

2.3.1 On site

The Flora and Vegetation Assessment completed at the Project over three survey periods (2010, 2011 and 2015) (GHD, 2016a), are summarised in Table 1.3. A total of 14 exotic species were recorded during the field surveys, one of these species Caltrop (*Tribulus terrestris*) is listed as a Class B/C Noxious weed under the *Weeds Management Act* and 7 species are identified as environmental weeds. A weed summary is provided in Table 2—2.

Overall there is a low to moderate level of infestation of weeds within the Project site. The most common introduced species is Buffel Grass (*Cenchrus ciliaris*), which was recorded predominantly within floodplain and riparian vegetation types and in areas that have been disturbed by cattle and/or by mining exploration.

Buffel Grass (*Cenchrus ciliaris*) is an environmental weed that has spread rapidly in arid and semi-arid regions of Australia (Miller et al, 2010), and represents a key threatening process for biodiversity in the region due to its rapid spread and potential to increase fire severity.

During the field survey the percentage of Buffel Grass (Cenchrus ciliaris) cover was assessed for each vegetation polygon and a score of 1-4 assigned as follows:

- Score of 1 – very low densities (< 5 percent cover);
- Score of 2 – low – moderate density (6-40 percent cover);
- Score of 3 – moderate to high densities (41-70 percent cover); and
- Score of 4 – high densities (71-100 percent cover).

In the 2015 survey, Buffel Grass percentages were recorded at < 5 percent cover across the proposed borefield area. Percentages at the processing site was generally recorded at <5 percent, with the except of minor areas which scored 6 – 40 percent cover. The accommodation village showed was predominately 6 – 40 percent cover, while at the mine site, scores ranged from <5 percent to 71 – 100 percent. Mapping of Buffel grass percentages is shown in Figure 4.2 of the EIS, Appendix M: Biodiversity – Flora and Vegetation Report (https://www.arultd.com/images/EIS/DOCUMENTS/Volume3/Nolans_EIS_Appendix_M_web.pdf). Buffelgrass is an important feed grass for cattle and has historically been planted across the station by previous station owners, so buffel grass will not be controlled or managed as part of this weed management plan.

2.3.2 Regional

In addition to those weeds identified during the 2010, 2011 and 2015 survey, the NT Department of Natural Resources, Environment and the Arts (now Department of Land Resource Management) assessed the Burt Plain Bioregion (Neave et al, 2006), which identified a total of 14 weeds within this Bioregion of which two species, Mesquite (*Prosopis pallida*) and Parkinsonia (*Parkinsonia aculeate*) are listed as Weeds of National Significance.

A summary of weeds identified onsite and within the bioregion is provided in Table 2—2.

Table 2—2 Weeds Summary

Name		Classification					Presence	
Common	Scientific	WoNS	Class A	Class B	Class C	Env	Bioregion [A]	In or close proximity to Project [Barea]
Caltrop	*Tribulus terrestris s.lat.*			✓	✓			✓
Khaki Weed	*Alternanthera pungens*		✓	✓		✓		
Cobblers Pegs	*Bidens bipinnata*					✓		✓
Rubber Bush	*Calotropis procera*			✓	✓		✓	
Saffron Thistle	*Carthamus lanatus*			✓	✓		✓	
Buffel Grass	*Cenchrus ciliaris*					✓		✓
Mossman River Grass	*Cenchrus echinatus*			✓	✓		✓	
Purple-top Chloris	*Chloris barbata* *Chloris virgata*						✓	✓ ✓
Paddy Melon	*Citrullus lanatus*					✓		✓
Couch Grass	*Cynodon dactylon var. dactylon*					✓		✓
Thornapples – Native Thornapple	*Datura spp – Datura leichhardtii*			✓	✓		✓	
Summer Grass	*Digitaria ciliaris*							✓
Patterson's Curse	*Echium plantagineum*		✓		✓		✓	
Pitted Lovegrass	*Eragrostis barrelieri*							✓
Hairyflower Lovegrass	*Eragrostis trichophora*					✓		✓
Lovegrass	*Eragrostis minor*							✓
Malvastrum	*Malvastrum americanum*					✓		✓
Prickly Pears – Devil's Rope Pear	*Opuntia spp. – Opuntia imbricata*			✓	✓		✓	
Parkinsonia	*Parkinsonia aculeata*	✓		✓	✓		✓	

Name		Classification					Presence	
Common	Scientific	WoNS	Class A	Class B	Class C	Env	Bioregion[A]	In or close proximity to Project[Barea]
Mesquite	*Prosopis pallida*	✓	✓		✓		✓	
Castor Oil Plant	*Ricinus communis*			✓	✓		✓	
Athel Pine	*Tamarix aphylla*			✓	✓		✓	
Mimosa Bush	*Vachellia farnesiana var. farnesiana*					✓		✓
Coffee Senna	*Senna occidentalis*			✓	✓		✓	
Milk Thistle	*Sonchus oleraceus*							✓
Bathurst Burr	*Xanthium spinosum*			✓	✓		✓	
Noogoora Burr	*Xanthium strumarium*			✓	✓		✓	
	Total	2	2	13	15	7	14	14

Notes: A Sourced form Neave et al 2006.

B Sourced from GHD survey data.

WoNS: Weed of National Significance

2.4 Weeds Requiring Control

The following weeds have been identified as requiring management (i.e. surveillance monitoring and/or active control methods such as physical, land management, chemical and biological) within the Project area based on their distribution and potential environmental impacts.

2.4.1 Caltrop (*Tribulus terrestris*)

Figure 2—1 Caltrop (FloraBase, 2021)

Caltrop (*Tribulus terrestris*) is native to southern Europe, eastern Africa, southern Asia and the USA. In northern Australia it has become naturalised and is commonly found in disturbed areas, roadsides and agricultural land.

Caltrop has seeds which can remain dormant in the soil profile for several years, generally germinating following periods of rainfall. Plants are known to grow rapidly, flowering and forming new burrs within three to five weeks.

Distribution

This species occurs in low abundance scattered throughout the Project area. Prior to commencement of construction. A weed survey will be completed prior to construction to produce a representative figure of weed distribution.

Potential Environmental Impacts

Caltrop is considered a noxious weed due to its potential to poison animals as well as causing discomfort to livestock with its sharp spiny fruit impacting the feet, mouth, stomach and intestines of animals. As well as animals if the spines come into contact with humans they can cause injury/discomfort. It is unlikely that this species would rapidly proliferate throughout the Project area if left uncontrolled.

2.4.2 Mimosa Bush (*Vachellia farnesiana var. farnesiana*)

Figure 2—2 Mimosa Bush (FloraBase, 2021)

Mimosa Bush (*Vachellia farnesiana var. farnesiana*) is a rounded shrub or small tree to 2-5 metres tall, spreading, thicket-forming, bark dark grey, rough; leaves pinnate.

Distribution

Mimosa Bush occurs in low abundance along creeks and drainage lines in the Project area. A weed survey will be completed prior to construction to produce a representative figure of weed distribution.

Potential Environmental Impacts

Mimosa Bush has the potential to spread and form thickets in waterways out-competing native vegetation.

2.4.3 Hairyflower Lovegrass (*Eragrostis trichophora*)

Figure 2—3 Hairyflower Lovegrass (Ausgrass, 2021)

Hairyflower Lovegrass (*Eragrostis trichophora*) is a tussock grass growing up to 0.7 metres which has the potential to rapidly proliferate and invade native vegetation.

Distribution

This species was recorded at three locations within the Project area including two areas at the mine site and one along the access road. A weed survey will be completed prior to construction to produce a representative figure of weed distribution.

Potential Environmental Impacts

Hairyflower Lovegrass has the potential to invade areas of native vegetation, outcompeting native species and altering community floristics.

3.0 CONTROL MEASURES

In instances where there is a low likelihood that weeds can be eradicated from the site, weed management actions should focus on protecting areas of native vegetation by preventing the spread of weeds into these areas. This would be most successfully achieved through containment, and land protection measures.

Other longer-term objectives for dealing with well-established weed species include undertaking measures to reduce the extent of the infestation of weed species (i.e. aiming for a slow reduction in the extent of these infestations overtime through a staged assault on these areas). Tackling large areas starting from the outside and working inwards would be the best approach for achieving this objective.

In areas where weed infestations are at their early stages and there are currently only a few isolated weeds, there is a high likelihood that this plan could result in the eradication of the weeds from these areas. In addition, if appropriate mitigation and monitoring measures are implemented, these areas could be successfully protected from future reinfestation.

3.1 Surveillance Monitoring

Surveillance monitoring is an essential component of any weed management program as it provides a means of identifying how well control measures are working, the rate of spread of weeds and/or the detection of new weeds established in disturbed areas. Weed management plans can be adapted as needed to improve results and accommodate changing circumstances or changes in the local environment.

Ongoing surveillance monitoring and management of weeds, particularly in disturbed areas is a high priority. Follow up control is vital as many weed species have a large number of long-lived seeds that have the potential to remain viable in the soil for many years. It is recommended that ongoing surveillance monitoring of sites be undertaken throughout the year, especially post wet season or after rains.

Surveillance monitoring programs should involve mapping the Project area for presence of weeds, taking photos at marked photo points and revisiting information to evaluate if the weed management plan requires updating.

Weeds identified should be logged within a weed register and include the following information:

- Changes in the extent of weed populations;
- Changes in the cover density of weed populations;
- Any new weed species that may become established;
- Documentation of any unexpected impacts of weed control activities (i.e. damage to native vegetation);
- Changes in the extent and condition of native vegetation; and
- Changes in any conditions that have the potential to impact on site restoration works.

3.2 General Control Techniques

Different weed control techniques have specific advantages and disadvantages. The optimum method of control is dependent on the type of weed, level of infestation and where the weed is located (e.g. disturbed areas verses native vegetation).

Treatment methods available include Physical, Land Management, Chemical or Biological and are detailed within Table 3—1.

Table 3—1 Control Techniques

Type	Description
Physical	
Hand Pulling	Labour intensive method that should be carried out systematically before seed set to ensure effectiveness of the treatment. It is important to ensure that all root material is removed, and plants or plant parts are not left on the ground to re-shoot or release seed. It is most effective for isolated small outbreaks and is particularly suitable for easy to remove shallow-rooted grasses and herbaceous plants.
Grubbing	This treatment uses implements such as shovels, spades and mattocks to manually remove weeds. This means of control is best suited to the removal of deep-rooted woody species.
Slashing	This mechanism of control involves the use of machinery to slash weeds before they are able to set seed. The advantage of this form of control is that it maintains some ground cover to prevent erosion and re-colonisation of weeds. It is relatively inexpensive and can be used for relatively large infestations. It is not usually effective for controlling perennial weeds but may eradicate some annuals if carried out before seed is mature. A disadvantage is that some plants may regrow close to the ground and set seed out of reach of machinery.
Cultivation	Cultivation of weeds aims to expose the roots and bury the plant to a depth where it cannot re-grow. This is a very effective method of controlling annual or herbaceous plants and seedlings. Deep cultivation or ripping technique can be utilised for perennial species. This method of control is relatively cheap and can be used for controlling large weed infestations.
Mowing	This provides a similar effect to slashing but is usually used on smaller infestations. It is recommended that mowing or slashing occurs from the outside patch of weeds and moving inwards as this has been shown to be more effective in containing an outbreak.
Mulching	Mulching around plants can be effective for small areas. This control technique prevents weeds from germinating by removing the light and increasing the temperature of the soil's surface. Materials that can be utilised include cardboard, sawdust, rocks, black plastic, straw, woodchip, etc. Mulching also has the additional benefit of helping reduce erosion and conserving soil moisture.

Type	Description
Land Management	
Revegetation	Revegetation may help to control weed infestations by encouraging the growth of native species, which are then able to out-compete and reduce the numbers of exotics. In cleared or disturbed areas revegetation can be utilised to prevent weeds from colonising. As a component of long-term weed management, revegetation can follow other control methods to prevent weeds from re- establishing. It is recommended that indigenous species are planted (i.e. plant of local provenance) as these species are more likely to be better adapted to the local soil and climatic conditions.
Quarantine	Isolating infestations can be an effective way of preventing dispersal or disturbance factors and therefore prevent a weed from spreading further. This technique is most effective for eradicating small outbreaks or may be used to help reduce the proliferation or spread of larger infestations.
Fire	In some instances, burning areas can work to eliminate weeds from an area. This means of weed control is particularly effective for woody weeds and fire-sensitive species. However, one disadvantage in using fire to control weeds is that it can have the reverse effect and encourage some weed species. As fire may trigger the germination of some weed seeds it is recommended that some form of follow-up control such as cultivation or spraying is undertaken.
Chemical	
Foliar Spray	Using a chemical based foliar spray may be a suitable method for the control of herbaceous weeds or young re-growth. Disadvantages with this kind of control is the potential for damage to surrounding native flora species or other non–target plants. The use of chemical sprays is best suited to large infestations of herbaceous weeds that are some distance from areas of native vegetation.
Soil Application	This method of weed control involves application of a granular, pellet or liquid herbicide directly onto the soil around a weed or infestation. The herbicide is absorbed through the plant roots. The disadvantage of this technique is that rain is required for the treatment to be effective and this may not occur within the desired time for best treatment.
Biological	
Biological	Biological control is an attempt to restore balance to systems that go out of kilter when exotic species invade or take over. It is rarely an attempt at eradication. The most common strategy is to import host-specific natural enemies of the invader from its native home, and to encourage them to establish and multiply in their new home. Once established, the populations are self-sustaining, and a long-term balance is reached with the target pest. None of the weeds present within the Project has a reliable biological control that can be used for management. This method of treatment is not considered a viable option for weed management at the site.

3.3 Chemical Control

Weed control should be undertaken prior to disturbances in accordance with the Ground Disturbance Permit System, as this will limit the potential for machinery or vehicles to spread weeds across the Project area. Upon approval of the project, weed control will be completed prior to the initial disturbance of material.

A summary of exotic weed species' chemical treatment methodologies are provided in Table 3—2. In general, chemical control is to be utilised and supplemented by alterative treatment methods as required.

3.3.1 Herbicide Application

The application of herbicides can be grouped into two discrete methods; application by foliar spraying; or direct application with a wiper or paintbrush (usually the cut stump method). The method of application should be chosen with consideration to the weed being managed and surrounding vegetation, as spraying of herbicides presents a risk to non-target species through spray drift which can potentially result in the mortality of native plant species.

Where possible plants should be treated when actively growing, according to the prescriptions and notes in Table 3—1. This is generally from early spring to late summer. However, herbicides are less effective if the plants are under environmental stress (e.g. drought), and this should be considered before application. In situations where environmental stress seems likely, herbicides should be applied at an alternative time of the year, when the effect of the stress is minimised; this will generally require a follow-up treatment.

Riparian Zones

Weed control in or near riparian areas, must also consider the presence of frogs and/or other aquatic species, with manual removal preferable. Otherwise low-toxicity non-residual herbicides registered as suitable in watercourses may be appropriate for use in a targeted manner such as spot spraying.

Native Vegetation

Care also needs to be taken in order to avoid impacting any native species during weed control works; make sure that such works are undertaken by an appropriately qualified person with the ability to accurately distinguish the relevant weed species from indigenous flora.

Table 3—2 Treatment Options

Priority Weed	Treatment Options	Active Ingredient / Example Commercial Product (content of active ingredient)	Application Rate of Commercial Product / L of Water	Optimal Treatment Season	Notes
Caltrop (*Tribulus terrestris*)	Foliar Spray	Glyphosate / (360 g/L)	10 ml/1L	Apply when actively growing (following rain)	Glyphosate is a non-selective herbicide, and care should be taken not to allow spray to drift onto non-target species. With regards to the cut stump method, the mixture must be applied immediately after the cut is made. When applying metsulfuron – methyl a wetting agent is required.
		2,4-D amine 635 g/L	10 ml/1L	Apply when actively growing (following rain)	
		Metsulfuron-methyl 600 g/kg	10 g/100L	Apply when actively growing (following rain)	
Mimosa Bush (*Vachellia farnesiana*)	Basal bark spray	Triclopyr / Garlon 600 ® (600 g/L)	1 L per 50 L of diesel distillate or kerosene	Actively growing prior to seed set (following rain)	Ensure all stems on multi-stemmed plants are treated.
		Cut Stump Method	Triclopyr / Garlon 600 ® (600 g/L)	1 L per 50 L of diesel distillate or kerosene	All season
Hairyflower Lovegrass (*Eragrostis trichophora*)	Foliar Spray	Fluazifop-p- butyle	250 ml/100 L	Actively growing prior to seed set (following rain)	Safe to use in riparian areas. Should be applied when leaves are at least 5 cm long.
		Glyphosate / RoundUp Biactive ® (360 g/L)	75-100 ml/15 L	Actively growing prior to seed set (following rain)	Non-selective and will damage or kill trees and grasses that come into contact with spray drift.

3.3.2 Documentation

It is important that accurate records are kept. The form and register (examples in Appendix A and B) records the following data:

- Assessor name;
- Time and date of control;
- Species targeted;
- Methods of control used;
- Herbicide dosages applied;
- Area applied; and
- Purpose of control.

3.4 General Mitigation Measures

3.4.1 Personnel, Vehicle and Equipment Hygiene

One of the major concerns associated with construction activities is the further spread of existing weeds or the introduction of new weed species into the area. Weed species can potentially spread between sites by a number of different vectors including, but not limited to, contaminated machinery, vehicles, equipment, clothing and footwear. Implementation of weed hygiene procedures are critical to minimising spread or introduction of weeds.

Appropriate weed hygiene measures are to be implemented to minimise further spread and introduction of weed species to the Nolans site and the adjacent pastoral station. Measures which must be followed by all site personnel, vehicles and equipment entering the Project area are to include the following:

- Establishing vehicle access points across the Project.
- Wash down bays will be established at the main processing plant gate and the mine area entrance. During construction, prior to the construction of the washdown bays, the current procedure of inspecting earthmoving equipment at the roadhouse will continue.
- Establishing contract conditions directing contractors and/or suppliers to ensure earthmoving equipment, vehicles and other stationary equipment coming onto site is cleaned and clear of any free dirt prior to arriving onsite. Arafura vehicles that have been off site must also be clear and free of dirt prior to arriving on site.
- All earthmoving equipment arriving on site will be inspected prior to being allowed to undertake ground disturbance activities. Any vehicles that arrive on site and are not clean and free of dirt and mud must be washed at one of the two washdown bays referenced above (or at the roadhouse during construction).
- LVs and other vehicles that are travelling on Napperby Road, or the main access road to camp, the processing plant and the mine area do not need to be inspected as they will be travelling on bitumen and well maintained roads.

- Earthmoving vehicles will be washed down by the site water truck (equipped with a hose) prior to moving areas in order to minimise the spread of weeds.

3.4.2 Ground Disturbance Permit

All ground disturbance must be undertaken through a permitting system with sign-off required prior to ground disturbance occurring. The GDP will be issued by the respective officers from HSEC Team. If the area contains weeds, they are to be removed where possible prior to vegetation clearance so that vegetative material would be clean and able to be mulched and reused directly on site. The Ground Disturbance Permit (GDP) should have photographic evidence of before and after impacts. The area of disturbance is to be kept to a minimum and no protected areas or buffer zones are to be disturbed. The GDP is to include:

- Disturbance Requirements (contractor, dates, works and dimensions);
- Area Assessment (restricted work areas, EIS approved area, within lease boundary, services, weeds controlled); and
- Clearing Details (surveyed and demarked by flagging, supervisor of clearing, post clearing survey data).
- Any imported fill associated with ground disturbance will need to be certified as weed free by the fill supplier prior to arrival on site. Documentation should be provided to the environmental department at Nolans.

4.0 MANAGEMENT AND MITIGATION

Weed management refers to weeds which are known to be present or have potential to be present across the Project. Management of weeds is structured below as follows:

- **Key Activities, Impacts and Residual Risks:** A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect.
- **Objective:** The guiding environmental management objective(s) and activities that apply to the element.
- **Mitigation Measures:** The procedures to be employed to ensure that the relevant objectives are met.
- **Responsibility:** Nominates the responsible position for implementing actions and monitoring.
- **Trigger, Action, Response Plan (TARP):** The actions to be implemented in the case of non-compliance. This includes strategies of remediation and the person(s) responsible for the actions.

4.1 Key Activities and Potential Environmental Impacts

The key activities and potential environmental impacts that have been identified for weed management are listed in Table 4—1.

Table 4—1 Key Activities and Potential Environmental Impact

ID No	Activity	Potential Environmental Impact
1	Construction of linear infrastructure (e.g. access tracks, water supply pipelines, powerlines etc) results in reduction in native vegetation and disturbance of habitat.	Loss of native vegetation allowing for weed establishment, along exposed edges and in cleared areas. Habitat fragmentation, particularly for small ground-dwelling fauna, and the introduction and/or spread of exotic plants (weeds) adversely affecting habitat values and capacity of individuals and/ or population to persist.
2	Diversion of Kerosene Camp Creek and alteration of waterway form.	Diversion of the old channel resulting in loss of riparian vegetation in the diversion area, and impact on riparian vegetation downstream in the floodplain associated with the old channel of Kerosene Camp Creek (approx. 3 km length).
3	Transport of materials, machinery and vehicle movements and inappropriate waste management allows for introduction of new weeds and spread of existing weeds into new areas during construction and operation phases. In accordance with the current scope of the project the service corridor will be used on a 24hr basis by service vehicles and 1 train truck (at a rate of at least 1 load / per hour).	Increased presence of weed species resulting in decline or modification of existing vegetation communities, including habitat quality. An increase in the incidence / spread of weed species leading to reduction in food plant availability and habitat of listed threatened species such that the population declines. Cause a long-term reduction of habitat for rare or threatened fauna species.

4.2 Mitigation Objectives

The weed management objectives have been established and are detailed in Table 4—2.

Table 4—2 Mitigation Objectives

Objective	Target	KPI
No spread of existing Declared weeds within the Project area.	No significant change to the extent and distribution of Declared weeds within one year of completion of construction activities compared to the extent and distribution of weeds prior to construction.	Weed surveillance monitoring to show that existing Declared weeds have not proliferated through Project area or into adjoining vegetation.
Prevent the introduction of new Declared weed species across the Project.	Zero occurrences of new weeds.	No new species of weeds recorded in the Project area.

4.3 Mitigation Measures

Mitigation measures have been developed to minimise potential impacts associated with weeds within the Project area. The mitigation measures, timing and responsibilities are provided in Table 4—3.

Table 4—3 Mitigation Measures

Mitigation Measure	Timing	Responsibility
Site Induction (Risk Activity 1 - 3)		
Site inductions are to include the following components for weed management: Summary of known weed infestations at the site; Requirement to enter and exit site through recognised vehicle access points; Requirement to inspect and clean vehicles/equipment entering and exiting the Project; Weed removal required prior to vegetation clearing; Areas to be cleared are to be flagged and approved through a Ground Disturbance Permit system; and All onsite personnel are to utilise existing/approved roads and tracks only.	Site Induction	All personnel
General (Risk Activity 1 and 3)		
Imported fill is to be certified weed-free prior to being utilised at the Project.	Construction and operation	Construction and Site Manager
All earth moving vehicles entering the Project area are to be inspected and if required power washed to remove potential seeds.	On site entry.	All personnel

Mitigation Measure	Timing	Responsibility
Regular weed surveillance monitoring (as required) and control of weeds across the Project. The survey is to determine if weed controls have been effective and if additional measures are required.	Regular surveys and weed control typically after rain events.	Environmental Technician
If works are being undertaken in an area known to contain WoNS or Class A, B or C weeds, plant/equipment and vehicles are to be washed prior to vacating the areas.	At all times.	All personnel
Vegetation Clearing (Risk Activity 1 - 3)		
Prior to clearing a Ground Disturbance Permit is required to be issued by the representative from HSEC Team.	At all times	HSEC Team
Minimise ground disturbance within sensitive areas such as riparian zones.		
Weed removal as required prior to vegetation clearing so that vegetative material would be clean and able to be mulched and reused directly on site.		
Areas to be cleared outside of existing disturbance will be flagged to prevent over clearing.		
Vegetation and soil stockpiled from clearing activities will be monitored and chemical control undertaken should weeds be identified.		
Inspection and Monitoring (Risk Activity 1 - 3)		
Assessment of compliance with Ground Disturbance Permit system.	As required	HSEC Manager
Regular (and following rain events) weed surveillance monitoring and application of chemical control as required. Monitoring and applications will be recorded in the Weed Register (Appendix).	Regular and after rain events.	Environmental Technician
Regular weed surveillance monitoring and control to be completed by an appropriately experienced and qualified person. The weed surveillance monitoring will establish potential requirements for additional control measures.	Regularly	HSEC Manager

4.4 Trigger, Action and Response Plan

The Trigger, Action and Response Plan (TARP) outlines remedial actions and responses to the situation. The levels of incidents and TARP are provided in Table 4—4.

Table 4—4 Trigger, Action and Response Plan

Trigger	Action	Response
Spread of environmental weeds to areas previously weed free.	**Environmental Officer:** Undertake additional chemical control as required and increase frequency of surveillance monitoring. Record monitoring and application of chemical control in the Weed Register.	**Area Manager:** Provide feedback to HSEC Manager.
Introduction of Class A, B and C weeds and WoNS to areas previous weed free	**Environmental Officer:** Undertake additional chemical control as required and increase frequency to monthly surveillance monitoring. Record monitoring and application of chemical control in the Weed Register. Commission an appropriately experienced and qualified person to undertake weed surveillance survey and control across the Project. The subcontractor is to establish additional weed mitigation measures as required. Revise the Environmental Management Plan and Weed Management Plan following HSEC Manager approval of additional mitigation measures. **Environmental Officer and subcontractor:** Undertake weed surveillance monitoring, assessment of Project activities and existing weed mitigation measures. **HSEC Manager:** Assess and implement surveillance report/mitigation measures.	**Environmental Officer and subcontractor:** Determine additional mitigation measures and provide a summary report. **HSEC Manager:** Facilitate the revision of the Environmental Management Plan and Weed Management Plan.
Clearing undertaken outside of established Ground Disturbance Permit approval but	**Environmental Officer and HSEC Manager:** Commence investigation into the clearing works to determine root cause of over clearing.	**HSEC Manager and General Manager:** Review summary report and undertake debriefing with site personnel.

Trigger	Action	Response
outside of sensitive areas (i.e. restricted works areas).	Establish the significance of over clearing and determine rehabilitation measures. Produce incident report.	
Clearing undertaken outside of established Ground Disturbance Permit approval and within sensitive areas (i.e. restricted works areas).	**Environmental Officer and HSEC Manager:** Commence investigation into the clearing works to determine root cause of over clearing. Establish the level/area of impact within the sensitive area. Produce summary of the incident occurring.	**HSEC Manager and General Manager:** Review summary report and inform relevant stakeholders regarding over clearance. Review contractor / personnel performance and implement management measures.

5.0 PERFORMANCE REVIEW

A regular review of performance of this management plan is to coincide with the review process of the Project's Mining Management Plan (MMP).

The review process assesses performance against objectives of this plan and the stated actions within the MMP. Any relevant outcomes, supporting information, reports and/or data, discussed within the relevant section of the MMP, and supporting information/reports will be provided within the appendices.

Any outcomes of the performance review that will assist in continually improving this management plan, its objectives, methods or controls, are to be included or reflected in an updated version of this document.

6.0 REFERENCES

6.1 Third Party Documents

Ref No.	Title	Document Number
C1.	Agriculture.gov.au (2019). *Australian Weeds Strategy 2017 to 2027*. [online] Available at: http://www.agriculture.gov.au/pests-diseases-weeds/pest-animals-and-weeds/review-aus-pest-animal-weed-strategy/aus-weeds-strategy [Accessed 28 Mar. 2019].	
C2.	Brocklehurst, P., Lewis, D., Napier, D., and Lynch, D. (2007). *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping*. Technical Report. Northern Territory Department of Natural Resources, Environment and the Arts.	
C3.	Environment.gov.au (2019). *Weeds publications and resources*. [online] Available at: http://www.environment.gov.au/biodiversity/invasive/weeds/publications/index.html [Accessed 28 Mar. 2019].	
C4.	Franks, A.J. (2002). *The ecological consequences of Buffel Grass Cenchrus ciliaris establishment within remnant vegetation of Queensland*. Pacific Conservation Biology, 8: 99- 107.	
C5.	GHD (2016). *Nolans Project Environmental Impact Statement, May 2016*. A report for Arafura Resources Limited.	
C6.	GHD (2016a). *Nolans Project Environmental Impact Statement. Appendix M: Biodiversity - Flora and Vegetation Assessment*. Unpublished report for Arafura Resources Limited	
C7.	GHD (2017). *Nolans Project Environmental Impact Statement - Supplementary Report, October 2017*. A report for Arafura Resources Limited.	
C8.	GHD (2018). *Impact of Proposed Operational Changes to EIS*. A report for Arafura Resources Limited.	
C9.	Miller, G, Friedel, M, Adam, P and V. Chewings (2010). Ecological Impacts of Buffel Grass (*Cenchrus ciliaris* L.) Invasion in Central Australia – Does Field Evidence Support a Fire Invasion Feedback? The Rangeland Journal 32 (4) 353-365.	
C10.	Neave, H., Sparrow, B., and Clifford, M. (2006). *Preliminary Report: Towards a resource assessment of the Burt Plain Bioregion for Conservation Planning*. Biodiversity Conservation Department of Natural Resources, Environment and the Arts.	
C11.	Northern Territory. Department of Land Resource Management (2015). *Northern Territory Weed Data Collection Manual*. Darwin, Northern Territory: Department of Land Resource Management, Weed Management Branch.	

Ref No.	Title	Document Number
C12.	Northern Territory. Department of Natural Resources, Environment, the Arts and Sport. Weed Management Branch (2010). *Buffel Grass: Management Guide for Central Australia*. Darwin: Northern Territory Government.	
C13.	Northern Territory. Department of Natural Resources, Environment, The Arts and Sport (2014). *Northern Territory Weed Management Handbook*. Northern Territory: Department of Natural Resources, Environment, The Arts and Sport.	
C14.	NRETAS (2005). *Northern Territory Parks and Conservation Masterplan – Northern Territory Bioregions Assessment of Key Biodiversity Values and Threats*, Department of Natural Resources, Environment, the Arts and Sport, Darwin, NT.	
C15.	Smith, N. M. and Environment Centre N.T (2002) *Weeds of the Wet/Dry Tropics of Australia: A Field Guide*. Darwin, N.T.: Environment Centre NT.	

APPENDIX A WEED MONITORING / CONTROL FORM (EXAMPLE)

Assessor					Date		
Site Location(s)					Purpose of Visit		
Weed Control Equipment					Weather		
Weed Species		Grid Reference (GDA94Z53)		Cover Abundance / Species Number	Flowering / Seeding	Control Method (include dilution ratios)	Previous Treatment Summary
Common Name	Scientific Name	Easting	Northing				

APPENDIX B WEED REGISTER (EXAMPLE)

your ref.	e.g. 2/11/2006	52 or 53	Set the Datum on your GPS receiver to WGS84 or GDA94 using easting and northings in metres		Common name	20, 50,100	2,3,4, 5	0, 25, 50, 75, 100 (3 columns add up to 100%)			Today, Previous No Treatment	Use List	Use List	Use List	Yes No	Yes No	Yes No	
WAYPOINT	DATE_REC	UTM_ZONE	EAST	NORTH	WEED_NAME	SIZE_DIA_M	DENS_CAT	SEEDLINGS	JUVENILES	ADULTS	TREATED	TREAT_TYPE	TREAT_CHEM	TREAT_MON	SEEDED	SOIL_DIST	VEG_DIST	COMMENTS