

# EPBC 2021 / 9133 – Offset Area Bushfire Management Plan



## Document Control

Client	Townsville City Council
Document	EPBC 2021 / 9133 - Offset Area Bushfire Management Plan
Project Name:	Haughton Pipeline Stage 2
Version:	03

## Revision History

Version No.	Date	Prepared By	Reviewed By	Approved For Issue By
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This BMP was prepared by Duncan Scott-Lawson. Duncan has over 20-years' experience in the bushfire industry and holds AFAC accreditation in Prescribed burn planning. Duncan has undertaken a range of incident management roles during bushfire suppression that includes but not limited to planning, operations, divisional command, taskforce leader and aviation specialist (Air Attack Supervisor). Duncan has been deployed interstate on several occasions to assist in bushfire suppression operations.

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# Executive Summary

This Offset Area Bushfire Management Plan documents the long-term and adaptive approach to burning within the Haughton Pipeline Stage 2 Offset Area. It outlines how the burn units and associated burn regimes will be implemented to reduce the risk of uncontrolled burns and support the desired outcomes and overall conservation objectives.

The Haughton Pipeline Stage 2 Offset Area has been provided as a requirement of Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval (EPBC ref: 2021/9133) in relation to the Haughton Pipeline Stage 2 Project. The 625 ha Offset Area is located south of Lake Ross within the Lake Ross Storage Area (LRSA), approximately 11.5 km southeast of the dam wall (Figure 1). The nominated area provides biodiversity offsets for EPBC Act listed matters southern black-throated finch (*Poephila cincta* subsp. *cincta*), bare-rumped sheath-tail bat (*Saccolaimus saccolaimus* subsp. *nudiclunatus*) and koala (*Phascolarctos cinereus*).

The monitoring and reporting process is targeted to the proposed actions within Management Action 5 – Fire management performance indicators (Table 7.5) and MNES ecological outcomes (Table ES 1.1.) of the Haughton Pipeline Stage 2 Offset Area Management Plan.

The Haughton Pipeline Stage 2 Offset Area has been compartmentalised into three burn blocks utilising the existing hard containment lines offered in and around the Offset Area. The burning schedule provided in Section 5 commences burning within the next two years, with future burning occurring every two years, resulting in an 8-to-10-year cyclic burn for each burn area to support the Southern Black-throated Finch habitat. Ignition sequences and strategies developed for each prescribed burn plan should include low intensity burning to protect koala, tree hollows and the dam foreshore where required.

A monitoring program within Section 6 provides burn patch monitoring and guidance on the management of infrastructure that supports fire management programs and response.

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Table 1: Glossary of Terms

Term	Meaning
Asset	A place, object, or area - including built assets, buildings and fences, significant flora and fauna, archaeological sites, commercial and industrial, social and economic area that requires protected from bush fire, as its value may be damaged or destroyed by flame, smoke or heat.
Asset Protection Zone	An area around a development or asset offering protection to reduce the bush fire hazard. It can consist of an Inner Protection Area (IPA) and an Outer Protection Area (OPA). Hazard reduction techniques can include slashing, raking, bush regeneration and burning.
Bush Fire Management Zones	Bush fire zones with specific bushfire management objectives.
Cultural Burning	A fire ignited for cultural intent, triggered by cultural value(s), undertaken by cultural people for cultural outcomes.
Fire Hazard	The potential severity of a fire. Usually measured in terms of intensity (kW/m). The factors that influence a bush fire hazard include climate and weather patterns, vegetation (fuel quantity, distribution and moisture) and slope.
Fire Regime	The history of fire in a particular area, including the frequency, intensity and season of burning.
Fire Risk	Is the chance of a bush fire igniting, spreading and causing damage to assets of value to the community. Risk may be rated as being extreme, major, moderate, minor or insignificant and is related to the vulnerability of the asset.
Fuel	Any material capable of being ignited and sustaining fire, such as grass, live vegetation, leaf litter and bark. Generally measured in tonnes per hectare of dry weight.
Fuel Load	Amount of combustible material ,6mm in diameter in a given area at a given time.
Hazard Reduction	Works designed to attain planned resource management objectives, primarily the reduction of fire threat. Activities include: <ul style="list-style-type: none"> <li>• Manual and mechanical thinning of vegetation (NOT broad scale clearing), and</li> <li>• Controlled burning of a predetermined area, carried out under specified weather and environmental conditions.</li> </ul>
Land Management Zone	A broader zone of the landscape, which do not satisfy the criteria for Strategic Fire Management Zones (SFMZ) or Asset Protection Zones (APZ). Fire in these areas should be managed to meet conservation objectives for species, habitats, populations and cultural heritage values.
Obligate Seeders	Plants that do not resprout and rely on seeding to regenerate their population after fire.
Overall Fuel Hazard	Key structural layers of the fine fuel that drive fire behaviour (bark, elevated, near-surface and surface fuels) to determine the overall fire hazard.
Prescribed Burning	A controlled burn to a predetermined area, carried out under specified weather and environmental conditions, designed to achieve planned resource management objectives.
Slashing	A management tool used to assist in the management of fuel loads, timing and control of prescribed burns. Achieved via tractor slashing and removing the cut material or allowing adequate time for decomposition prior to the bush fire season.
Strategic Fire Advantage Zone	A zone or area in which the principal fire objective is to undertake bush fire risk management treatments to provide a strategic advantage during bush fire suppression operations.
Trittering	This is a mechanical method of fuel reduction, usually applied to shrub and regenerating canopy vegetation, due to the mulching tritter head ability to treat large width vegetation.
Bush fire	An unplanned fire that includes forested, heath and grassland fires. Interchangeable with 'Bush fire'
Fire Exclusion Zone	A zone that fire is excluded from due to natural, cultural, heritage, social or commercial values

Table 2: Abbreviations & Acronyms

Abbreviation	Meaning
AFAC	Australasian Fire Authorities Council
AFMG	Area Fire Management Group
APZ	Asset Protection Zone
AS	Australian Standard
BAL	Bushfire Attack Level
BMZ	Bushfire Management Zones
BMP	Bushfire Management Plan
BOPs	Bushfire Operations Plans
BPAD	Bushfire Planning and Design
BPM	Bushfire Protection Measures
Cat	Category (fire vehicle)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DILGP	Department of Infrastructure, Local Government and Planning
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
ENSO	El Niño Southern Oscillation
FEZ	Fire Exclusion Zone
FFDI	Forest Fire Danger Index
GHD	GHD Consulting
IMZ	Ignition Management Zones
IPA	Inner Protection Area
LRSA	Lake Ross Storage Area
LRSAMP	Lake Ross Storage Area Management Plan
LMZ	Land Management Zone
NCC	National Construction Code
OAMP	Offset Area Management Plan
OFH	Overall Fuel Hazard
OPA	Outer Protection Area
PCT	Plant Community Type
BODs	Bushfire Operational Delineations
RE	Regional Ecosystem
SFAZ	Strategic Fire Advantage Zone
TCC	Townsville City Council
TLDMG	Townsville Local Disaster Management Group
QFES	Queensland Fire and Emergency Services



# 1. Introduction

Townsville City Council (TCC) obtained approval under the *Environmental and Biodiversity Conservation Act 1999* (EPBC Act) for the development of the Haughton Pipeline Stage 2 Project (HPS2) (EPBC ref 2021/9133) in February 2023. The purpose of the project was to provide supplementary water supply from the Burdekin River Clare Weir Storage to the Ross River Dam to meet the increasing demands of the region. Part A of the EPBC approval conditions required the provision of environmental offsets to compensate for significant residual impacts of the project on habitat for the following protected matters:

- Southern black-throated finch (*Poephila cincta subsp. cincta*).
- Bare-rumped sheath-tail bat (*Saccolaimus saccolaimus subsp. nudiclunatus*), and
- Koala (*Phascolarctos cinereus*).

TCC addressed the environmental offset requirements with the provision of a 625 ha offset area within the TCC owned and managed Lake Ross Storage Area surrounding the Ross River Dam. The Haughton Pipeline Stage 2 Offset Area Management Plan (2023) (OAMP) documents and guides the delivery and management of the offset area to preserve and enhance habitat for the above protected matters. Inherent to the overarching OAMP is the need for several subplans to address each of the discrete environmental management disciplines, including the development and implementation of a Bushfire Management Plan.

This Offset Area Bushfire Management Plan (BMP) documents and supports the long-term and adaptive approach to burning within the Haughton Pipeline Stage 2 Offset Area (Offset Area) as per *Management Action 5* of the OAMP. The BMP addresses how the burn units and associated burn regimes will be implemented to:

- Meet the water quality objectives for the Lake Ross Storage Area.
- Reduce the risk of uncontrolled burns, and
- Support the habitat values of the southern black-throated finch, bare-rumped sheath-tail bat, and koala (*Phascolarctos cinereus*) to achieve the desired outcomes and overall conservation objectives of the Offset Area.

The BMP was developed in consultation with the Whole-of-Government Queensland Fire and Emergency Services – Queensland Bushfire Plan (2020), Townsville Bushfire Risk Mitigation Plan (2024), the Lake Ross Storage Area Management Plan (2023) and the Haughton Pipeline Stage 2 Offset Area Management Plan (2023).

Of primary consideration is the location of the Offset Area within the Townsville City Council (TCC) managed Lake Ross Storage Area, the catchment area for Townsville's main water storage dam. The Lake Ross Storage Area Management Plan (LRSAMP) (Townsville City Council 2023) outlines the management objectives and initiatives for the storage area for the purpose of water quality management. The objectives of the LRSAMP were given priority consideration in the development of this plan. This BMP has additionally been developed to be included as an addendum to the LRSAMP as part of a holistic approach to management of the area.

## 1.1. Offset Area Description

The 625 ha Offset Area is located on the southern side of Lake Ross, within the Lake Ross Storage Area (LRSA) approximately 11.5 km southeast of the dam wall (Figure 1 & Figure 2). It provides biodiversity offsets for the above-mentioned EPBC Act listed matters impacted by the HPS2 project.

## 1.2. Objectives

In accordance with the OAMP, the primary objective of bushfire management is to prevent extensive and uncontrolled fires, such that no uncontrolled bushfires burn more than 50% of the offset area.

In addition to the bushfire management objective detailed in the OAMP, the proposed management processes within this BMP align with the primary water quality objective of the LRSAMP, which is to maintain raw water at the best possible quality.

To achieve these objectives this plan documents the values of the site, prescribes appropriate bushfire treatment strategies and details a monitoring program for the offset area using long-term fire

management principles that mitigate the risk of high intensity bushfires, and maintain and enhance water quality and biodiversity values.

The recommendations within this management plan will provide certainty to the regulatory authorities that bushfire risks can be managed to acceptable levels in accordance with the core concepts identified within Whole-of-Government Queensland Fire and Emergency Services – Queensland Bushfire Plan (2020) and Townsville Bushfire Risk Mitigation Plan (2024), which aim at a proactive effort to mitigate bushfire risks.

A summary of objectives, recommendations and actions within overarching and associated plans that have formed the basis of this BMP is presented in Table 3.

*Table 3: Summary of Objectives & Actions*

Document	Objectives	Recommendations / Actions
Offset Area Management Plan – Houghton Pipeline Stage 2 (GHD 2023)	<ul style="list-style-type: none"> <li>To prevent extensive and uncontrolled fires that burn more than 50% of the offset area.</li> <li>Create habitat with a mosaic of fire histories by maintaining landscapes with a variety of burning regimes, i.e. in timing and intensity and area of fires, and</li> <li>Protect habitat from late dry season fires especially in areas close to water.</li> </ul>	<ul style="list-style-type: none"> <li>Develop a Bushfire Management Plan within 12 months of approval.</li> <li>Identify fire breaks using existing fence lines and track networks, widening fire breaks up to a width of 10 m if necessary.</li> <li>Undertake scheduled, periodic fuel management via hazard reduction burning.</li> <li>Manage vegetation generally consistent with guidelines for local regional ecosystems with prescribed</li> <li>Avoid wet season fires and plan burns for periods when soil moisture is still good, and</li> <li>Follow fire regimes recommended by the Queensland Herbarium (2024b) for the relevant REs within the offset area.</li> </ul>
Management Plan for Black-throated Finch ( <i>Poephila cincta cincta</i> ) Habitat at Lake Ross Storage Area, Townsville (NRA 2018)	<ul style="list-style-type: none"> <li>Prevent extensive and uncontrolled fires, and</li> <li>Maintain landscapes that have variety in burning regimes</li> </ul>	<p>For land not grazed by livestock the following is recommended:</p> <ul style="list-style-type: none"> <li>Maintain landscapes with a variety of burning regimes (i.e. variety in the timing and intensity of fires and the areas burnt each year). This can be achieved by adopting a fire regime that involves burning fire breaks earlier in the season then following up with early dry season (May to July) patch burns (cool burns) in discrete areas (i.e. don't burn entire landscapes at once).</li> <li>Areas should be left unburnt for 5 or more years apart from fire breaks which may require more frequent treatment.</li> <li>Fire regimes shall consider weed and pest animal responses and how applying the proposed fire frequencies and intensities will impact weed and pest animal populations and movements.</li> <li>Protect dry season black-throated finch habitat, especially grasslands near to water, from late dry season fires. This is particularly important during dry years. Also protect grasslands near water sources during the black-throated finch breeding season when there is no alternative water or habitat nearby, and</li> <li>Burn when there is good soil moisture. Spell grasslands after fire to reduce woody vegetation thickening and assist in the recovery of native perennial grasses.</li> </ul> <p>The following additional management measures were also recommended:</p> <ul style="list-style-type: none"> <li>Management should aim to prevent extensive and uncontrolled fires particularly where not grazed.</li> <li>Wet season fires should be avoided to reduce impacts to early seeding and annual grasses.</li> </ul>

Document	Objectives	Recommendations / Actions
		<ul style="list-style-type: none"> <li>Weather conditions, topography and soil type should be considered when planning fires, and</li> <li>Hot fires may reduce woody vegetation thickening however, due to the complexity of this approach hot fires should be managed with careful planning research</li> </ul>
Lake Ross Storage Area Management Plan (TCC 2023)	<ul style="list-style-type: none"> <li>Maintain raw water at the best possible quality.</li> </ul>	<ul style="list-style-type: none"> <li>Maintain the integrity of all vegetated buffer zones' surrounding Lake Ross.</li> <li>Control vegetation and weeds in areas sensitive to herbicides.</li> <li>Reduce the threat and intensity of uncontrolled bushfire, and</li> <li>Protect life and property within the Lake Ross Storage Area and surrounding lands.</li> </ul>
Townsville Area Fire Management Group - Bushfire Risk Mitigation Plan - Version 1.1 (TCC 2023)	<ul style="list-style-type: none"> <li>Identification of high priority hotspots of buildings (assets) with a high risk from bushfires and identified several planned activities.</li> </ul>	<ul style="list-style-type: none"> <li>No high-risk areas identified in the LRSA.</li> </ul>





# Terra

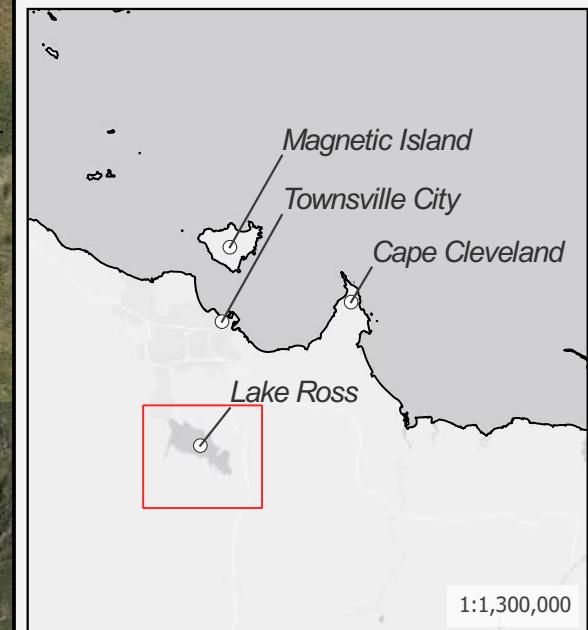
SOLUTIONS

FIGURE 1: SITE LOCATION



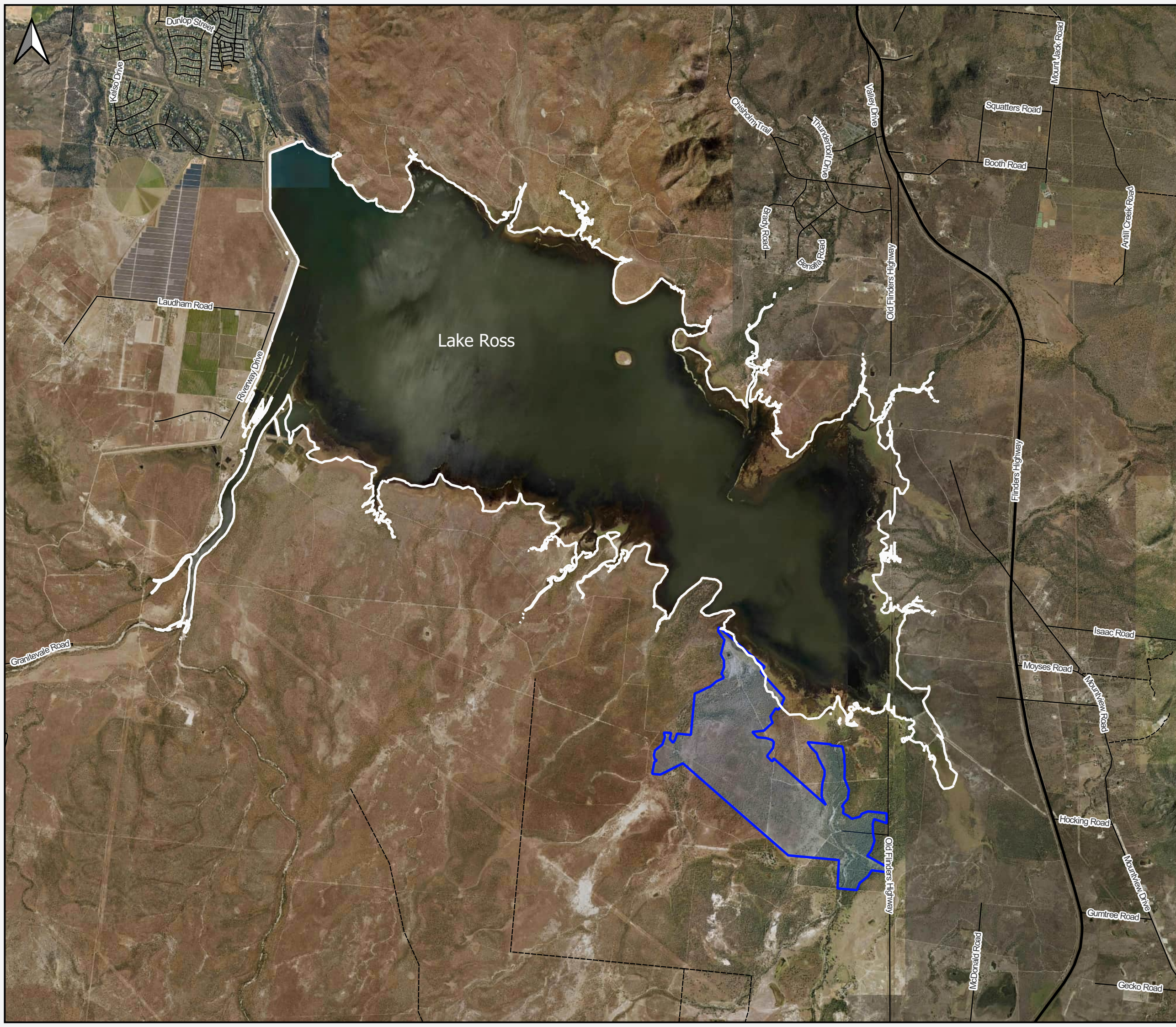
LEGEND:

- Ross River Dam Full Supply Level
- Houghton Pipeline Stage 2 Offset Area
- Queensland Roads & Tracks
  - Highway
  - Local
  - Secondary Track

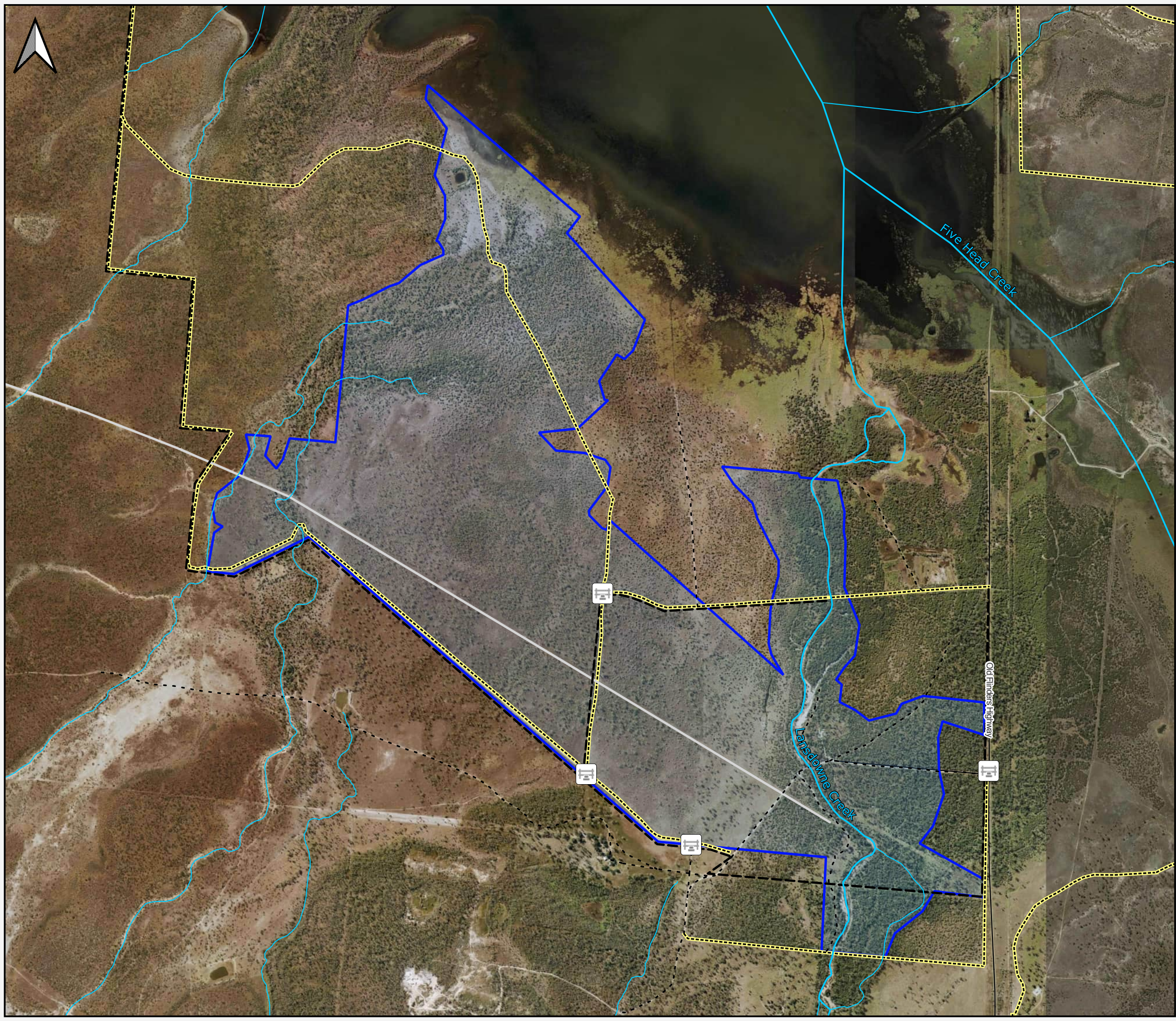


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COORDINATE SYSTEM: GDA2020 / MGA zone 55

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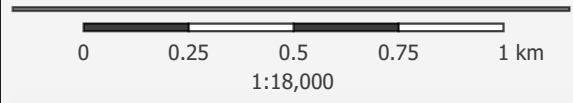













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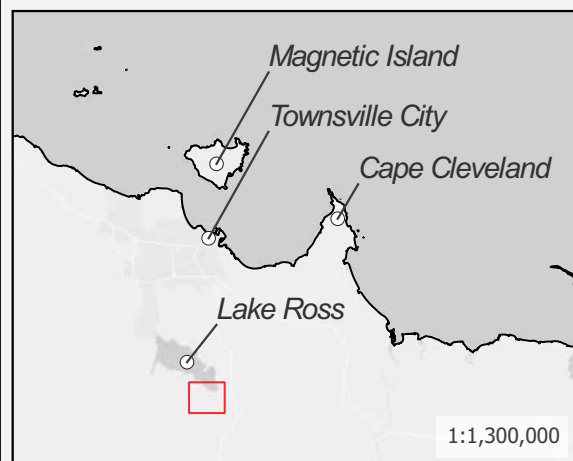
## SOLUTIONS

FIGURE 2: OFFSET AREA LAYOUT



LEGEND:

-  Gates
-  Firebreaks / Tracks
-  Other tracks
-  Roads
-  Maintained Fences
-  High Pressure Gas Pipeline
-  Watercourses [defined by Water Act 2000]
-  Vegetation Management Watercourses
-  Houghton Pipeline Stage 2 Offset Area



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### 1.3. Relevant Legislation & Documentation

The legislative instruments relating to BMP are:

- *Building Act 1975 (Qld).*
- *Disaster Management Act 2003 (Qld).*
- *Fire and Emergency Services Act 1990 (Qld).*
- *Forestry Act 1959 (Qld).*
- *Nature Conservation Act 1992 (Qld).*
- *Planning Act 2016 (Qld).*
- *Public Safety Preservation Act 1986 (Qld).*
- *Vegetation Management Act 1999 (Qld),* and
- Local Government Laws.

Further documents that provide guidance on bushfire management in Queensland and Townsville region include:

- Whole-of-Government Queensland Fire and Emergency Services - Queensland Bushfire Plan.
- Townsville Bushfire Risk Mitigation Plan.
- Natural hazards, risk and resilience - Bush fire - State Planning Policy - state interest guidance material.
- Bush fire Resilient Communities - Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire, and
- Australian Standard AS 3959 - Construction of buildings in Bushfire-prone areas.



## 2. Bushfire Behaviour Analysis & Risk

Prior to assessing bushfire risk, concepts and terms need to be defined.

Bushfire is a normal part of Australia's natural environment, particularly in eucalypt forests. However, the frequency and intensity of bushfires varies throughout the landscape and seasons. Bushfires are a common occurrence during drier parts of the year.

Climate change is expected to bring longer bushfire seasons to parts of Australia, an increasing number of extreme fire weather days, and increasing fire intensity.

Bushfires of low or moderate intensity often pose little threat to life, property and community assets, but the potential for changes in wind direction can be a significant hazard. However, bushfires that burn in heavy fuels, steep terrain or on hot, dry and windy days often spread rapidly, crown in forests, produce powerful convection columns and create extensive spot fires ahead of the fire front, often making their control impossible until weather conditions moderate.

As the fire danger reaches 'extreme', bushfires are often described as firestorms and become impossible to control. When the fire danger reaches 'Catastrophic', the risk of serious injury or death to people in the path of a bushfire increases significantly, and many properties and other community infrastructure can become difficult or impossible to defend.

The intensity of a bushfire, which determines associated damage, is a product of the fuels burning (quantity, arrangement, size, moisture content), the weather at the time (temperature, wind speed and direction, relative humidity, atmospheric stability) and the topography of the land where the fire is burning (slope and aspect).

Vulnerability to bushfire risk is a combination of the physical location of the persons under threat and the understanding and ability that person has that enables them to deal with the risk. It is the position of Australian fire agencies that the safest action to protect life is for people to be away from the Bushfire or threat of Bushfire as early as possible.

### 2.1. Bushfire Season

In Northern Queensland bushfires predominantly occur in the dry season with a heightened risk during the months (June to December). Fire risk is highest under conditions where vegetation has a high fuel load, low fuel moisture, strong winds, high ambient temperature, and low relative humidity. The main ignition sources are due to out-of-control breach of containment during prescribed hazard reduction burning, lightning, arson, accident, and incendiaries.

### 2.2. Bushfire History

Available bushfire records from 2011, identifies four bushfires and 15 prescribed burns have been occurred around Lake Ross Dam. Of these, one wildfire in 2016 impacted the site with two prescribed burns were undertaken in 2016. Bushfire history is provided in Figure 3.

### 2.3. Townsville Bushfire Risk Mitigation Plan

The Townsville Bushfire Risk Mitigation Plan provides the primary mechanism for the coordinated identification of high-risk areas and the planning of bushfire mitigation activities.

The plan recognises the continuing challenges of bushfire conditions into the future, where proactive efforts to mitigate bushfire risks continues to be of high importance at all levels of government and throughout the Queensland community.

This Bushfire Risk Mitigation Plan will be used to support:

- The identification of Bushfire Hazards within a Local Government area.
- Support long term vegetation management and Community Engagement initiatives.
- Operational planning, long term (1-3 years) and decision making by AFMG members during the annual Operation Sesbania implementation period.

- Forward planning for progressive future mitigation activities in subsequent years (AFMG partner three-year business plan if available).
- Support operational readiness planning of QFES, its partner organisations and landowners in preparation for bushfires.
- The integration of hazard - specific planning for bushfire mitigation into Queensland's Disaster Management Arrangements.
- Recognition of Local Disaster Management Plans (LDMPs) and associated activities of Local Disaster Management Groups (LDMGs), and
- The plan also establishes a collaborative standardised framework for the reporting of bushfire mitigation activities during the annual Operation Sesbania reporting cycle.

## 2.4. Fire Weather Severity

Regional scale bushfire hazard mapping drawn from the State Planning Policy (SPP) Interactive Mapping System shows large areas of medium potential bushfire intensity within and adjacent to the offset area as well as a small area of high potential bushfire intensity towards the south-eastern extent (Figure 4).

Potential severe fire weather mapping indicates the regional variation across Queensland, including hot, dry, and windy days with little preceding rainfall. Fire weather severity maps developed for Queensland by CSIRO are based on the Forest Fire Danger Index (FFDI) (McArthur 1973). The maps show an FFDI that is expected to be exceeded about once every 20 years, with a 5% chance of being exceeded in any single year (DILGP 2016). While more severe fire weather events are possible, these conditions are considered suitable for setting the level of bushfire risk mitigation measures (Queensland Fire and Emergency Services, 2019).

The potential severe fire weather mapping dataset indicates an FFDI of 58 for a 1:20 year for the majority of the offset area and an FFDI of 57 within a smaller area in northern extent. The fire weather severity mapping is illustrated in Figure 5.

## 2.5. Bushfire Management Zones

Bushfire Management Zones (BMZ) are a useful way to define the primary purpose for fire management in a given area of land. The process involves compartmentalising the landscape into BMZ and delegating the primary purpose of that zone for fire management. Each compartment within the off-set has been assessed to meet one of the following zones:

- Asset Protection Zone.
- Strategic Fire Advantage Zone.
- Land Management Zone.
- Fire Exclusion Zone, and
- Ignition Management Zones.

## 2.6. Bushfire Risk Treatments

Bushfire risk treatments are undertaken through the implementation of 'active' and 'passive' Bushfire Protection Measures (BPMs). Passive BPMs are the preferred mechanism to manage risk, although active BPMs have a role and are increasingly considered in risk mitigation.

Establishing passive BPMs to support active BPMs is an essential consideration to ensuring risk is mitigated to acceptable levels while maintaining the safety of responding emergency services and maintain the values of the site.

Passive BPMs include measures such as site access, water sources and defensible spaces.

## 2.7. Active Bushfire Risk Treatments

Active BPMs are bushfire suppression operations, actions, tactics, and strategies (including prescribed burning) that are employed to reduce the negative outcomes of an uncontrolled bushfire. Within the bushfire planning framework adequate passive BPMs are the priority to support active BPMs.

## 2.8. Bushfire Operational Delineations

Bushfire Operational Delineations (BODs) is a pre-fire season planning tool to promote safe and effective wildland fire response (active BPM), strengthen risk management approaches in fire management and better align fire management objectives. BODs are a collaborative planning approach based on spatial analytics to identify potential bushfire control lines and assess the desirability of fire before ignition. They offer the opportunity to apply risk management principles with partners before the compressed timeframe of incident response.

Successfully employing BODs will require leadership commitment, stakeholder and partner engagement and interdisciplinary staff involvement. Council should look to strengthen coordination and strategic approaches for wildland fire response by utilising pre-season collaboration and data analytics, through the Townsville Local Disaster Management Group (TLDMG).

## 3. Site Description

### 3.1. Topography

Effective slope has a direct influence on the potential rate of fire spread and rate of fuel consumption. Steep slopes provide an opportunity for rapid fire growth under elevated fire weather and increased rate of spread reducing the ability of human intervention to suppress fire growth.

The topography of the site and surrounds has been assessed to identify the maximum slope present under the classified vegetation (hazard). Slope data has been calculated from LiDAR Digital Elevation Model (DEM) (Figure 6).

The site is generally flat with slopes < 5 degrees which will have minimal impact of fire behaviour during bushfire events and prescribed burning operations.

### 3.2. Life, Property & Economic Risk

The offset area is contained within a boundary fence intended to exclude cattle (Figure 2). Several maintained internal fences associated with historical grazing land use are present, including gates. Additionally, several tracks and firebreaks traverse the offset area. An area of linear clearing that crosses the offset area contains an underground high pressure gas pipeline. A farm dam is located in the northwest extent of the offset area.

There are no records within the offset area of infrastructure such as buildings, landscaping structures, signage, water or vegetation monitoring points or day-use areas that require protection.

Lake Ross (Ross River Dam) has a capacity of 233,187ML which provides the raw water supply for the City of Townsville. High raw water quality is critical to ensuring portable water is supplied to the community and is identified as a critical community asset covered by Ross River Dam Emergency Action Plan 2023.

Protection of the raw water supply and conservation values within the offset area are the principal values of the site.

### 3.3. Natural Heritage (Flora & Fauna)

This section described the bushfire management prescriptions for known flora, fauna and vegetation communities in and around the site.

The principal objective of the land management programs within the offset area is to achieve beneficial biodiversity and conservation outcomes. Hence supporting and promoting the health and condition of vegetation communities is a fundamental consideration when developing strategic prescribed burning strategies.

It should be noted, the response of the understorey vegetation within woodlands to applied prescribed burning will depend heavily on the nature of individual remnants, season, landscape position, soil type, seed bank, disturbance history and susceptibility to edge effects. Some species, particularly leguminous shrubs and short-lived obligate seeders will be promoted by fire in the short-term. Generally, resprouting species that make up a large proportion of the flora in woodlands will be little affected unless burning is too frequent.

The effects of fire on birds are strongly dependent on the severity of the fire and the structural components of the vegetation that is burnt. The recovery of populations is linked to the recovery of the vegetation. Some seed-eaters may be advantaged in the long-term if fire promotes new vegetation growth. Other species may be advantaged in the short-term by the availability of post-fire carrion or the reduction in protective cover for prey. However, species that rely on the ground layers for nesting or foraging may be disadvantaged in the short-term by low-intensity fire, particularly if it interferes with breeding.

The effects of fire on mammals are also linked to the effects and recovery of the vegetation and the intensity of the burn. Some common herbivores take advantage of the flush of new plant growth, but small animals dependent on the ground layer will be disadvantaged in the short-term. Arboreal mammals are likely to be disadvantaged only if the fire is of high intensity. In general, it is believed that small

mammal populations will not be disadvantaged, provided the minimum inter-fire period is at least 15-20 years. However, in isolated private remnants, recolonisation by small mammals after fire may be difficult. Many reptiles and frogs are likely to be disadvantaged in the short-term by any burning due to their dependence on the litter and ground layers. Spring burning will affect the breeding of many reptile species, while autumn burning may affect the breeding of some frog species. In remnants, isolation is likely to be a barrier to recolonisation after fire.

### 3.3.1. Threatened Fauna

Table 4 presents the threatened fauna species identified by the desktop assessment as being potentially present in the offset area. A likelihood of occurrence assessment was conducted for the offset area which found that 10 species may occur, or are likely to occur, and four are known to occur.

The southern black-throated finch occurs in grassy open woodlands dominated by Eucalyptus, Corymbia and Melaleuca, near water and where seeding grasses occur (Black-throated finch Recovery Team 2007). In the wet season, southern black-throated finches require a mosaic of different habitats for foraging. Within suitable habitats, the southern black-throated finch requires access to three key resources:

- Water sources.
- Grass seeds, and
- Trees providing suitable nesting habitat (DEWHA 2009).

Table 4: Threatened Fauna Species Returned by PMST Search & Their Likelihood of Occurrence in the Offset Area

Scientific Name	Common Name	NC Act Status	EPBC Act Status	Likelihood of Occurrence
<i>Calidris acuminata</i>	sharp-tailed sandpiper		Vulnerable	Likely
<i>Calidris ferruginea</i>	curlew sandpiper	Critically Endangered	Critically Endangered	Likely
<i>Charadrius leschenaultii</i>	greater sand plover	Vulnerable	Vulnerable	Unlikely
<i>Erythrotriorchis radiatus</i>	red goshawk	Endangered	Endangered	Unlikely
<i>Falco hypoleucos</i>	grey falcon	Vulnerable	Vulnerable	Unlikely
<i>Gallinago hardwickii</i>	Latham's snipe		Vulnerable	Likely
<i>Geophaps scripta</i> subsp. <i>scripta</i>	squatter pigeon (southern)	Vulnerable	Vulnerable	Known
<i>Hirundapus caudacutus</i>	white-throated needletail	Vulnerable	Vulnerable	Known
<i>Limosa lapponica</i> subsp. <i>baueri</i>	Alaskan bar-tailed godwit	Endangered	Vulnerable	Possible
<i>Neochmia ruficauda</i> subsp. <i>ruficauda</i>	star finch (eastern)	Endangered	Endangered	Unlikely
<i>Numenius madagascariensis</i>	eastern curlew	Endangered	Critically Endangered	Likely
<i>Poephila cincta</i> subsp. <i>cincta</i>	southern black-throated finch	Endangered	Endangered	Known
<i>Rostratula australis</i>	Australian painted snipe	Endangered	Endangered	Likely
<i>Tringa nebularia</i>	common greenshank		Endangered	Likely
<i>Tyto novaehollandiae</i> subsp. <i>kimberli</i>	masked owl (northern)	Vulnerable	Vulnerable	Unlikely
<i>Dasyurus hallucatus</i>	northern quoll		Endangered	Unlikely
<i>Macroderma gigas</i>	ghost bat	Endangered	Vulnerable	Possible
<i>Petauroides minor</i>	greater glider (northern)	Vulnerable	Vulnerable	Unlikely
<i>Petauroides volans</i>	greater glider (southern and central)	Endangered	Endangered	Unlikely

Scientific Name	Common Name	NC Act Status	EPBC Act Status	Likelihood of Occurrence
<i>Phascolarctos cinereus</i>	koala	Endangered	Endangered	Likely
<i>Saccolaimus saccolaimus</i> subsp. <i>nudicluniatus</i>	bare-rumped sheath-tail bat	Endangered	Vulnerable	Known
<i>Egernia rugosa</i>	yakka skink	Vulnerable	Vulnerable	Possible
<i>Varanus mertensi</i>	Mertens' Water Monitor	Endangered	Endangered	Unlikely

### 3.3.2. Threatened Flora

Table 5 presents the threatened flora species identified by the desktop assessment as being potentially present in the offset area. A likelihood of occurrence assessment was conducted for the offset area which found that all these species are unlikely to occur.

*Table 5: Threatened Flora Species Returned by PMST Search & Their Likelihood of Occurrence in the Offset Area*

Scientific Name	Common Name	NC Act Status	EPBC Act Status	Likelihood of Occurrence
<i>Backhousia tetraptera</i>	-	Critically Endangered	-	Unlikely
<i>Commersonia reticulata</i>	-	Vulnerable	-	Unlikely
<i>Croton magneticus</i>	-	Vulnerable	-	Unlikely
<i>Dichanthium setosum</i>	bluegrass	-	Vulnerable	Unlikely
<i>Dubouzetia saxatilis</i>	Cliff quandong	Vulnerable	-	Unlikely
<i>Eucalyptus paedoglauca</i>	Mt Stuart ironbox	Vulnerable	Vulnerable	Unlikely
<i>Eucalyptus raveretiana</i>	Black ironbox	-	Vulnerable	Unlikely
<i>Graptophyllum excelsum</i>	scarlet fuschia, prickly fuschia	Near Threatened	-	Unlikely
<i>Leichhardtia araujacea</i>	-	Critically Endangered	Critically Endangered	Unlikely
<i>Leichhardtia brevifolia</i> listed as <i>Marsdenia brevifolia</i>	-	Vulnerable	Vulnerable	Unlikely
<i>Sannantha papillosa</i>	-	Vulnerable	-	Unlikely
<i>Scleromitron polycladum</i>	-	Near Threatened	-	Unlikely
<i>Tephrosia leveillei</i>	-	-	Vulnerable	Unlikely

### 3.3.3. Vegetation Communities

Three vegetation communities were confirmed within the offset area (GHD 2023) (Figure 7). The vegetation communities identified were converted into Regional Ecosystems (RE) and then into the Vegetation Hazard Class (VHC). The offset area is comprised predominantly of remnant (268 ha) and regrowth (112 ha) woodland vegetation belonging to the regional ecosystems 11.3.12, 11.3.25b and 11.3.35. The remainder are non-remnant areas that were historically cleared for grazing.

Table 6 provides a description of each RE and provides a breakdown of the total land area of remnant, regrowth and non-remnant portions of each RE.



Table 6: Field-verified Regional Ecosystems Within the Offset Area. Descriptions Retrieved from Queensland Herbarium's Regional Ecosystem Description Database (2024a).

Regional Ecosystem	VM Status	Description	Remnant (ha)	Regrowth (ha)	Non-remnant (ha)
11.3.12	Least concern	<p><i>Melaleuca viridiflora</i> woodland to open woodland, occasionally with <i>M. argentea</i> and <i>M. dealbata</i>. Occasional midstratum of <i>Grevillea pteridifolia</i> and <i>Acacia leptocarpa</i>. Ground layer of perennial grasses such as <i>Themeda triandra</i>, <i>Elionurus citreus</i>, <i>Ectrosia leporina</i>, <i>Eriachne rara</i>, <i>Eremochloa bimaculata</i>, <i>Thaumastochloa pubescens</i>, <i>Eragrostis brownii</i> and <i>Ischaemum australe</i>. Occurs on alluvial plains on strongly duplex clay soils with restricted drainage. Contains Palustrine. (BVG1M: 21a).</p> <p>Vegetation communities in this regional ecosystem include:</p> <p>11.3.12a: <i>Melaleuca leucadendra</i> and <i>Livistona decora</i> open forest, with occasional <i>Corymbia tessellaris</i> and <i>Nauclea orientalis</i>. The secondary tree or shrub layer is dense, including <i>Atractocarpus fitzalanii</i>, <i>Chionanthus ramiflorus</i>, <i>Carallia brachiata</i>, <i>Macaranga tanarius</i>, <i>Ficus copiosa</i> and <i>Hibiscus tiliaceus</i>. The ground layer is sparse to moderately dense. <i>Scleria polycarpa</i> forms pure stands in swampy parts. Other common species are <i>Ludwigia octovalvis</i>, <i>Crinum pedunculatum</i>, <i>Eclipta prostrata</i> and <i>Basilicum polystachyon</i>. Several vine species are present, such as <i>Entada phaseoloides</i>, and <i>Luffa aegyptiaca</i>. Occurs in depressions on coastal floodplains. Palustrine. (BVG1M: 22c) .</p>	54.08	0	19.62
11.3.25b	Least concern	<p><i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland to open forest. Other tree species, including <i>Casuarina cunninghamiana</i>, <i>E. coolabah</i>, <i>Melaleuca bracteata</i>, <i>Melaleuca viminalis</i>, <i>Livistona</i> spp. (in north), <i>Melaleuca</i> spp. and <i>Angophora floribunda</i>, may occur. An tall shrub layer may occur, including <i>Acacia salicina</i>, <i>A. stenophylla</i> and <i>Lysiphyllum carronii</i>. Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth (Burgess 2003). Riverine. (BVG1M: 16a).</p> <p>Vegetation communities in this regional ecosystem include:</p> <p>11.3.25b: <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i>, <i>Nauclea orientalis</i> open forest. A range of other canopy or sub-canopy tree species also occur including <i>Pandanus tectorius</i>, <i>Livistona</i> spp., <i>Eucalyptus tereticornis</i>, <i>Corymbia tessellaris</i>, <i>Millettia pinnata</i>, <i>Casuarina cunninghamiana</i>, <i>Livistona decora</i>, <i>Lophostemon suaveolens</i> or <i>L. grandiflorus</i>, rainforest species and, along drainage lines, <i>Eucalyptus camaldulensis</i> or <i>E. tereticornis</i>. A ground layer of tall grasses such as <i>Chionachne</i></p>	28.77	0	20.82

Regional Ecosystem	VM Status	Description	Remnant (ha)	Regrowth (ha)	Non-remnant (ha)
		<i>cyathopoda</i> , <i>Mnesithea rottboellioides</i> or <i>Heteropogon triticeus</i> may be present. Often occurs on coarse sand spits and levees within larger river channels. Riverine. (BVG1M: 22c).			
11.3.35	Least concern	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland, occasionally with <i>Corymbia tessellaris</i> . A secondary tree layer commonly occurs, including <i>Planchonia careya</i> , <i>Pandanus spiralis</i> , <i>Melaleuca viridiflora</i> or <i>M. nervosa</i> and <i>Petalostigma pubescens</i> . The ground layer is usually tussock grasses, including <i>Themeda triandra</i> , <i>Heteropogon contortus</i> , <i>Mnesithea rottboellioides</i> and <i>Bothriochloa decipiens</i> , together with herbs or forbs such as <i>Glycine tabacina</i> , <i>Galactia tenuiflora</i> or <i>Sida hackettiana</i> . Occurs on Cainozoic alluvial plains. Older floodplain complexes, major stream levees and lighter deltaic deposits. Not a Wetland. (BVG1M: 9e).  Vegetation communities in this regional ecosystem include:  11.3.35a: <i>Corymbia tessellaris</i> , <i>C. clarksoniana</i> and <i>Eucalyptus platyphylla</i> woodland. Occurs on Cainozoic alluvial plains. Older floodplain complexes, major stream levees and lighter deltaic deposits. Not a Wetland. (BVG1M: 9e).	184.78	111.97	207.18
Non-remnant/ Pipeline	-	Non-remnant - maintained as a slashed grassland	0	0	12.17

### 3.3.4. Vegetation Response to Fire

Fire is a natural phenomenon in the Australian landscape and plays a critical role in the structure and function of vegetation communities. The response of native vegetation to fire is dependent on a number of variables including the composition of vegetation communities present, the timing of the fire (i.e. the moisture availability within soil and vegetative material) the intensity and duration of the fire. The intensity and duration of the fire is dictated by the amount and types of fuel loads, soil and vegetative moisture, temperature, winds and terrain.

Inappropriate or altered fire regimes have the potential to change the ecological community present, allow invasive weed species to proliferate and impact on habitat availability for fauna. Inappropriate or altered fire regimes differ from what would normally occur in a natural and anthropogenically unimpacted vegetation community without intervention and can occur as a result of:

- Deliberate starting of fires outside of the normal fire season.
- Higher than normal fuel loads due to a lack of fires in preceding years.
- Higher than normal fuel loads due to the presence of highly productive weed species, and
- Higher than average rainfalls resulting in high fuel loads coupled with a hot late dry season fire.

The Queensland Herbarium has provided fire management guidelines for each regional ecosystem described in Queensland (Queensland Herbarium, 2024b). The guidelines have been developed to promote the ecological community present within each RE to maintain and enhance biodiversity. These guidelines are to be considered in conjunction with site attributes such as existing fuel loads, weather, landforms, infrastructure and other relevant land management considerations. Guidelines for each of the REs present within the offset area are provided in Table 7.

Table 7: Regional Ecosystem Fire Management Guidelines

Regional Ecosystem	Fire Management Guidelines
11.3.12	<p>SEASON: Mid-dry season.</p> <p>INTENSITY: Low to moderate.</p> <p>INTERVAL: Occasional fires, typically every 5 - 10 years.</p> <p>STRATEGY: Use occasional burning to promote herbs and shrubs and reduce excessive fuel build up that can cause high intensity fires.</p> <p>ISSUES: The coastal north Queensland populations of <i>Grevillea pteridifolia</i> are fire-killed obligate seeders with fire promoted germination. Many herbs are promoted by fire, such as ground orchids. Conversely, terrestrial orchids can be killed by fires that are intense enough to scorch them in the canopy and therefore they provide a useful indicator of past fire intensities. Ensure maintenance of a diverse ground and shrub layer. Where <i>Grevillea pteridifolia</i> or other fire-killed shrubs are present, wait until subsequent post-fire seedlings have matured before burning again.</p>
11.3.25b	<p>SEASON: Primarily early dry season.</p> <p>INTENSITY: Low.</p> <p>INTERVAL: 3 - 5 years.</p> <p>STRATEGY: Protection relies on broad-scale management of surrounding country with numerous small fires throughout the year so that bushfires will be very limited in extent. Communities c-g: Depending on position in the landscape, protection depends on broad-scale management of surrounding country, with numerous small fires throughout the year so that bushfires will be very limited in extent.</p> <p>ISSUES: Fringing communities are critical habitat. In some situations it may be best not to burn. Intense and extensive fires degrade vegetation structure and destroy fauna habitats. Restrict the extent and intensity of fires. Hollow trees are critical habitat. Green panic may be an issue and an intensive grazing regime for very short periods, may be necessary to limit potential of bushfire. Communities c-g: If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants. Sedges are disadvantaged by repeated fires. Impact of fire on rare and threatened plants associated with mound springs that include <i>Arthraxon hispidus</i> and <i>Dimeria sp.</i> (Salvator Rosa R.J.Fensham RJF3643) should be considered. Boggomosses/springs can bounce back following fire but care should be taken where a dry peat layer has developed (particularly in degraded situations). Fire is an option for control of weeds (possibly in ungrazed situations). If riparian areas need to be burnt to reduce fuel loads then burning should occur when there is good soil moisture and active growth.</p>
11.3.35	<p>SEASON: Early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains.</p> <p>INTENSITY: Primarily low to moderate, with occasional high intensity fires.</p> <p>INTERVAL: Typically 2 - 7 years, with some areas longer unburnt.</p> <p>STRATEGY: A predominance of early dry season fires is recommended, although there is value in occasional late dry season fires, or storm burns, over small areas. Burning should begin very soon after the wet season, to secure boundaries and adjacent fire-sensitive vegetation. Subsequent repeat ignitions can be used within the same section of land weeks or months after the boundaries have been secured by early burning, to produce a mixture of burnt areas with multiple ignition dates. Use topographical features to ignite areas as soon as they dry out. This will create a mosaic of areas that were burnt at different dates and unburnt sections within the same area of woodland. Burn away from riparian communities, which can be critical habitat for some species. Approximately 25% of the grassy woodlands within a landscape should receive patchy fires in most years.</p>

Regional Ecosystem	Fire Management Guidelines
	<p>ISSUES: These woodlands have a diverse native grass and herb layer that is maintained and promoted by regular fire. Burning that starts immediately after the wet season, with follow up small fires ignited progressively over multiple dates can increase the availability of grass and herb seed, which is a critical food source for many birds and small mammals. Recently burnt grass clumps tend to produce more seed than unburnt clumps and the earlier burnt grass usually seeds earlier than later burnt grass. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against bushfires. Low to moderate intensity burns with good soil moisture minimise the risk of losing hollow trees. An occasional late season burn will promote grasses and legumes. Ensure a diverse grass layer; maintain hollow-bearing trees and vegetation structure.</p>

### 3.3.5. Weed Species Considerations

Weed species may respond differently to fire than native vegetation. Some species, such as rubber vine may be controlled by fire in conjunction with other management approaches, whilst other species such as grader grass are known to proliferate following disturbance and fire and may quickly spread into surrounding areas. The response of all species to fire within a planned burn area should be considered prior to burning to ensure that negative land management and biodiversity outcomes are avoided. Furthermore, the allocation of adequate resources for follow-up monitoring and management are required for the early identification and treatment of negative outcomes associated with planned burns. Table 8 provides an outline of the response of priority weeds to fire, the required follow up monitoring, and management requirements.

Table 8: Priority Weeds, Their Response to Fire, & Required Follow-up Monitoring & Management

Weed Species	Response To Fire	Monitoring & Management Actions
Woody Weeds		
chinee apple ( <i>Ziziphus mauritiana</i> )	Fire alone is not a recommended tool for controlling chinee apple. While fire may cause initial damage to a plant, established plants appear to respond with regrowth rapidly post fire (Department of Agriculture and Fisheries, 2023a), although smaller plants may be killed by fire. Although seeds have a woody endocarp, seed mortality is high after intense fires. No information is available for fires of lower intensity (Grice, 1998).	Fire may be used in conjunction with other weed management measures such as manual or chemical control. Treatment of chinee apple pre-fire may make individuals more susceptible to fire resulting in higher mortality rates. Post-fire, chemical application using drill and fill methods may be effective. Mechanical control post fire is not recommended due to the lack of ground cover and the risk of disturbance and erosion from machinery.
lantana ( <i>Lantana camara</i> )	<p>Fires are known to reduce survival, germination rate and the seed bank and may be useful in conjunction with additional control measures (Department of Agriculture and Fisheries, 2023b).</p> <p>Mechanical control prior to burning may be beneficial as soil disturbance may promote germination of the seed bank with seedlings then being more prone to fire.</p> <p>Regular burning (12-18 month intervals) may control lantana populations. however these burn intervals do not align with the objectives of the OAMP.</p>	<p>Follow up chemical control of lantana in the warmer months will assist with further control of lantana.</p> <p>Where outbreaks of lantana can be isolated from the surrounding vegetation using firebreaks or slashing, back burning into these isolated populations at more regular intervals (12-18 monthly) may be useful in reducing the lantana infestations.</p>
rubber vine ( <i>Cryptostegia grandiflora</i> )	Fire is an effective tool for managing rubber vine and younger growth and the seed bank are highly susceptible to fire. For best results fires are best implemented over consecutive years (Department of Agriculture and Fisheries, 2024), though this does not align with the objectives of the OAMP. It may be	As rubber vine is highly productive, follow up spray of rubber vine in growing seasons between fires will further reduce populations and subsequent scheduled fires may be sufficient to control rubber vine long term. Consideration should also be given to the presence of ripe pods (occurring from spring to

Weed Species	Response To Fire	Monitoring & Management Actions
	possible to implement targeted burns where areas of rubber vine can be isolated from the surrounding vegetation.	late autumn) due to the potential for the wind dispersed seeds to be carried by updraft from the fire, though there is little documentation available on this topic. Monitoring up wind of rubber vine infestations after the fire will assist in identifying dispersal.  Where outbreaks of rubber vine can be isolated from the surrounding vegetation using firebreaks or slashing, back burning into these isolated populations at more regular intervals (12-18 monthly) may be useful in reducing the infestations.
Grasses & Shrubby Weeds		
hymenachne ( <i>Hymenachne amplexicaulis</i> )	When integrated with mechanical/physical removal the use of fire can improve overall results and reduce cost.	Dry season fire in conjunction with mechanical/removal is recommended for the control of hymenachne.
grader grass ( <i>Themeda quadrivalvis</i> )	Grader grass infestations significantly increase fuel loads and proliferate quickly following fire, the seeds germinate earlier, and the species grows faster than most native grasses (Bethel, 2021).  Fire, slashing and other disturbance significantly promotes the presence of grader grass and fire frequency tended to be positively correlated with grader grass dominance (Sillar, 1969; W. Vogler, 2017).  In grazing lands pasture resting is effective at reducing populations of grader grass (Bethel, 2021; Keir & Vogler, 2006), one study showing areas left undisturbed for 20 months prior to burning had reduced post-fire densities of grader grass (W. Vogler, 2017).  Burning or slashing followed by chemical control significantly reduced the presence of grader grass, as did preflowering or full flowering cut to reduce the potential seed bank (W. Vogler, 2017).	We recommend that all patches of grader grass within the offset area are mapped, and post fire chemical control undertaken when green-pick first appears.  As studies indicate that resting reduces grader grass populations, burns aligned with environmental burn intervals of 5 years or more have a lower risk of grader grass domination. A follow up program of monitoring and chemical control of regrowth and removal of seed heads pre-maturity (mid-late wet season while still green) in following seasons will assist in reducing the presence of grader grass in the offset area.
siam weed ( <i>Chromolaena odorata</i> )	Siam weed infestations greatly increase fuel loads and can result in intense dry season fires (Department of Agriculture and Fisheries, 2020), though it is reported to have poor survival rates in response to hotter fires (Keir & Vogler, 2006). It is generally reported to have reasonable survival rates in response to a mild fire however, resprouting vigorously soon after (Williams et al., 2004). Williams et.al conclude in their 2003 study of the affects of fire on siam weed in the Wet Tropics (near Tully, Queensland) that fire can result in the mortality of the weed especially smaller plants. It was noted that a benefit of the application of fire is that it opens the vegetation for access and application of a chemical control.	Fire alone is unlikely to control populations of siam weed and infested areas should be monitored, and chemical control applied to regrowth after fire where possible.  Consideration should also be given to the presence of ripe seed heads (occurring from July-August and again in October- November) due to the potential for the wind dispersed seeds to be carried by updraft from the fire, though there is little documentation available on this topic. Monitoring up wind of siam weed infestations after the fire will assist in identifying dispersal.
rats tail grasses ( <i>Sporobolus spp.</i> )	Fire is a useful tool in the eradication of giant rats tail grass ( <i>S. pyramidalis</i> ) (W. D. Vogler et al., 1998). Due to the similarity in seed size of other weedy <i>Sporobolus</i> species it may be likely that they respond similarly to fire.	Monitor occurrences to determine localised response to fire.

Weed Species	Response To Fire	Monitoring & Management Actions
thatch grass ( <i>Hyparrhenia rufa</i> )	Thatch grass has not yet been identified as a priority weed in the Townsville region, likely due to its relative palatability. Where herbivory is removed as a control thatch grass can become dominant and, as a technical report on the grass from the Northern Territory discusses there is a risk of population increase and dominance in response to fire as competition for resources is removed (Northern Territory Government, 2013).	Monitor occurrences and treat similarly to grader grass where present.

## 3.4. Heritage

### 3.4.1. Aboriginal Cultural Heritage

There are no culturally significant sites in the offset area that are listed on the Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships Cultural Heritage Database and Register.

The offset area is within the boundary of the Bindal People #2 Cultural Heritage Party and the Gudjuda Reference Group Aboriginal Corporation Cultural Heritage Body (Table 9).

*Table 9: Cultural Heritage Party & Body in the Offset Area*

Reference Number	Federal Court Number	Name	Contact Details
QC2016/005	QUD503/2016	Bindal People #2	Bindal People #2 Just Us Lawyers PO Box 120 RED HILL, QLD 4059 Phone: (07) 3315 2727 Email: ted.besley@justuslaw.com
Departmental Reference No.	Name	Registration Date	Contact Details
CHB020009	Gudjuda Reference Group Aboriginal Corporation	05/07/2021	Gudjuda Reference Group Aboriginal Corporation PO Box 255 AYR, QLD 4807 Phone: (07) 4782 8451 Email: info@gudjuda.com.au

### 3.4.2. European Cultural Heritage

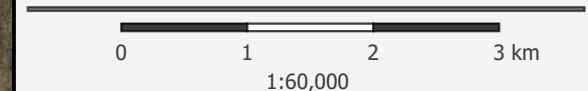
There are no places of national, state or local heritage significance within or nearby the offset area.





# Terra SOLUTIONS

FIGURE 3: LAKE ROSS STORAGE AREA FIRE HISTORY

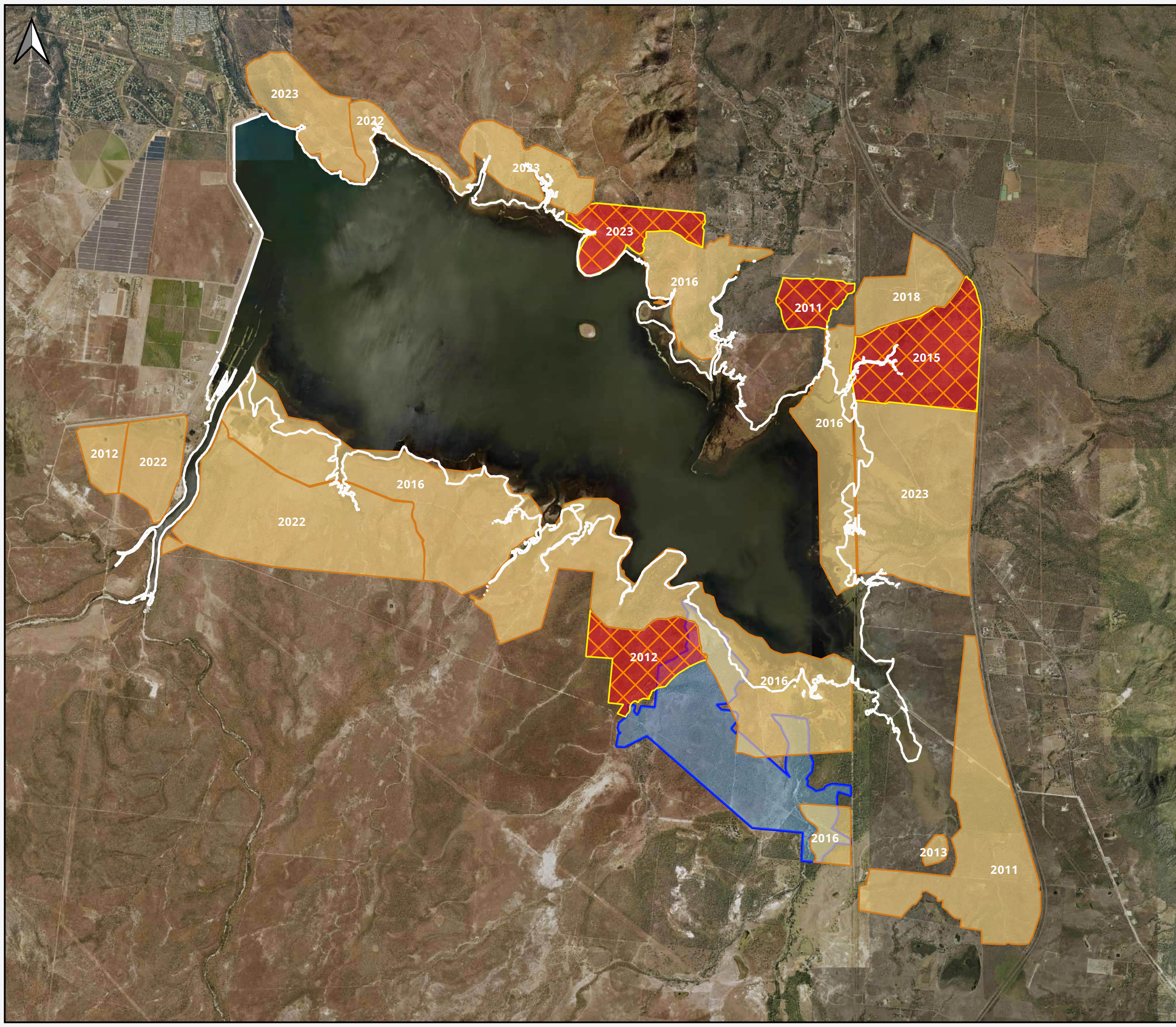


- LEGEND:
- Haughton Pipeline Stage 2 Offset Area
  - Ross River Dam Fire History**
    - Bushfire
    - Planned/controlled burn



PAGE SIZE: A3  
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DATE: 24/09/2024  
AUTHOR: K PARISON  
COORDINATE SYSTEM: GDA2020 / MGA zone 55

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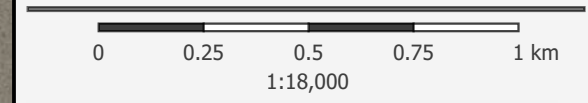




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FIGURE 4: BUSHFIRE PRONE AREAS

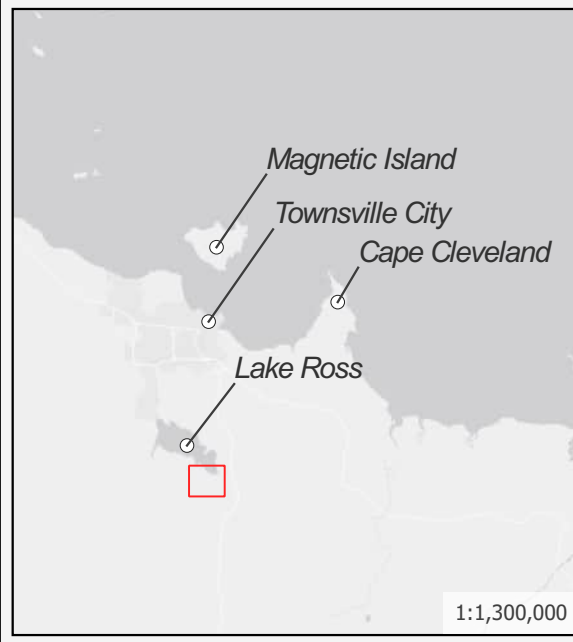


LEGEND:

Haughton Pipeline Stage 2 Offset Area

Bushfire Prone Areas

- High Potential Bushfire Intensity
- Medium Potential Bushfire Intensity
- Potential Impact Buffer



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DATE: 12/07/2024  
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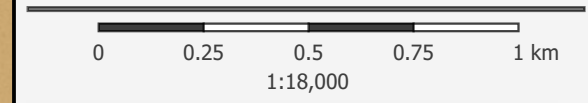





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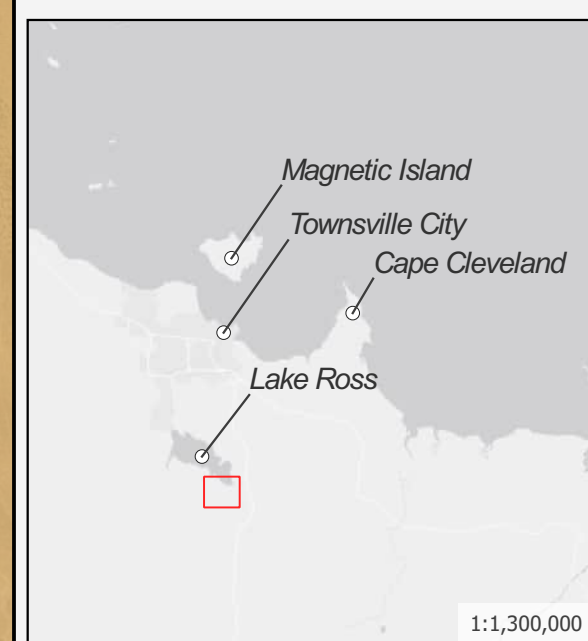
SOLUTIONS

FIGURE 5: FIRE WEATHER SEVERITY



LEGEND:

-  Houghton Pipeline Stage 2 Offset Area



1:20 Year FFDI = 57

1:20 Year FFDI = 58

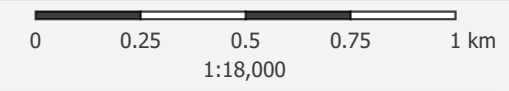





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FIGURE 6: SLOPE ANALYSIS









LEGEND:

 Haughton Pipeline Stage 2 Offset Area

DEM Slope Analysis  
(Degrees)

(1 m Resolution)

-   $\leq 5.0000$
-  5.0000 - 10.0000
-  10.0000 - 15.0000
-  15.0000 - 20.0000
-  20.0000 - 25.0000
-   $> 25.0000$

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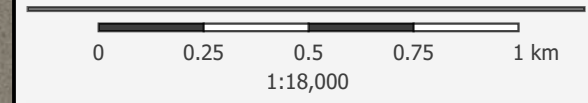




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FIGURE 7: FIELD-VERIFIED  
VEGETATION COMMUNITIES



LEGEND:

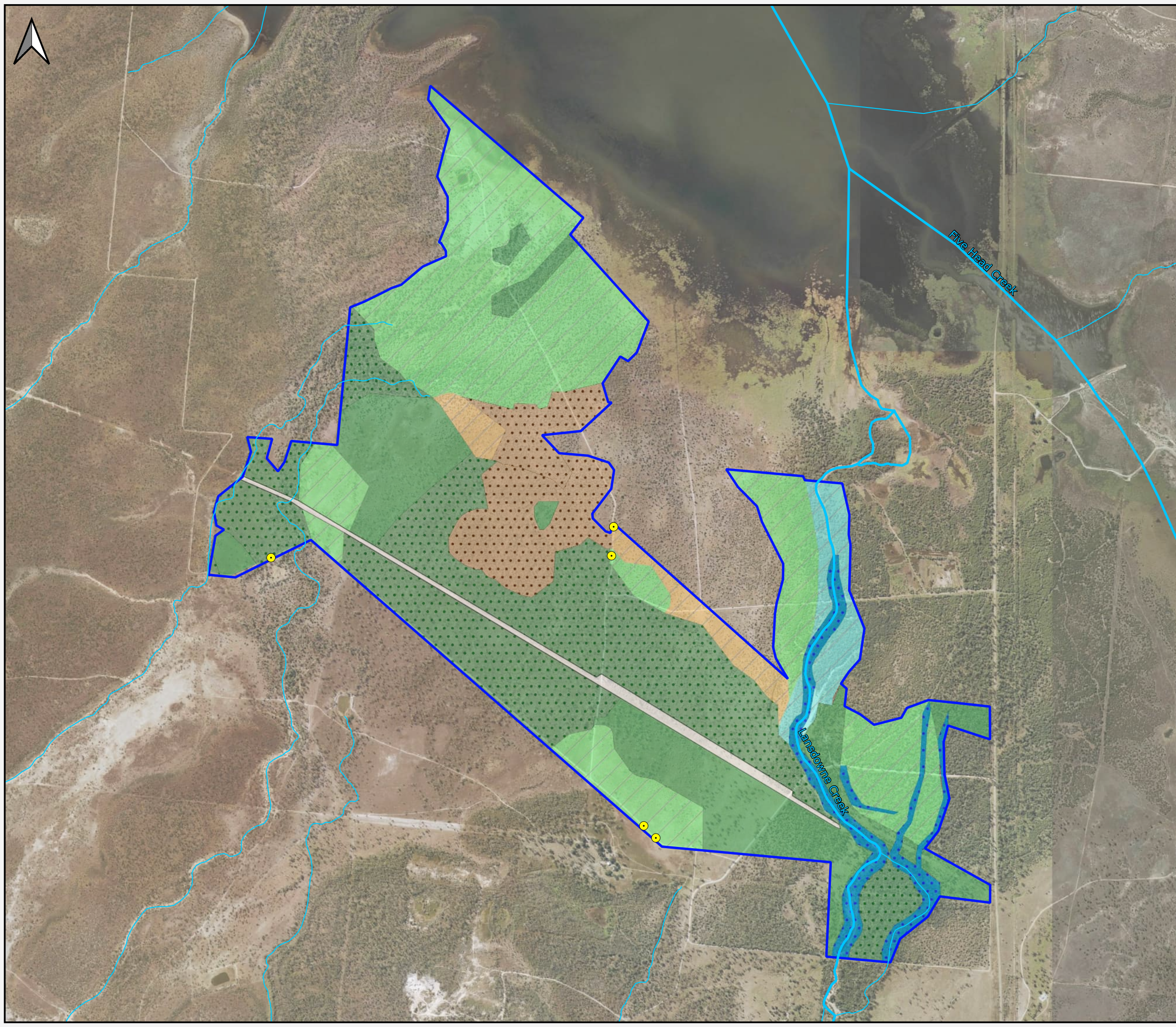
- Vegetation Management Watercourses
- Post-2013 BTF records
- ▭ Houghton Pipeline Stage 2 Offset Area

Field-verified Vegetation Communities

- 11.3.12
  - Non-rem
  - Remnant
- 11.3.25b
  - Non-rem
  - Remnant
- 11.3.35
  - Non-rem
  - Regrowth
  - Remnant
- Non-remnant (underground pipeline)

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CLIENT: Townsville City Council  
DATE: 18/07/2024  
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COORDINATE SYSTEM: GDA2020 / MGA zone 55

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## 4. Prescribed Burning

### 4.1. Purpose

The purpose of prescribed burns is to achieve the objective of the OAMP (TCC, 2023) and align with the objective of the LRSAMP Action 5- Fire Management (Table 3). The OAMP's preliminary focus for fire management within the Offset Area is to mitigate threats to habitat associated with uncontrolled wildfires and maintain and improve habitat for the three targeted protected matters.

While the objectives of the LRSAMP and the OAMP differ, the overall strategies align with Planned Burn Guidelines for the Brigalow Belt Bioregion (QPWS, 2013) and contain a fire management approach that provides for both land management and biodiversity outcomes for black-throated finch, bare-rumped sheath-tail bat and koala.

### 4.2. Benefit Analysis of Prescribed Burning

A risk assessment provided in the OAMP identified several relevant potential hazards associated with the delivery of the offset area as habitat for the bare-rumped sheath-tail bat and black-throated finch. Risks include:

- Catastrophic/uncontrolled fire resulting in impacts to habitat within the offset area.
- Degradation of forage habitat by shrubby weed infestation due to a lack of active weed management within the offset area (chinee apple and lantana), and
- Failure of weed control/rehabilitation due to hydrological or other chronic events.

The LRSAMP (TCC, 2023) identified the following risks associated with burning:

- Reduction in grass and groundcover immediately prior to first storm event exposing soil profile to erosion and risking and increase in sediment, nutrients and pathogens entering the Lake.
- Reduction in floristic and/or structural diversity.
- Addition of nutrient-rich ash into the water body.
- Loss of fauna, and
- Damage to infrastructure.

Risks and benefits associated with planned burning and not burning are detailed in Table 10.

*Table 10: Risks & Benefits Associated with Planned Burning & Not Burning*

Risks Associated with <u>Planned Burning</u>	Benefits of <u>Planned Burning</u>
<ul style="list-style-type: none"><li>• Loss of control and damage to additional vegetation and infrastructure.</li><li>• Increased presence of grader grass and other potentially responsive weeds (thatch grass) resulting in increased requirement for monitoring and control, and</li><li>• Loss of habitat (short-term).</li></ul>	<ul style="list-style-type: none"><li>• Reduction in fuel loads.</li><li>• Reduce thickened vegetation due to overabundant saplings, particularly in Melaleuca communities.</li><li>• Reduce weeds (lantana, rubber vine, giant rats tail grass).</li><li>• Reduction in weed cover (chinee apple, siam weed) increasing access for management and resources for native vegetation.</li><li>• Promote the germination of fire promoted germination species such as acacias and some grasses, and</li><li>• Create a mosaic of vegetation of various ages and available bare ground, particularly when implemented immediately after the wet season with follow up mosaic spot fires.</li></ul>
Risks Associated with <u>Not Burning</u>	Benefits of <u>Not Burning</u>
<ul style="list-style-type: none"><li>• Changes in vegetation structure and composition and increased fuel loads.</li><li>• Altered/inappropriate fire regimes resulting in more intense fires or larger areas of fires, also resulting in a non-compliance with respect to the delivery of the offset area, and</li><li>• Loss of habitat values due to competition and altered fire regimes.</li></ul>	<ul style="list-style-type: none"><li>• Limit risk of expansion of grader grass due to fire, and</li><li>• Reduce risk of damage to additional vegetation and loss of infrastructure.</li></ul>



### 4.3. Offset Bushfire Management Zones

There are no built assets that warrant the provision of Asset Protection Zones.

There are no high value natural or cultural areas that warrants the provision of Fire Exclusion Zones.

There are no high arson issues that warrants the provision of Ignition Management Zones.

There are no near-by vulnerable developments that warrants the provision of Strategic Fire Management Zones.

The offset area provides three operational Land Management Zones, illustrated in Figure 10:

- LMZ M - 105 ha within the offset area.
- LMZ S - 222 ha within the offset area, and
- LMZ N - 283 ha within the offset area.

### 4.4. Prescribed Burning in LMZ

A prescribed burn 'prescription' means several conditions must be met. Safe and effective prescribed burns need the right combination of fuel load; fuel moisture; temperature; relative humidity; and wind direction and speed, which along with the slope, determine the intensity and speed at which a site will burn.

National Council for Fire and Emergency Services (AFAC) Centre of Excellence Prescribed burning -The Objectives, Monitoring and Evaluation Framework for Prescribed Burning identifies the four phases of planning and implementing prescribed burning:

- Strategic planning.
- Program planning.
- Operational planning, and
- Burn implementation.

#### 4.4.1. Prescribed Burn Planning

Operational requirements of each prescribed burn, which include Situation, Mission Execution, Administration, Communication, Safety (SMEACS) are specific with a 'Prescribed Burn Plan' which is developed for each burn. Any prescribed burn plan shall be written by a competent fire practitioner that holds the national competency of PUAFIR506 - Conduct complex prescribed burns or equivalent and ideally is recognised through AFAC Emergency Management Professionalisation Scheme for prescribed burning planning.

The burn plan shall have the principal intent of ecological burning and illustrate the preferred season (timing and ignition sequence and strategies to obtain the desired fire intensity for ecological outcomes for the dominant vegetation type within the burn patch).

At a minimum the prescribed burn plan outlines the prescriptions (fuel and weather), ignition sequence and strategies, containment and fall-back lines, resources, command structure, communications, extinguishing techniques, approximately burn-out timing, medivac, and logistical arrangements.

Bushfire information provided through the regional ecosystem (RE) descriptions indicate the bushfire season is limited to early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains. The intensity of these fire can vary and generally have 5 to 15-year intervals.

Hazard reduction burning is recommended early in the winter season, although there is value in occasional late dry season fires, or storm burns, over small areas. Where a slope is present ignite initial fires so that they burn downslope. Multiple dates of ignition within the same forest area will produce a mosaic of burnt landscape.

Too frequent fires may eliminate fire-killed shrubs and small trees. Once boundaries are secured with early fires, late dry season and storm-burning may provide the intensity required to enhance seed germination of many species but restrict spread and allow the creation and maintenance of a multi-aged mosaic. Ensure moderate densities of mature wattles are maintained; ensure the persistence of large eucalypts.

## Ecological Burning

Fire as a regenerative tool for ecological sustainability. Prescribed burning schedules shall consider proposed regeneration areas. The application of fire to the landscape can significantly impact regenerating trees.

The challenge for land managers is to understand and apply the right kind of fire with the right techniques at the right times and places to provide the best possible ecological outcomes, while resolving competing objectives of burning and other constraints. This risk management framework for ecological risks associated with prescribed burning provides a way to consider the steps and processes that all land managers can take when seeking the best ecological outcomes.

The principal objective of burns within the LMZ of the offset area are aimed at promoting beneficial ecological outcomes, with a secondary intent to reduce hazard, therefore providing protection to adjacent vegetation the impacts of high intensity bushfires.

Burns with the ecological outcomes as the principal objective will have different ignition sequences and strategies, to promote mosaic burn patterns, various intensities and burn scarring, and are incorporated and consistent with other land management programs such as asset maintenance (trails), weed, and pest management programs.

The principal management objective of the offset is the protection of the natural environment and protect the raw water quality. The occurrence and long-term viability of an ecological community is the result of a multitude of environmental factors and a complex array of species and climatic interactions.

Fire management principles shall be adapted for landscapes that have been identified or have a high likelihood to support black-throated finch.

It is likely that prior to European settlement, periodic burning by bushfires and Indigenous people played an important role in the development and maintenance of grassy ecosystems. On the other hand, too frequent or extensive burning may limit recruitment of some species, cause local extinctions of fire sensitive species, facilitate the spread of weed/exotic species, changing the structure of the vegetation, reduce fauna habitat features (fallen logs, hollow trees, litter) and threaten fauna populations.

Establishing the appropriate fire regime and thresholds is critical to ensure interdependent land management practises are consistent with the over-arching objective of the offset.

Ecological risks and outcomes are considered at the time of implementing a prescribed burn, in accordance with information specified in the operational burn plan. Activities and decisions at the strategic plan level, program plan level and operational plan level will guide management of ecological risks for burn implementation, but there are assessments and decisions to be made on the day of burning that will also contribute to managing ecological risks and outcomes.

The performance measures of this plan have to strongly links to improving black-throated finch habitat in accordance with Houghton Pipeline Stage 2 Offset Area Management Plan.

## Mosaic Burning

Mosaic burning, or otherwise referred to as patch burning, is a concept applied to fire management to describe fire history across a landscape. The extent (size) of the burn patches that form the mosaic pattern are determined by the values of the landscape. As an example, burn patch to support avian species can be larger than ground dwelling animals, as birds are able to easily access the different burn patches in their larger home ranges.

Establishing mosaic burn patterns can be achieved, either within a burn or across the landscape. If within the burn, ignition sequences and strategies rely on overnight temperatures, fuel moistures and discontinuous fuels to mitigate fire spread and extinguishment resulting in unburnt patches within a burn area. This can be achieved through aerial or ground dot ignition in the late afternoon, when fuel and weather conditions suppress overnight fire growth. Alternatively,

The principal ecological value is the black-throated finch and landscape value is the raw water quality of Lake Ross. Limiting burn patches to no greater than 1,500m at the widest point allows the black-throated finch to access a range of adjacent habitat with different fire history within 800m of any point. Applying mosaic burn patterns in landscapes adjacent to the edge of the dam will assist in unburnt vegetation

filtering and limiting soil instability and run-off into the dam following a fire impacting on the raw water quality.

### Burning Period

Burns are scheduled for a period that will generate the preferred intensity rather than by calendar or tradition (i.e. when there is still sufficient soil moisture to facilitate post fire recovery, but fuel is dry enough to carry a burn).

Fires are planned for the early dry season to allow for re-establishment of the ground cover prior to the wet season.

## 4.4.2. Prescribed Burn Actions

### Pre-Burn Actions

Implementation and management of the burns is undertaken by the TCC dam management team in conjunction with Department of Resources staff. Where additional staffing is required, the TCC fire crew are also be engaged to assist.

Burns are planned and coordinated by the Dam Management/Ranger who will manage the below tasks:

The following actions shall be undertaken from approximately 12 months prior to the proposed burn date:

- Commence prescribed burn planning, this will include:
  - Collect and analysis recent survey data collected following this plan.
  - Identify the proposed burn patch in accordance with this Section Error! Reference source not found. of this plan and the minimum fire frequency for known values.
  - Identify excluded assets (if any).
  - Undertake site visit to determine and map preparation works required, such containment line maintenance.
  - Complete DRAFT burn plan as per National Council for Fire and Emergency Services (AFAC) Centre of Excellence Prescribed burning process.
  - Peer review the DRAFT prescribed burn plan and ensure operational requirements are meet, and
  - Complete prescribed burn plan and supportive documentation.

The following actions shall be undertaken from approximately 6 months prior to the proposed burn date:

- Submit burn planning documentation to consent authority to obtain required approvals, and
- Identify other land management programs to integrate with the burn (such as post burn weed spray, feral animal control, natural and cultural surveys).

The following actions shall be undertaken from approximately 3 months prior to the proposed burn date:

- Prescribed burn conduct practitioner to complete site visit and commence monitoring weather and fuel prescriptions.
- Confirm theoretical predictions and intuitive insights with practical field evidence to determine burn window, and
- Containment lines (or Fire breaks where required) are established and maintained using earth moving machinery as required.

The following actions shall be undertaken within 4 days of the proposed burn:

- Confirm burn date and undertake notices to neighbours, stakeholders and RFS.
- Confirm logistical arrangement of fire crew such as accommodation and welfare.
- Establish burn ground operational markings and mechanical containment lines.
- Undertake actions to exclude identified assets from burn, and
- Mobilise resources, up-scaling or down-scaling on well-considered assessments of fire behaviour potential and ongoing residual risk.

## Burn Conduct Actions

It is ultimately the responsibility of the landholder to ensure the prescribed burn conduct practitioner completes the following actions:

- Review safety considerations, operational objectives through SMEAC briefing day of burn.
- Ensure operational markings and containment lines are prepared and ready for burning operations.
- Appropriate measures taken by wildlife carers if burned wildlife is observed/caught.
- Ensure adequate fire appliance, earth moving, and other resources are provided to safely implement to burn.
- Ensure perimeter of burn is secure, such as logs and trees associated with the containment line are extinguished or monitored.
- Following mop up and patrol activities are programmed in for following days from the burn, and
- Monitor fire burn-out, crew demobilisation, mop-up and patrol, and treatment of residual public safety risk.

## Post-Burn Actions

It is ultimately the responsibility of the landholder to ensure the post-burn actions are completed, although may wish to engage fire practitioner to complete the following:

- Complete operational debrief and lessons learnt with client and staff to evaluate burn results against objectives to form part of continuous improvement process.
- Map burn extent and severity.
- Monitoring and reporting of fire management performance indicators in line with Section 10 of this plan, and
- Assess and implement post-burn land management programs such as weed and pest management and/or natural and cultural survey work. Activities that can be considered are:
  - Weed management adjacent and within burn unit to help minimise edge effects and establishment of weed species.
  - Presence of exotic flora or fauna species would be assessed against the integrated weed management plan and integrated pest control plan performance indicators.
  - Feral pest species management strategies adjacent and within burn unit to help minimise impact to flora species (whilst regenerating) and fauna species (whilst susceptible), and
  - Assessment of erosion establishment within the burn unit and apply erosion control measures if required.

The data obtained in the post-burn actions in relation to the implementation of ecological burns to be submitted as part of the annual review/reporting process.

### 4.4.3. Other Management Challenges

The dam catchment area is subject to regular inundation during flooding events and an increase in water retained within the catchment due to the dam's presence. Much of the dam management area becomes inaccessible during the wet season and therefore management interventions within the offset area may be problematic until well into the late wet season.

### 4.4.4. Adaptive Management

The principal focus of strategic burn planning is maintaining functioning and healthy ecosystems. Indicators are established to guide fire practitioners so that they can identify areas that are in healthy conditions, areas where application of fire might be required or areas showing a range of ecological health problems (such as weed invasion, an overabundance of a single species, rapid ecosystem change etc.). These degraded areas may require an altered approach if the management goal is to rehabilitate the system. For each management issue identified, specific fire regime guidance is offered including information on fire frequency, seasonality, intensity etc. which include but are not focused on consideration of fire frequency intervals.

This adaptive approach elevates the role of 'reading country' and attempts to provide fire practitioners the skills they need to judiciously apply fire regimes, nuanced by considerations of the need to adjust these regimes based on the condition of the land as it presents.

## 4.5. Access

Access to the Lake Ross Storage Area is managed by the TCC Water Resources & Dam Safety team and is not accessible to the public. It is essential to ensure that adequate ingress/egress is provided within the offset to facilitate bushfire suppression, prescribed burning and other land management operations. Well-designed and located access that is integrated with the surrounding landscape provides a range of fire advantages, such as:

- Providing easy and safe movement away from any encroaching fire for both staff and emergency services.
- Providing emergency services with easy access to a safe working area close to assets and water supply to suppress fires and protect property.
- Allowing for alternative safe access and evacuation routes should access in one direction be blocked in the event of a bushfire, and
- Providing opportunities to establish control lines from which to conduct hazard reduction or back-burning operations.

The site provides access and egress routes through the existing fire trail network for bulk water supplies and heavy fire fighting vehicles. Acceptable outcome of the Townsville City Plan Planning Scheme bushfire hazard overlay requires all other perimeter and fire trails system shall comply with:

- A minimum cleared width of 6m and a minimum formed width of 4m.
- A minimum of 4.8 m vertical clearance.
- A cross-fall of no greater than 10 degrees, and
- A maximum gradient of 12.5%, with adequate drainage to prevent soil erosion and minimise ongoing trail maintenance.

## 4.6. Fire Breaks

The objective of firebreaks is principally to provide access to limit grassfire spread in lower fire danger conditions.

A firebreak is a strip of land that has been cleared of all long grass and other combustible material, providing a 'fuel free' area within grassland environments. They can be created by grazing, slashing, hard surfaces (fire trails), burning and herbicide spraying. Firebreaks are intended to allow access for firefighting vehicles and can provide a fuel free area from which the progress of grass fire can be impeded, or prescribed burning can be undertaken. They may slow or stop the spread of a low-intensity bush fire however they should not be relied upon to prevent the spread of a forest fire as spotting (fire branding) can travel over the fire break and create further ignitions.

The effectiveness of a firebreak depends on the width of the firebreak, the weather conditions, flame length and whether embers are being produced. A firebreak will be more effective at preventing the spread of a fire if:

- It is close to the fire ignition point so that the fire is not at its maximum flame length.
- It is approached by the flank (side) of the fire, as the flank will have a shorter flame length than the front (head) of the fire.
- It forms an effective break in both the vertical and horizontal continuity of the fuel, which reduces the flame length and makes the fire easier to suppress.
- Nearby trees and shrubs are not producing embers, and
- It provides safe and efficient access for firefighting resources.

Grassland fire produce a low ember density and are generally short range, although this is heavily dependent on wind velocities. There are very effective when human intervention assists in the containment of the spread of fire, although should not be relied upon to contain grass fire spread.

Haughton Pipeline Stage 2 Offset Area Management Plan suggests widening fire breaks up to a width of 10m if necessary. Where necessary widths of up to 20m may be more appropriate to the vegetation type present.

## 4.7. Fire Trail Signage

The intent of fire trail signs ensure that trails are easily identified, hazards are marked in advance and critical points are identified. Fire trails should be described as strategic or tactical.

Strategic fire trails provide significant value in the suppression or management of fire within the landscape. They are generally major arterial fire trails that facilitate movement of category 1 fire appliances. Tactical fire trails support the prevention and suppression of fire. These may include multi-purpose trails.

Trail signage should be placed at the last exit point of the trail for any 'no through' trail to denote a lack of alternative escape route, provide distances to water supplies and include reflective text to improve night vision.

Standardised fire trail signs should be installed and maintained throughout the fire trail network. An example of fire trail signage is provided in Figure 8.



Figure 8: Indication of Fire Trail Signage



## 4.8. Water Supply

The intent of water measures is to provide adequate services of water to be utilised during prescribed burning operations and during and after the passage of a bushfire.

A static water supply (ground tanks) is provided within and surrounding the Houghton Pipeline Stage 2 offset area.

These static water supply for fire-fighting purposes should be above-ground, accessible and clearly marked. Where static water supply is provided Figure 9 provides an indication of the type of signage that should be installed along fire trails at a location that is clearly visible (assume smoke) to approaching emergency services to guide them to the static water supply. It is noted that TCC utilise heavy vehicle bulk water supplies to provide water for operations which facilitates water supply requirements.



*Figure 9: Indication of Static Water Supply Signage*

# 5. Program Actions

This section should be read concurrently with the bushfire Operations Map provided in Figure 10. This section provides a summary program of actions (Table 11), fire management infrastructure treatments and management actions (Table 12) and a prescribed burn schedule (

). All proposed management actions align with the actions described in Management Action 5 - Fire management Haughton Pipeline Stage 2 Offset Area Management Plan.

*Table 11: Program of Actions*

Actions	Outcomes
Fire Infrastructure	Complete annual review of Table 12
Prescribed burning schedule	Undertake burn as per
Complete Pre-Burn Actions	Complete task in Section 4.4.2
Complete Burn Conduct Actions	Complete task in Section 4.4.2
Complete Post-Burn Actions	Complete task in Section 4.4.2

Table 12: Fire Management Infrastructure

Name	Treatment Criteria	Management Actions
Fire Trails capacity	Assess all trails within Houghton Pipeline Stage 2 Offset in accordance with Section 4.5.	Review annually, record and undertake works to maintain to standard.
Fire breaks	Assess all Fire breaks associated with fence lines within Houghton Pipeline Stage 2 Offset in accordance with Section 4.6.	Review annually, record and undertake works to maintain to standard.
Fire Trail signage	Assess all signage within Houghton Pipeline Stage 2 Offset in accordance with Section 4.7.	Review annually, record and undertake works to maintain to standard.
Water Points	Assess all water points within Houghton Pipeline Stage 2 Offset in accordance with Section 4.8	Review annually, record and undertake works to maintain to standard.

Table 13: Prescribed Burn Scheduling

NAME / CODE and SIZE	DOMINANT VEGETATION COMMUNITY  (KEITH 2004)	FIRE ATTRIBUTES	MANAGEMENT ACTIONS	BURN FREQUENCY and PERFORMANCE MEASURES	SUPERVISION and EXTINGUISHING TECHNIQUES	TREATMENT and PRIORITY
LMZ S - 328 ha  of which  222 ha within the offset area	11.3.35	<p>Fire frequency: 5-7 years</p> <p>Previously burnt:  2016 Prescribed burn</p> <p>Preferred burning period  Early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains.</p> <p>No burning late dry season, avoid wet season fires.</p>	<p>To undertake mosaic burning to reduce the likelihood of spread of fires.</p> <p>Repeat burning towards the lower fire frequency will encourage grassland environments.</p> <p>Protection of hollow bearing trees from impact of prescribed fire.</p> <p>Ensure fire ignition sequence and strategies result in spatial variation in intensities between prescribed burns.</p> <p>Protection of fence line along southern containment.</p> <p>Survey for koalas and protect hollow-bearing trees .</p>	<p>Exclude all fire within 5-year minimum threshold.</p> <p>&lt;10% with high intensity burn scar during prescribed burn.</p> <p>&gt; 70% of LMZ S burnt within the 5-7 year minimum threshold.</p> <p>Per event &lt;70% of burn area burnt (mosaic burn).</p> <p>Ignition sequence and strategy to minimise burning within 100m of Dam foreshore.</p> <p>Follow-up weed management and mapping</p> <p>Secure northern containment line across creek.</p>	<p>A prescribed burn plan shall be written by a competent fire practitioner that holds the national competency of PUAFIR506 - Conduct complex prescribed burns or equivalent and recognised through AFAC Emergency Management Professionalisation Scheme.</p> <p>Ignition sequence and strategy to introduce low intensity burning in consideration of potential koala habitat. If possible, protect known hollow bearing trees.</p> <p>Burn to be led by an appropriately qualified operator.</p> <p>Extinguishing technique will utilise appropriate fire vehicles suppressing fire activity adjacent to containment and utilising hard containment lines, or fuel reduced containment (hand-tool/slashed lines) to extinguish active fire.</p> <p>Internal fire allowed to progress releasing heat flux to encourage germination.</p> <p>Patrol and mop-up required for days following the burn.</p>	<p># 1 Priority - Partial burn to be undertaken in the southern section of LMZ S.</p> <p># 2 Priority - First treatment to be undertaken by approximately 2028.</p>
LMZ N - 453 ha  of which	11.3.12	<p>Fire frequency: 5-10 years</p>	<p>To undertake mosaic burning to reduce the</p>	<p>Exclude all fire within 5-year minimum threshold</p>	<p>It is recommended that a prescribed burn plan shall be prepared by a competent fire practitioner that holds the national competency of PUAFIR506 - Conduct complex prescribed burns or</p>	<p># 3 Priority - First treatment to be undertaken by approximately 2030.</p>

NAME / CODE and SIZE	DOMINANT VEGETATION COMMUNITY  (KEITH 2004)	FIRE ATTRIBUTES	MANAGEMENT ACTIONS	BURN FREQUENCY and PERFORMANCE MEASURES	SUPERVISION and EXTINGUISHING TECHNIQUES	TREATMENT and PRIORITY
283 ha within the offset area		<p>Previously burnt: 2012 Wildfire</p> <p>Preferred burning period Mid-dry season</p> <p>No burning late dry season, avoid wet season fires.</p>	<p>likelihood of spread of fires.</p> <p>Short interval burns (e.g. 5 years) will promote grasslands.</p> <p>Protect hollow-bearing trees from impact of prescribed fire.</p> <p>Ensure fire ignition sequence and strategies result in spatial variation in intensities between prescribed burns.</p> <p>Protect fence line along southern containment.</p> <p>Protect dam foreshore and water quality.</p>	<p>&lt;10% with high intensity burn scar during prescribed burn.</p> <p>&gt; 70% of LMZ N burnt within the 5-7 year minimum threshold.</p> <p>Per event &lt;70% of burn area burnt (mosaic burn).</p> <p>Follow-up weed management and mapping</p>	<p>equivalent and recognised through AFAC Emergency Management Professionalisation Scheme.</p> <p>Burn to be led by an appropriately qualified operator.</p> <p>Fire will be extinguished using vehicles appropriate for suppressing fire activity along hard or reduced fuel containment lines (hand-tool/slashed lines) to extinguish active fire.</p> <p>Internal fire should be allowed to progress releasing heat flux to encourage germination.</p> <p>Patrol and mop-up required for days following the burn.</p>	
LMZ M - 525ha  105 ha within the offset area	11.3.35	<p>Fire frequency: 5-7 years</p> <p>Previously burnt: 2016 Prescribed burn</p>	<p>To undertake mosaic burning to reduce the likelihood of spread of fires.</p> <p>Repeat burning towards the lower fire frequency will</p>	<p>No burning within 100m of dam foreshore.</p> <p>&lt;10% with high intensity burn scar during prescribed burn.</p> <p>&gt; 70% of LMZ M burnt within the 5-7 year minimum threshold.</p>	<p>A prescribed burn plan shall be written by a competent fire practitioner that holds the national competency of PUAFIR506 - Conduct complex prescribed burns or equivalent and recognised through AFAC Emergency Management Professionalisation Scheme.</p> <p>Burn to be led by an appropriately qualified operator.</p>	# 4 Priority - First treatment to be undertaken by approximately 2032.



NAME / CODE and SIZE	DOMINANT VEGETATION COMMUNITY  (KEITH 2004)	FIRE ATTRIBUTES	MANAGEMENT ACTIONS	BURN FREQUENCY and PERFORMANCE MEASURES	SUPERVISION and EXTINGUISHING TECHNIQUES	TREATMENT and PRIORITY
		<p>Preferred burning period</p> <p>Early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains.</p> <p>No burning late dry season, avoid wet season fires.</p>	<p>encourage grassland environments.</p> <p>Protection of hollow-bearing trees from impact of prescribed fire.</p> <p>Ensure fire ignition sequence and strategies result in spatial variation in intensities between prescribed burns.</p> <p>Low habitat value for black-throated finch.</p>	<p>Per event &lt;70% of burn area burnt (mosaic burn).</p> <p>Ignition sequence and strategy to Minimise burning within 100m of Dam foreshore.</p> <p>Follow-up weed management and mapping</p> <p>Secure southern containment line across creek.</p>	<p>Extinguishing technique will utilise appropriate fire vehicles suppressing fire activity adjacent to containment and utilising hard containment lines, or fuel reduced containment (hand-tool/slashed lines) to extinguish active fire.</p> <p>Internal fire allowed to progress releasing heat flux to encourage germination.</p> <p>Patrol and mop-up required for days following the burn.</p>	

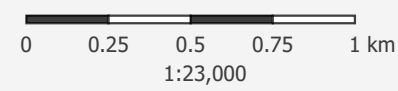




# Terra

SOLUTIONS

FIGURE 10: BUSHFIRE OPERATIONS MAP

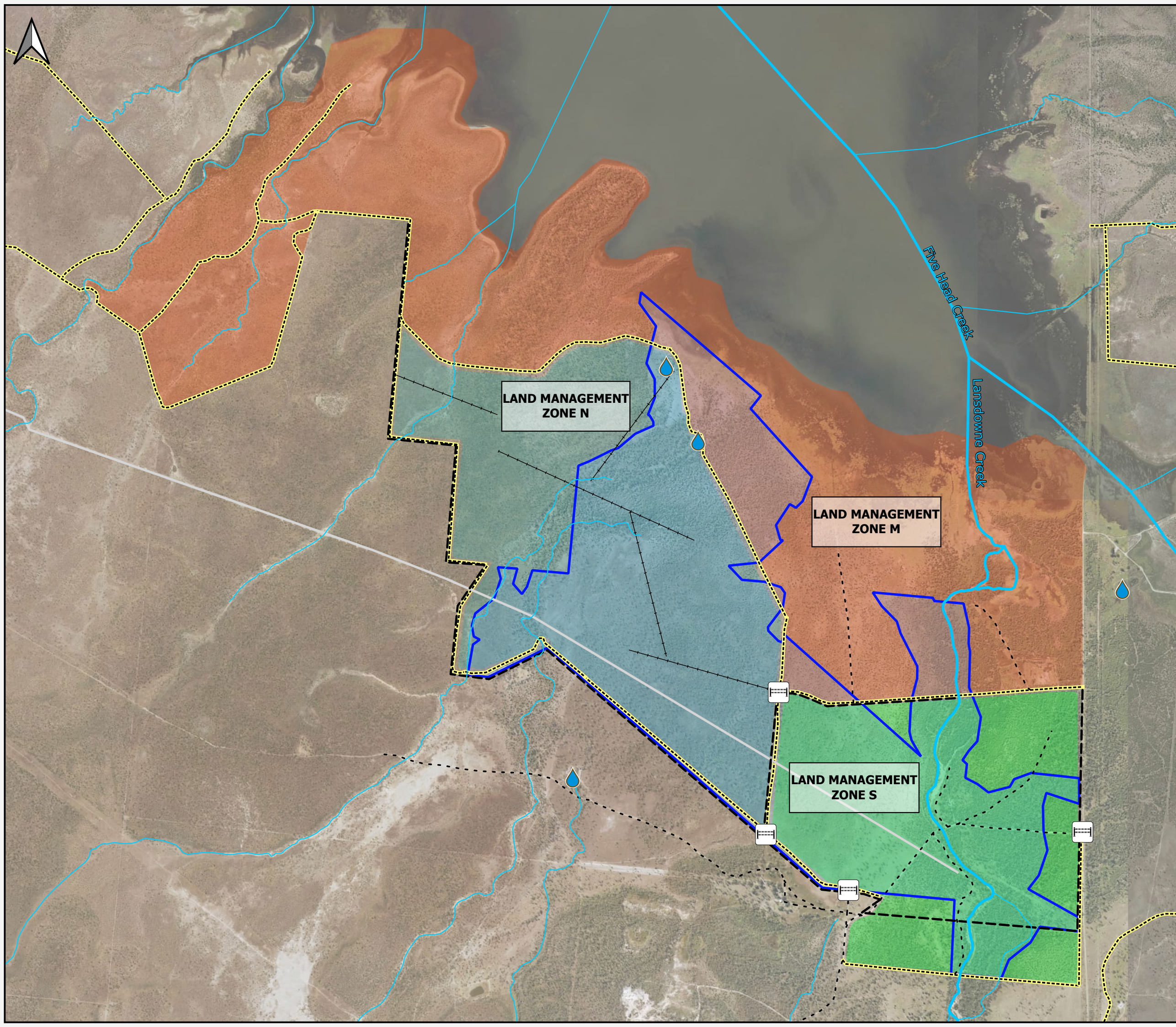


LEGEND:

- Farm Dam / Water Vehicle
- Gates
- Watercourses [defined by Water Act 2000]
- Vegetation Management Watercourses
- Firebreaks / Tracks
- Other Tracks
- Maintained Fences
- Unmaintained Fences
- Haughton Pipeline Stage 2 Offset Area

Land Management Zones

- LMZ M
- LMZ N
- LMZ S





## 6. Monitoring & Reporting

This section provides the monitoring and reporting requirements to be implemented.

### 6.1. Staff Awareness / Inductions

All staff have a general duty of care to observe and report fire hazards within and surrounding the reserve. Within employee and contractor induction, bushfire awareness, safety and reporting processes shall be included to ensure early detection and suppression operations are initiated as soon as possible.

The landowner is responsible for overall monitoring of fire hazard within site.

### 6.2. Annual Auditing

The audit process is targeted to the proposed Actions within Management Action 5 – Fire management

1. Within 12 months of Project approval, a Bushfire Management Plan will be developed and implemented (this plan).
2. A fire management strategy including a program of actions will be developed (Table 11) and on average no greater than 50% percent of offset area in any one year are burnt (s).
3. Identification and maintenance of fire breaks using existing fence-lines and track networks, widening fire breaks up to a width of 10 m if necessary (Table 12).
4. Scheduled, periodic fuel management via hazard reduction burning (Table 13).
5. Review offset area burn register.

### 6.3. Plan Review

This Bushfire Management Plan will be reviewed every 5 years or more frequently where issues are identified. The review will include, but not limited to:

- Consider any estate additions or removal.  
Location and value of site and neighbouring assets (built, natural and cultural).
- Update fire history and bushfire risk profile in consideration of climate.
- Fire history and minimum fire frequency.
- Update Bushfire Management Zones in consideration of new estate or values.
- Update fire trail and fire breaks, and
- Update bushfire advantages such as water access points.



## 7. References

- AFAC - National Council for Fire and Emergency Services, Centre of Excellence Prescribed burning - The Objectives, Monitoring and Evaluation Framework for Prescribed Burning. Accessed online: <https://knowledge.aidr.org.au/media/4902/objective-monitoring-and-evaluation-framework-for-prescribed-burning.pdf>
- AFAC - National Council for Fire and Emergency Services, Centre of Excellence Prescribed burning - Prescribed burning Performance Measures Framework. Accessed online: <https://knowledge.aidr.org.au/media/5512/prescribed-burning-performance-measures.pdf>
- AFAC - National Council for Fire and Emergency Services, Centre of Excellence Prescribed burning - A Risk Framework for Ecological Risks Associated with Prescribed Burning. Accessed online <https://www.afac.com.au/auxiliary/article/a-risk-framework-for-ecological-risks-associated-with-prescribed-burning>
- A report by the Independent Bushfire Group after the Black Summer fires of 2019-2020. Reducing the costs and impacts of Bushfires. Submission 162 - Attachment 1
- Councils of Standards Australia (2018), AS 3959:2018: Construction of Buildings in Bushfire-prone Areas. SAI Global
- Clarke, H., Lucas, C., Smith, P., (2012). *Changes in Australian fire weather between 1973 and 2010*, International Journal of Climatology. DOI: 10.1002/joc.3480
- Department of Infrastructure, Local Government and Planning (2016), State interest guideline - Natural hazards, risk and resilience, State Planning Policy, Brisbane, Queensland.
- Douglas, G., (2017). *Property Protection from Extreme Bushfire Events under the Influence of Climate Change*. Doctor of Philosophy at the Western Sydney University, Sydney, Australia
- Dold, J. W., Zinoviev, A., 2009. Fire eruption through intensity and spread rate interaction mediated by flow attachment. *Combustion Theory and Modelling* 13(5), 763-793.
- Drysdale, D. D., Macmillan, A. J. R., (1992). Flame spread on inclined surfaces. *Fire Safety Journal*, 18(3), 245-254.
- GHD, (2023). Haughton Pipeline Stage 2 Offset Area Management Plan, Townsville City Council. Townsville.
- Grumstrup, T.P., McAllister, S.S., Finney, M.A. (2017). Qualitative Flow Visualization of Flame Attachment on Slopes. 10th U. S. National Combustion Meeting Organized by the Eastern States Section of the Combustion Institute April 23-26, College Park, Maryland
- McArthur (1973). Fire behaviour in eucalyptus forests. Forestry and Timber Bureau.
- Lucas, C. 2010. *On developing a historical fire weather data-set for Australia*. Australian Meteorological and Oceanographic Journal. 60.1-14
- Townsville City Council (TCC), 2023
- Townsville Area Fire Management Group. (2024). Townsville City Council Operation Sesbania - Townsville Bushfire Risk Mitigation Plan.
- Queensland Fire and Emergency Services (2015). Fire hydrants are designed and installed in accordance with Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots
- Queensland Fire and Emergency Services. (2020). Whole-of-Government Queensland Fire and Emergency Services - Queensland Bushfire Plan
- Queensland Fire and Emergency Services. (2019). Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire'

