GOVERNMENT OF WESTERN AUSTRALIA

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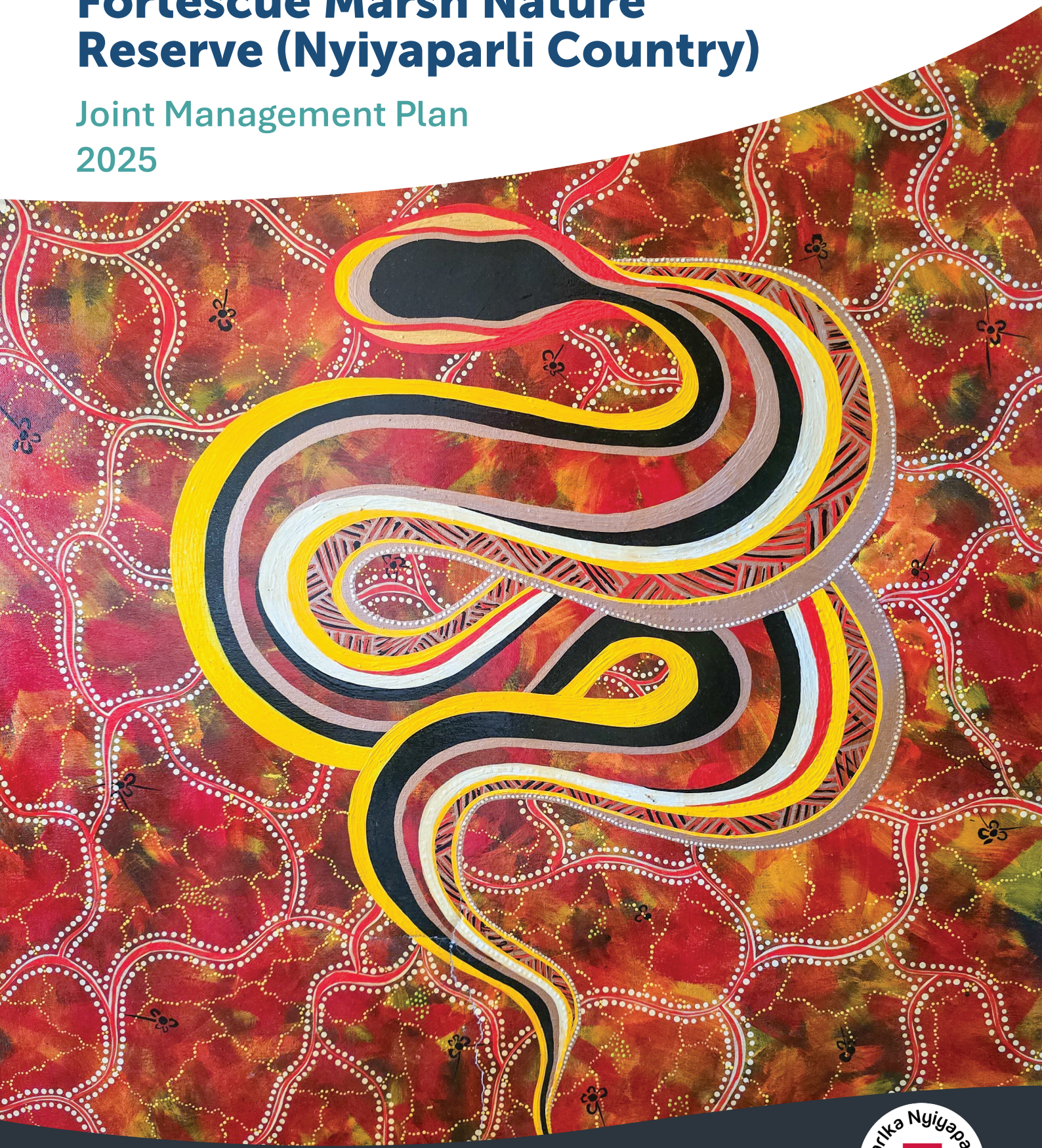
Fortescue Marsh Nature Reserve (Nyiyaparli Country)

Joint Management Plan 2025



GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**
Department of **Communities**

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Warning: This plan may show photographs of, and refer to quotations from, Aboriginal people who have passed away. Karlka Nyiyaparli Aboriginal Corporation RNTBC (KNAC) have given approval for all photographs, mentions and quotations within this joint management plan, including those of Aboriginal people who have passed away.

NB: The spelling of some of the words for Country, and species of plants and animals in language are different in various documents. This is primarily due to the fact that establishing a formal and consistent 'sounds for spelling' system for a language that did not have a written form takes time to develop and refine.

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2025

Department of Biodiversity, Conservation and Attractions
Conservation and Parks Commission
Karlka Nyiyaparli Aboriginal Corporation RNTBC

Vision

Nyiyaparli and DBCA working together on-Country to keep culture and yurlu strong and healthy, supported by Traditional Nyiyaparli and western science knowledge systems.

KNAC and DBCA preparing for prescribed burning in 2023. *Photo – Melissa Pepper/KNAC*

The Nyiyaparli Ranger team around newly installed song meter to record bird calls.
Photo – Melissa Pepper/KNAC

Acknowledgements

We acknowledge the Nyiyaparli People as the Native Title Holders and Traditional Owners of the management plan area.

DBCA wishes to thank joint management partners, KNAC and Nyiyaparli People for their contributions: for the sharing of cultural knowledge; the field work assistance by many Nyiyaparli People working with DBCA staff; and the guidance, advocacy and direction provided by KNAC.

We also recognise and acknowledge Nyiyaparli Elders who are no longer with us for their knowledge, leadership and guidance in the management of Nyiyaparli Country. We acknowledge KNAC as the registered native title body corporate for the Nyiyaparli Native Title Holders of the reserve and enter into this joint management to work together to manage this Country.

Thank you to the dedicated team of DBCA staff from the Pilbara region for their hard work and support in implementing joint management initiatives across Fortescue Marsh. Thanks also to specialist branches and those individuals within the department who have contributed to the development of this joint management plan.

DBCA would like to acknowledge the *Nyiyaparli People & Country Plan Fortescue Marsh 2023-2032* (Karlka Nyiyaparli Aboriginal Corporation RNTBC 2022) as an important guide in the development of this joint management plan.

Contents

Introduction

This joint management plan (the plan) was prepared by Karlka Nyiyaparli Aboriginal Corporation RNTBC (KNAC) and the Conservation and Parks Commission (the Commission), through the Department of Biodiversity, Conservation and Attractions (DBCA).

The plan considers the values, aspirations and objectives articulated in the *Nyiyaparli People & Country Plan Fortescue Marsh 2023 - 2032* (KNAC RNTBC 2022). The plan also considers the priorities and actions from the *Fortescue Marsh management strategy 2018-2024* (DBCA 2018). This plan replaces the *Fortescue Marsh management strategy 2018-2024*.

This plan will guide the management of the reserve for 10 years from the date the plan is gazetted. During this time, amendments to the plan may be made in accordance with section 61 of the *Conservation and Land Management Act 1984* (CALM Act), which includes public notification of plan amendments under section 57 of the CALM Act. If the plan is not reviewed and replaced by the end of the 10-year period, it will remain in force until a new plan is approved, as specified under section 55(2) of the CALM Act.

1. Overview

The Fortescue Marsh (the Marsh) is the largest and most important wetland in the Pilbara region. It is located in the middle reaches of the Fortescue River, in the broad Fortescue River Valley between the Chichester Range to the north and the Hamersley Range to the south (Map 1).

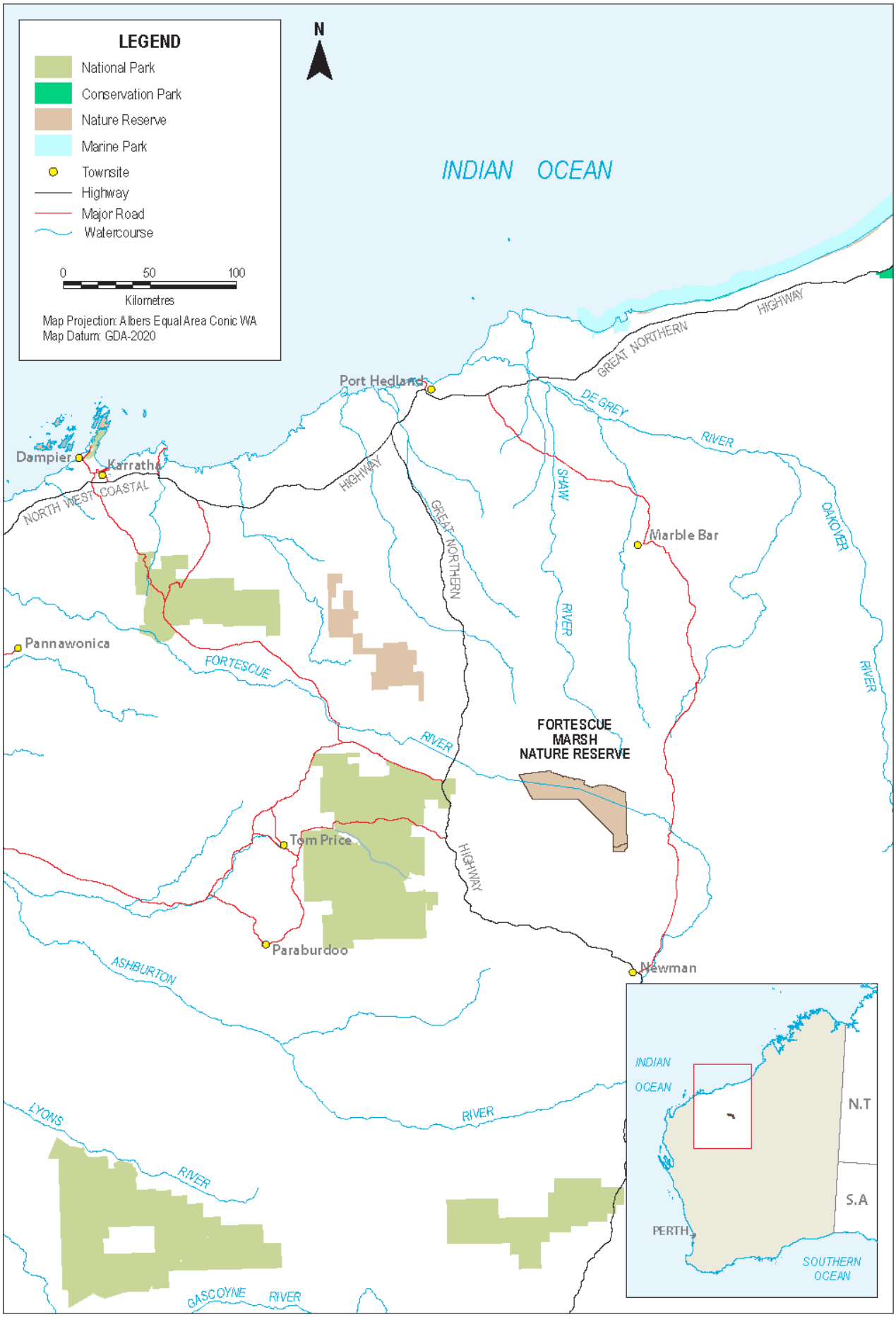
The Marsh is listed on the Directory of Important Wetlands of Australia as a wetland of regional and national importance due to its outstanding cultural values, significance as an extensive inland floodplain system, and its ecological role as a major breeding area for *jurtarra* (Australian pelican) and *kalajitu* (black swan) (DAWE 2019). It protects cultural heritage and conserves contiguous significant habitat for native plants and animals (in particular, the night parrot, northern quoll, greater bilby and Pilbara olive python), over a 100km long area that is bisected by the Newman-Port Hedland railway line. It faces significant management issues such as unmanaged cattle, pest animals (e.g. feral cats and feral bees), weeds (e.g. *Parkinsonia aculeata*), altered hydrological regimes (including cumulative hydrological impacts from surrounding land uses) and adjacent mining activities.

This plan covers approximately a 70km long section of the Marsh and surrounding land, which forms a Class A nature reserve. The nature reserve provides security of tenure[1] and statutory protection under the CALM Act. The nature reserve is referred to as 'Fortescue Marsh Nature Reserve' or 'the reserve' throughout the document.

The purpose of this plan is to provide management direction and guidance for the reserve, with the aim to protect and conserve the cultural and natural values of the reserve, and where appropriate, to consider culturally appropriate and environmentally sustainable visitor opportunities.

[1] Security of tenure reflects the level of approval required to reduce the area or purpose of a reserve. Excision of areas greater than one hectare or 5% of the total area from class 'A' reserves requires the agreement of both Houses of Parliament.

Map 1. Fortescue Marsh Nature Reserve: Locality



2. Nyiyaparli *Yurlu* (Country)

Plan area

The reserve lies within Nyiyaparli Country for which Nyiyaparli People have continuing rights and responsibilities. Nyiyaparli, which also refers to the name of the language, means 'the people' or 'belonging to the people'.

The reserve is located about 100km north-west of Newman and covers an area of about 107,000ha (Map 2). Until 30 June 2015, the reserve was part of four active pastoral leases (Mulga Downs, Marillana, Hillside and Roy Hill). Due to its important values, a large portion of the Marsh was excluded from these pastoral leases on 1 July 2015 through long-standing negotiated agreements with the respective pastoral lessees and was returned to the State with the intention of establishing a conservation area over a substantial portion of the excised area.

To validly create the Fortescue Marsh Nature Reserve, an Indigenous Land Use Agreement between KNAC and the State has been executed and registered (see section 5 **Native Title and Indigenous Land Use Agreement**). The Fortescue Marsh Nature Reserve is jointly vested in KNAC and the Commission.

Proposed eastern extension area (future opportunity)

An extension to the reserve, which will extend from the eastern boundary of the reserve into the eastern section of the Marsh (covering approx. 40,000ha), has been proposed. This addition will be progressed by KNAC, with support from DBCA and in consultation with key stakeholders. The future reservation of the proposed Eastern Extension Area, or any portion of it, is subject to the resolution of a range of issues to the satisfaction of the State that may involve reaching agreement with third parties, as well as the State's further determination to include the proposed extension into the conservation estate. It is intended that this proposed addition will be managed in accordance with this plan if and when the reserve vesting is finalised and the change in land tenure and purpose occurs.

Adjacent lands and their management

Pastoral leases

The Fortescue Marsh Nature Reserve is surrounded by the pastoral leases of Mulga Downs, Hillside, Roy Hill and Marillana. Support and cooperation from pastoral leaseholders will be sought for the protection and conservation of the reserve's cultural and natural values and management programs. This will ensure that cross-boundary issues such as weeds, pest animals, unmanaged stock and fire regimes are considered and addressed across the broader landscape.

It is important for a whole-of-landscape management approach to be considered and implemented where practicable. A range of documents have been prepared by different organisations that provide direction for a coordinated landscape approach across the Pilbara region. These documents include: *The Enduring Pilbara* (Booth et al. 2021) which promotes the region's cultural and natural values, and the importance of forming partnerships for large scale land management; the *Pilbara Conservation Strategy* (Government of Western Australia 2017) which identifies the Marsh as a priority area; and the *Pilbara Bioregion Conservation Action Plan* (Heydenrych & Parsons 2018) which identifies the Marsh as a key conservation asset, and will complement the management of the Marsh.

Mines

There are existing iron ore mines adjacent to the reserve including Cloudbreak (Fortescue, formerly known as FMG), Christmas Creek (Fortescue), Roy Hill (Roy Hill), Marillana (BHP) and Gudai-Darri previously known as Koodaideri (Rio Tinto). These existing iron ore mines and prospective mining areas make or will make significant economic contributions to the State. The Fortescue Marsh Nature Reserve is subject to existing and potential future resource development rights and interests under or for the purposes of government agreements within the meaning of section 2 of the *Government*

Agreements Act 1979 (WA) (State Agreements). These State Agreements include the *Iron Ore (FMG Chichester Pty Ltd) Agreement Act 2006*, the *Iron Ore (Hamersley Range) Agreement Act 1963*, the *Iron Ore (Mount Bruce) Agreement Act 1972* and the *Iron Ore (Mount Newman) Agreement Act 1964*. The area is also subject to resource development interests pursuant to non-State Agreement-related tenements and may be subject to future applications for tenements under the *Mining Act 1978* (WA).

The State Agreement proponents have recognised the environmental and cultural significance of the Marsh and have expressed to the State and KNAC their support for the creation of the reserve and its classification as Class A Nature Reserve, subject to continued access to the reserve pursuant to their rights under relevant State Agreements and the Mining Act. The State Agreement proponents indicated a continued need to access the reserve in particular to conduct activities in connection with environmental approvals (including conditions imposed by Ministerial Statements), mainly for the purposes of environmental monitoring and water management activities necessary to protect the Marsh.

This plan:

- acknowledges the potential for activities within the reserve in connection with rights and interests held under or for the purposes of any State Agreements or the Mining Act;
- is not intended to derogate from the operation of any State Agreement or the Mining Act;
- seeks to provide for and facilitate, as far as practicable, the coexistence of the reserve and its values with any rights and interests held under or for the purposes of a State Agreement and the Mining Act and any activities on the reserve pursuant to such rights and interests;
- acknowledges that an effective water management, reinjection and monitoring framework is critical to both the cultural and environmental health of the reserve and the continuing operation of adjacent mines; and
- acknowledges that other development activities nearby and on the reserve under the relevant State Agreements may occur in the future.

Mining and associated management activities related to iron ore tenements within and adjacent to the reserve are addressed under section 18 **Mineral exploration and development**.

Management objective: To progress the proposed addition as appropriate.
Maintain effective and cooperative working arrangements with neighbouring land managers.

Management strategies

1. Progress and implement the proposed eastern extension area (proposed addition) to the conservation estate and manage the proposed addition in accordance with this plan and applicable legislation.
2. Continue to work cooperatively with neighbouring land managers/users to foster complementary management of lands adjoining the reserve. If required, develop agreements that outline roles, responsibilities and integrated working arrangements with neighbouring land managers to address cross-boundary issues, such as fire management, pest animal control (baiting, trapping, and shooting) and weed management.
3. Develop agreements with neighbouring land holders/users for the construction and management of the reserve's boundary fencing (refer to section 14 **Weeds and pest animals**: management strategy no. 7).

Looking after *Yurlu* (management direction and context)

This plan aims to conserve the key values of the reserve in the long-term by providing a framework for joint management (see section 6 **Joint management**), guidance for operational documents that provide more specific on-ground management direction and allows for adaptive management. The plan will build on the work already undertaken by DBCA staff and Nyiyaparli Rangers through the 'Working Together' projects undertaken in 2021 to 2024. It provides a summary of operations proposed to be undertaken in the reserve as guided by the aspirations of Nyiyaparli People, and DBCA and Commission policies and guidelines[2].

3. Legislation and policy

The reserve will be managed in accordance with the provisions of the CALM Act, *Biodiversity Conservation Act 2016* (BC Act), the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cth) and other relevant legislation and policies[3] mentioned throughout this plan.

In preparing a management plan for any land, DBCA has the legislative objective of achieving or promoting the purpose for which the land is reserved. For this reserve, which is a nature reserve, the plan is designed to "*maintain and restore the natural environment, and to protect, care for, and promote the study of, native plants and animals, and to preserve any feature of archaeological, historic or scientific interest*", as stated under section 56(1)(d) of the CALM Act. Management plans also have the overarching purpose of "*protecting and conserving the value of the land to the culture and heritage of Aboriginal persons*", as described in section 56(2) of the CALM Act.

International conservation agreements

The Convention on Wetlands (known as the Ramsar Convention) is an international treaty concerned with the conservation and wise use of wetlands identified as wetlands of international importance. Based on the unique and significant species and ecological communities of Fortescue Marsh, it will be considered for nomination as a Ramsar wetland. The area of the Marsh that will be considered for nomination extends past the reserve boundary.

To progress a nomination, the documentation requirements include an Ecological Character Description for the Marsh and a completed Ramsar Information Sheet. Recent survey data and engagement with key stakeholders will be required. Through the implementation of this plan, there will be continuing progress towards documenting and compiling existing background work and survey information and gathering support from stakeholders to further progress the potential nomination of the site as a Ramsar wetland of international importance.

In addition to the Ramsar Convention, Australia is a signatory to bilateral agreements. The China–Australia Migratory Bird Agreement, the Japan–Australia Migratory Bird Agreement and the Republic of Korea–Australia Migratory Bird Agreement provide a collaborative framework for the protection of habitats of migratory birds within the East Asian–Australasian Flyway. Several species listed in these agreements use the Marsh while transiting through the northwest and some are also listed under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

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[2] Policy statements for DBCA are available at: dbca.wa.gov.au/about-us/legislation/corporate-policies. The Commission's Position Statements can be found at: conservation.wa.gov.au/publications/position-statement.

[3] Relevant Western Australian legislation can be found at: legislation.wa.gov.au

4. Strategic objectives

The following strategic objectives will provide the overarching broad direction for management of the reserve and link to the key values:

- Protect and care for Nyiyaparli *Yurlu* as part of the broader Upper Fortescue River catchment.
- Protect and conserve the cultural heritage of Nyiyaparli *Yurlu*.
- Uphold and respect the culture and traditional knowledge of the Nyiyaparli People.
- Provide for traditional and customary use and practices in Nyiyaparli *Yurlu* by Aboriginal People.
- Protect and conserve biodiversity, and ecological and hydrological integrity.
- To minimise impacts from adjacent economic and resource use on the values of the reserve.
- To increase the understanding of the key values of the reserve, to guide, adapt and improve management.

Key values

The plan focuses on the protection of the cultural and natural values for the reserve. The key values are summarised in Table 1.

Table 1. Summary of the key values of Fortescue Marsh Nature Reserve

Cultural values
• The Marsh is of immense cultural significance to Nyiyaparli People. • The Marsh is described as the heart of the region's water system. • There is a long history of use of the area by Aboriginal People and it contains many Aboriginal heritage places, and sites of cultural and mythological importance/significance. • The area contains historical remnants of pastoralism in the Pilbara and Nyiyaparli People's connection to the pastoral stations.
Natural values
• The area provides habitat for culturally important and conservation significant animal species, including the critically endangered night parrot (*Pezoporus occidentalis*), endangered northern quoll (*Dasyurus hallucatus*), and vulnerable greater bilby (*Macrotis lagotis*) and Pilbara olive python (*Liasis olivaceus* subsp. *barroni*) and ghost bat (*Macroderma gigas*). • The Marsh is recognised as a Key Biodiversity Area (KBA[4]) of international importance as a habitat and feeding area for significant numbers of waterbirds following inundation. • The area supports a high diversity of aquatic invertebrates and stygofauna. • The Marsh Land System, which covers most of the reserve, has a regionally significant flora assemblage dominated by samphire (*Tecticornia* spp.) and important communities of grove-intergrove Mulga and snakewood (*Acacia xiphophylla*) are found on the fringes. • Based on the area's unique and significant species and ecological communities, the Marsh is worthy of consideration for nomination as a Ramsar wetland.

Management issues

The main management issues for the reserve include inappropriate fire regimes, limited access to *Yurlu*, unmanaged cattle, pest animals, weeds and altered hydrology. Unmanaged visitation is of concern but requires monitoring to determine its level of impact to the reserve. The management issues are addressed in the section **Caring for *Yurlu***.

The management issues and the potential impacts to the key values are addressed in the management strategies presented throughout the plan. Background text in each section supports and explains the key values, management issues and strategies (see section 22 **Performance monitoring and evaluation**).

[4] KBAs are sites of global importance for the persistence of biodiversity in terrestrial, freshwater and marine ecosystems. For sites to qualify as KBAs, they must meet certain criteria identified by the International Union for Conservation of Nature (IUCN) in its Global Standard for the Identification of KBAs (IUCN 2016). A partnership of 13 international, non-government nature conservation organisations aim to identify, map, monitor and conserve KBAs worldwide.

5. Native Title and Indigenous Land Use Agreement

On 26 September 2018, the Federal Court of Australia made a determination (that was revised in 2021) that the Nyiyaparli People are the recognised native title holders of approximately 3,668,400ha of traditional Country in the Pilbara region. The reserve is located within this Nyiyaparli native title determination area and Nyiyaparli People have determined native title rights and interests based on strong and ongoing cultural connections to the land. KNAC is the registered native title body corporate for the Nyiyaparli People.

An Indigenous Land Use Agreement (ILUA) is a voluntary agreement under the *Native Title Act 1993* (Cth) between a native title group and other parties (e.g. organisation, industry or government) about the use and management of land and water. The WA Government has negotiated an ILUA with KNAC, which is required to provide the native title consent for the creation of the nature reserve. The creation of the reserve will not extinguish native title.

The nature reserve will be managed in accordance with the CALM Act, which contains provisions that enable Aboriginal people to undertake Aboriginal customary activities on CALM Act land.

6. Joint management

Joint management is given effect under the CALM Act through the section 56A joint management agreement (JMA) between KNAC and DBCA. The Chief Executive Officer of DBCA will jointly manage the reserve with KNAC. Formal joint management will commence upon execution of the JMA (to be attached to the final joint management plan). This is to occur as soon as practicable after the plan is approved. The JMA provides for the establishment of a Joint Management Body (JMB) with representatives from KNAC and DBCA's Parks and Wildlife Service.

The KNAC-DBCA JMB oversees the management of the reserve and meets regularly (at least once every four months). The JMB is responsible for making strategic decisions about how Country is looked after. The JMB is also responsible for making decisions about the management, implementation and monitoring of the plan.

Joint management will provide opportunities; for on Country trips; to maintain access to Country; protect and maintain cultural heritage; for transfer of traditional knowledge; to enhance the protection of landforms, habitats, native plants and native animals (including important medicinal plants and bush foods); and to consider culturally appropriate opportunities for visitors. The joint management framework will also apply to research and monitoring activities and the management of fire, pest animals and weeds.

Administration and management

DBCA will provide administrative support for the JMB. Under the guidance of the JMB, DBCA Pilbara region operational staff and KNAC's Ranger Program Manager will be responsible for coordinating the operational management of the reserve. Other staff from KNAC and Pilbara regional office in Karratha, and from specialist branches within DBCA will provide support, direction and assistance.

Subsidiary plans and implementation programs

More detailed subsidiary plans or other guidance documents will be prepared to guide implementation of this plan. Subsidiary plans for the reserve may include fire, weed and pest animal management plans, or monitoring and reporting plans. An annual operations plan or works plan will be prepared to guide the implementation of this plan. The plan will be implemented using Nyiyaparli Rangers, DBCA staff, contractors, finances and other resources as needed.

Ranger hub

There is a shared desire to establish a ranger hub (e.g. large shed/s and associated amenities), and basic satellite camping sites (e.g. compost toilet and bore/water tank) within or adjacent to the reserve. The proposal is for a hub and operational outstations (basic camping sites) to be used for cultural and operational purposes.

The ranger hub and associated operational outstations will facilitate Nyiyaparli People's connection to *Yurlu* and for Nyiyaparli Rangers and DBCA staff to undertake operational activities for the purpose of protecting and conserving the cultural and natural values of the reserve.

This proposal requires discussions between joint management partners, and if necessary with key stakeholders, and an assessment to determine the suitable locations and infrastructure, and responsibility for the sites and infrastructure. Various models will be considered such as CALM Act lease (lessee exclusive use) or licence (non-exclusive use) arrangements, or direct management by DBCA or KNAC (if adjacent to the reserve).

Tash and Beverley collecting field data using the fulcrum app. *Photo – Melissa Pepper/KNAC*

Management objectives: To ensure the reserve has appropriate legal, administrative, financial and human resource frameworks in place so that they are jointly managed with Nyiyaparli People.

To ensure the appropriate, efficient and effective joint management of the reserve.

To recognise and provide increased protection of the Marsh.

Management strategies

1. DBCA to support KNAC representative members on the JMB to provide information back to KNAC on joint management matters.
2. Work with the JMB to determine the best method to measure the KPIs related to joint management, such as how to measure successful operation of the JMB and Nyiyaparli People satisfaction levels with joint management.
3. Work with Nyiyaparli Rangers to plan, carry out and monitor projects to protect and enhance the cultural and natural values of the Marsh, and to train as CALM Act Honorary Officers to undertake compliance activities in the reserve to manage Country; with local area arrangements to be developed as required.
4. Identify and facilitate training, employment and economic development opportunities for KNAC and the wider Nyiyaparli community through joint management arrangements.
5. Prepare and implement subsidiary plans or other documents where needed to guide on-ground operational activities, including monitoring and reporting.
6. Ensure the annual operations plan or works plan align with the management priorities identified in this plan and subsidiary plans.
7. KNAC and DBCA to work together to investigate, assess, discuss and implement options relating to establishing a ranger hub and operational outstations within the reserve.
8. Collaborate with stakeholders to resource the development of an Ecological Character Description and Ramsar Information Sheet for the Marsh and other required documentation in accordance with the Australian Government Ramsar site nomination guidelines to progress a potential recommendation to the Commonwealth Government for nomination under the Ramsar Convention.
9. To progress a potential recommendation to the Commonwealth Government for nomination under the Ramsar Convention, establish a collaborative advisory group to facilitate management and implement a public participation strategy to engage stakeholders.

Key performance indicators: Joint management

Performance measure	Target	Reporting
Ability of Nyiyaparli People to make decisions about the management of their Country.	Conduct JMB meetings in accordance with the JMA.	Annually
Effective management of the reserve through the JMB, demonstrated through all scheduled meetings taking place and participants' satisfaction with meetings and outcomes.	Successful operation of the reserve through the JMB.	Annually
Level of joint management partner satisfaction with joint management.	Joint management partners are satisfied that they can undertake their roles and responsibilities as custodians and managers of Country in the context of jointly managed conservation estate.	Annually
Key performance indicator: Ramsar nomination		
Nomination of the Marsh as a Ramsar wetland.	1. Preparation of materials that are required to progress the nomination of the Marsh as a Ramsar wetland, to be completed by the end of the 10-year period (i.e. life of the plan). 2. Progress a recommendation to the Commonwealth Government for nomination under the Ramsar Convention.	Every two years

Connection to *Yurlu* (cultural values)

Australia's heritage ("*is all the things that make up Australia's identity - our spirit and ingenuity, our historic buildings, and our unique, living landscapes.*" DCCEEW 2024) is managed and protected by a heritage system under the Commonwealth EPBC Act.

Management of Nyiyaparli cultural heritage and other cultural heritage is guided by WA's *Aboriginal Heritage Act 1972* (Aboriginal Heritage Act), *Heritage Act 2018* and DBCA policies. The Department of Planning, Lands and Heritage has statutory responsibility for the administration of the Aboriginal Heritage Act. The Aboriginal Heritage Act provides a framework to recognise, protect, conserve and preserve Aboriginal cultural heritage. Management of Nyiyaparli cultural heritage is also guided by Nyiyaparli lore and cultural governance systems.

Places of other cultural heritage significance are included on the 'State Register of Heritage Places'. These places have statutory protection, and work that has the potential to impact a registered place must not be undertaken unless a permit authorising the specified work has been granted by the Heritage Council of WA.

7. Nyiyaparli cultural heritage

Management of CALM Act land shall be carried out in a manner that protects and conserves the value of the land to the culture and heritage of Aboriginal persons, as described in section 33(2) of the CALM Act. DBCA's *Policy Statement No. 25 Protect and Conserve Aboriginal Cultural Heritage,* and *Corporate Guideline No. 45 Protect and Conserve Aboriginal Cultural Heritage*, provide guidance in protecting and conserving Aboriginal cultural heritage.

Nyiyaparli People's connection to *Yurlu*

Nyiyaparli People have a responsibility to look after Country under traditional lore, and a strong desire to be involved in the management of the conservation estate to strengthen their connection to Country. Joint management partners working together for Country help to preserve cultural and natural values, enrich cross-cultural awareness and provide cultural, spiritual and economic benefits.

Working on Nyiyaparli Country guidelines/protocols for all operational visitors (e.g. DBCA staff, researchers, consultants, mining companies) to the reserve will be developed by KNAC with guidance from the JMB and Senior Nyiyaparli to protect the cultural safety of all operational visitors and the cultural heritage of the reserve. The guidelines/protocols will provide information such as the location of restricted access areas.

Plants, animals and sites of significance

The kinship system connects Nyiyaparli People to Country and provides rules on how Country should be looked after. The kinship system sits within Nyiyaparli lore and determines how Nyiyaparli People relate to one another and their environment. It also outlines each person's roles and responsibilities to Country and how it should be cared for. All things in the world have *inny* (a skin group) – all plants, animals, the stars, the sun, wind, rain, important sites and *yindas*, for example, belong to one of the four *inny* groups (Purungu, Milangka, Panaka or Karimara) and are therefore in relationship to *Marlpa* in the same way as an uncle, aunty, cousin or parent. Because of this, plants and animals are an integral part of Nyiyaparli culture and their relationship with the world (KNAC RNTBC 2022).

Bush plants are used by Nyiyaparli People for food (*marta*), to heal illnesses and ailments, to create artefacts and bough sheds during ceremony time, and as firewood. Bush meat harvest and preparation maintains an important place in Nyiyaparli diet and cultural practices. Traditional bush food knowledge remains embedded within a customary system and is passed on through songs and stories. Reducing threats from unmanaged cattle, invasive weeds and unmanaged fire regimes (addressed later in the plan) are ways in which DBCA, Nyiyaparli Rangers and key stakeholders can work together to help protect culturally important bush plants and maintain biodiversity.

There are sites of significance within and adjacent to the reserve[5], some of which have gender restrictions. There are also places that have not been recorded due to their cultural sensitivity but are still protected under the Aboriginal Heritage Act and as such due diligence should be exercised during project planning and any on-ground works. DBCA and KNAC will work together in project planning to prioritise the cultural safety of the operational team.

Depending on the cultural sensitivity, sites of significance can be vulnerable to a variety of management issues (e.g. weeds, pest animals, inappropriate fire regimes, unmanaged visitation). These are discussed in more detail in the relevant sections of this plan. In many cases, maintaining confidentiality and restricting access to culturally sensitive areas will be imperative to retaining site integrity.

Papa (water) cultural significance

Nyiyaparli People believe that Fortescue Marsh "is the heart of the region's water system" (Nyiyaparli Community et al. 2015). The Marsh is a place of immense cultural significance to Nyiyaparli People not just as a singular important site, but as part of a broader complex of important sites that are interconnected by songlines. Numerous important ceremonial and mythological sites are located in and near the Marsh. A songline associated with the *Yurturrpa* snake runs the length of the Marsh ending at a *yinda* (waterhole) called *Mirilimpirrinha* in the north-west. It is here, at *Mirilimpirrinha*, that *Yurturrpa* travelled underground, re-emerging at Deep Reach in Millstream National Park where he continues to reside today. Several creeks that flow into the Marsh from the north-east have their origins at *Mankarlyirrakurra*, a highly important site that sits to the north of Roy Hill Station **(**KNAC RNTBC 2022).

The floodplains around the Marsh continue to be used for hunting and camping by Nyiyaparli People and are represented in the lore. Several important bush meats such as *marlu* (kangaroo), *marningarra* (bush turkey), *maruntu* (goanna) and *jarnkurta* (emu) are commonly found around the Marsh. Other sought after bush foods such as *kapumarta* (bush tomato), wild honey, *marta* (bush potato) and *patharra* (wild plum) are also found around the Marsh **(**KNAC RNTBC 2022).

Traditional knowledge

Traditional cultural and ecological knowledge is held by Elders and Senior Nyiyaparli People. This knowledge is passed down through lore, stories, songs, ceremonies, and time spent on Country. Nyiyaparli People want to ensure that their knowledge, stories, language, ceremonies and connection to Country are maintained and strengthened.

Nyiyaparli lore is an important part of passing knowledge on to younger generations.
Nyiyaparli People are concerned about the loss of their knowledge and language and seek to keep it alive through cultural mapping projects, getting younger people on Country, recording language and creating learning resources.

Traditional knowledge contributes to DBCA's ability to conserve and protect natural and cultural assets. DBCA commits to ensuring Nyiyaparli traditional knowledge is protected and respected and will ensure that it is handled in accordance with Nyiyaparli People's requirements.

[5] Information on registered Aboriginal Sites and Other Heritage Places (lodged but not yet assessed) is available via the Aboriginal Cultural Heritage Inquiry System at: wa.gov.au/government/document-collections/find-aboriginal-cultural-heritage-wa

Accessing and engaging with Country for customary purposes

Much of the reserve is difficult to access. Therefore, providing an appropriate level of vehicle access to sites where Nyiyaparli People can continue to undertake cultural activities and responsibilities is the main priority to enable effective management of cultural values of the reserve (see section 17 **Access**).
Customary activities are an important part of culture and connection to the land, and enable maintenance of relationships with the land, water and fire. Access to the reserve to carry out cultural activities is important for Nyiyaparli People as it ensures the continuation of traditional practices, the transfer of knowledge to younger generations and looking after places of significance.

Nyiyaparli People, represented by KNAC, have been granted non-exclusive native title rights and interests for the reserve. These rights include:

(a) the right to live, being to enter and remain on the land, to camp and erect shelters and other structures for that purpose, and travel over and visit any part of the land and waters;
(b) the right to hunt, fish, gather, take and use the traditional resources;
(c) the right to take and use water;
(d) the right to engage in cultural activities and the transmission of cultural knowledge including:
  (i) visiting places of cultural or spiritual importance and maintaining, caring for, and protecting those places by carrying out activities to preserve their physical or spiritual integrity; and
  (ii) conducting ceremony and ritual, including burial and burial rites; and
(e) the right to be accompanied by those people who, though not native title holders and who (for the avoidance of doubt) cannot themselves exercise any native title right, are:
  (i) spouses, parents or children of the native title holders; or
  (ii) people required by or entering in connection with traditional law and custom for the performance of ceremonies or cultural activities.

Native title rights coexist with the nature reserve and can continue to be exercised consistent with the CALM Act. The CALM Act and the BC Act allow Aboriginal people to undertake activities for customary purposes on reserves[6]. In relation to customary activities on the reserve under section 103A of the CALM Act, DBCA provides Nyiyaparli People and their families standing written permission, through this plan, in the exercise of their native title rights and interests, to access the reserve to carry out Aboriginal customary activities for the purposes of the following CALM Act regulations:

- r. 115 – animals (bringing animals)
- r. 116 – vehicles (operation of vehicles)
- r. 118 – fire (lighting fires for cooking/heating/ceremonial purposes)
- r. 119 – camping (camping temporarily)
- r. 121(1)-(5) and (9) – protected thing (hunting/taking firewood, plants)

Customary activities must be carried out safely and be consistent with this plan, relevant legislation (e.g. regarding the use of fire and firearms) and DBCA's *Policy Statement No. 86 Aboriginal customary activities* and *Corporate Guideline No. 22 Guidelines regarding Aboriginal customary activities*.

Customary take of *mantu* (bush meats) can sometimes require further arrangements to allow time for a species' population to recover (such as populations of *marlu* and *jarnkurta*) or to ensure the harvest is sustainable in the long term. Mantu knowledge, harvest and preparation is of cultural, spiritual and economic (subsistence) importance to Nyiyaparli People. Traditional bush foods reinforce culture and demonstrate affiliation with tradition and the land. If the recovery of a species' population is required, the JMB will develop local area arrangements for the customary take of the

[6] Further information is available in the *Guide to Aboriginal customary activities on Parks and Wildlife-managed lands and waters.* The guide and other information on customary activities on DBCA-managed lands is available at: dbca.wa.gov.au/management/aboriginal-engagement

species (including threatened species, as required) to ensure sustainability and provide for community aspirations. These agreements should be based on sound science and local traditional knowledge.

Management objectives: To protect and conserve cultural sites, and support the continuation and strengthening of connection to Country and sharing of cultural knowledge.

Management strategies

1. Work with the JMB to determine the best method to measure the KPIs related to Nyiyaparli cultural heritage.
2. Protect, maintain, manage and where possible record and monitor known or identifiable sites of cultural heritage significance in accordance with the requirements of the *Aboriginal Heritage Act 1972*.
3. Support Nyiyaparli People to monitor the condition of and manage culturally significant sites and species (e.g. fencing, signage or markers to indicate areas of cultural sensitivity, or ground burning in the late wet season).
4. Protect cultural sites and, through the JMB, determine which sites of high cultural sensitivity may require special management and/or access restrictions and implement as appropriate.
5. Support on Country trips by Nyiyaparli People to maintain or improve the health of Country and keep culture strong.
6. DBCA provides standing written permission, through this plan, to Nyiyaparli People and their families to access the reserve to carry out Aboriginal customary activities for the purposes of CALM Act regulations 115, 116, 118, 119 and 121(1)-(5) & (9); with local area arrangements to be developed as required.
7. Work with KNAC to engage Nyiyaparli People businesses to provide cultural awareness training for DBCA staff and other personnel working in the reserve.
8. Ensure that DBCA staff have opportunities to work together on Country with Nyiyaparli People and gain the cultural authority to undertake land management activities across the reserve.

Key performance indicators: Nyiyaparli cultural heritage

Performance measure	Target	Reporting
Identification and protection of heritage places.	Stable or increasing number of heritage places being protected.	Annually
Condition of significant cultural and heritage places.	All known areas with cultural and/or gender access restrictions are monitored and managed accordingly.	Annually
Level of Nyiyaparli People satisfaction that traditional knowledge is being considered and adopted into management.	Nyiyaparli People (through the JMB) are satisfied that traditional knowledge is being considered and adopted as appropriate into management of the reserve.	Annually
Opportunities for Nyiyaparli People to visit their Country within the reserve, including for on Country planning meetings and visiting special sites.	Maintain or increase opportunities for Nyiyaparli People to access their traditional lands.	Annually
Level of Nyiyaparli People satisfaction that they have been able to continue customary practices and remain custodians of Country and culture.	Nyiyaparli People (through the JMB) are satisfied that they are able to access the reserve for the purposes of carrying out customary practices, transferring knowledge to younger generations and enjoying Country.	Annually

8. Other heritage

There are responsibilities for historic heritage protection under the Heritage Act, the Government Heritage Property Disposal Process, the *State Cultural Heritage Policy and State Planning Policy 3.5: Historic Heritage Conservation*. *The Burra Charter, the Australian (International Council on Monuments and Sites) Charter for the Conservation of Places of Cultural Significance 2013* is also relevant. The standard practices contained in the Burra Charter will be applied, the underlying principle is that the conservation of places of cultural significance is an integral part of good management.

There are no sites registered on the State Register of Heritage Places or on local government municipal inventories in the reserve. To date there has been no survey of historical heritage across the reserve.

History

Leases for pastoral stations around the Marsh were granted in the 1880s and 1890s and Roy Hill, Mulga Downs and Hillside stations were all established around this time. Marillana Station was established in the 1920s. Many Aboriginal people worked on pastoral stations as stockmen and domestic workers and played a vital role in the development of pastoralism in the Pilbara. The pastoral industry is part of Nyiyaparli People's history and many have a strong connection to pastoral locations, e.g. Warrie Outcamp which lies just outside the reserve is important to Nyiyaparli People. The buildings and other structures are evidence of the contribution that Aboriginal workers made to the development of the pastoral industry and are an important aspect of the heritage and contemporary identity of traditional custodians.

Undertaking an assessment of old infrastructure associated with historical pastoral activity (e.g. fences, machinery, wells and bores, tanks, access roads and tracks and equipment) and mineral resource developments will establish whether any is of heritage significance and worthy of protection. Infrastructure with no heritage significance will be considered for removal.

The reserve contains several old fences along old pastoral boundaries. These contain barbed-wire and can kill or injure waterbirds (when the Marsh is inundated), night parrots and ghost bats if they collide with fences or become entangled. Ghost bats and night parrots are particularly vulnerable to entanglement in fences as they often fly at fence height (Armstrong & Anstee 2000). Ghost bats roost across the Hamersley Range and forage on the Marsh. Fences (or the barbed-wire, leaving the posts in situ) without any heritage or management value will be removed.

Management objective: Identify and protect other heritage sites of significance in consultation with relevant stakeholders.

Management strategies

1. Identify and assess, in collaboration with Nyiyaparli People, historical pastoral and mining infrastructure for its heritage value, and remove infrastructure where no heritage significance is detected or where it poses a threat to visitors or wildlife.
2. Support the registration of significant infrastructure as historical sites with the Department of Planning, Lands and Heritage to assist in their ongoing protection.
3. Protect, maintain and manage known or identifiable heritage sites of significance consistent with relevant legislative, policy and other requirements; and ensure these sites inform and guide management actions, where relevant and appropriate.

Old stockyard at 8 Mile (outside the reserve). *Photo – Melissa Pepper/KNAC*

9. Geology, landforms and soils

Under the classification scheme provided in the Interim Biogeographic Regionalisation of Australia (version 7), the reserve is located in the Pilbara bioregion (Fortescue subregion) in the north-west of Australia and is described by Kendrick (2001).

Geology and landforms

The reserve sits on the Pilbara craton, which is the oldest landform in Australia, up to 3.5 billion years old.

The geology of the Marsh is described by Thorne and Tyler (1997) and MWH (2015) and is summarised below. The Marsh is part of the Hamersley Basin and the underlying geology was formed in the late Archaean to early Proterozoic (2,765 - 2,470 million years ago). The Marsh lies within the Fortescue Valley, a flat low-lying complex sequence of Quaternary and Tertiary alluvial, colluvial and lacustrine sediments overlying the basement. Parallel to the Marsh and the Fortescue Valley are the Hamersley Range and the Chichester Range (Figure 1).

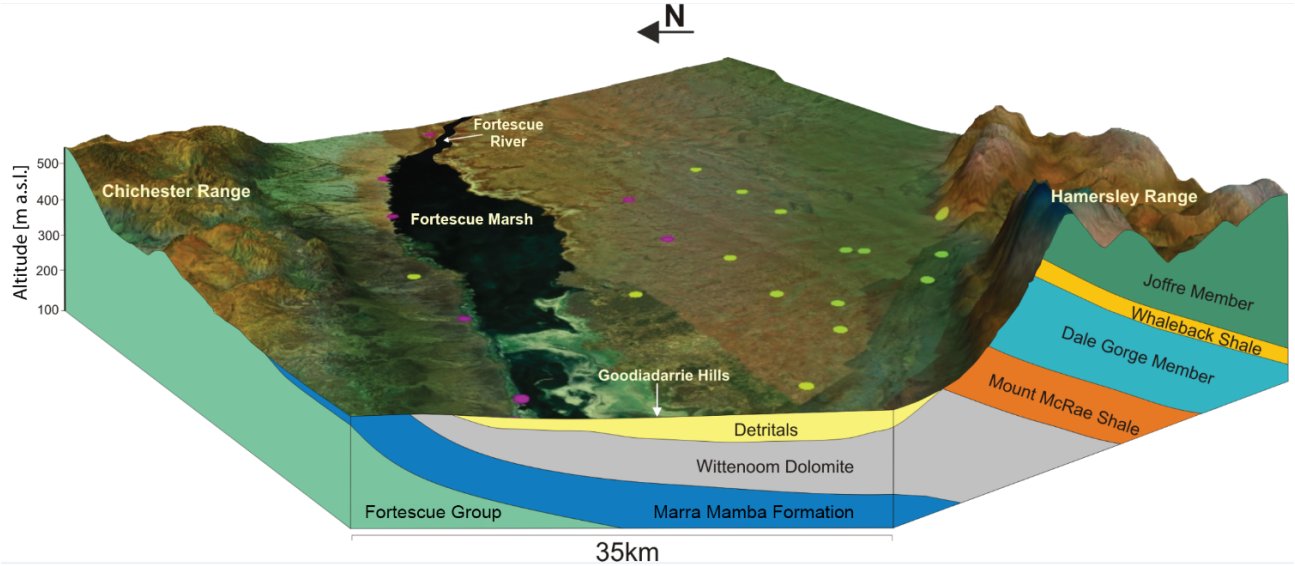

Figure 1: A conceptual geological model of the Fortescue Marsh, Hamersley Range and Chichester Range (Skrzypek, et al. 2013).

The Hamersley Range lies to the south of the Marsh and comprises extensive mountains up to 1,250m above sea level and steep-sided gorges. The ridgelines and peaks of the Hamersley Range have steep slopes and deep drainage lines in major valleys, with gentle undulating slopes at the base. The foot-slopes are in the southern portion of the reserve. The geology of the Hamersley Range is mainly outcrops of Weeli Wolli Formation (jaspilite, chert, shales and dolerite sills) and Brockman Iron Formation (Banded Iron Formation [BIF], shale and chert bands).

Chichester Range is a plateau rising to 500m above sea level and bound by the Fortescue Valley to the south. Margins of the Chichester Range are in the northern part of the reserve. The geology of the Chichester Range comprises outcrops of Marra Mamba Iron Formation and Wittenoom

Formation. The major rock types of the range are chert, basalt, shale, BIF, mudstone, dolomite and thin-bedded meta-sandstone.

The Fortescue Valley, an elongated, gently undulating, north-west alluvial plain, separates the Hamersley Range and Chichester Range. The Marsh itself comprises sparsely vegetated clay flats, surrounded by flats of the Fortescue River Valley, where Cainozoic alluvial and colluvial deposits form gently sloping plains and broad valleys. These deposits are up to 100m thick within the Marsh and there are also exposures of calcrete and dolocrete on the fringes.

The Department of Primary Industries and Regional Development's (DPIRD) Pilbara Ranges Project (van Vreeswyk et al. 2004) identified over 100 land systems based on topography, geology, soils and vegetation in the region. There are 10 land systems in the reserve, including the Marsh and Narbung land systems, with most of the reserve covered by the Marsh Land System. Two of the land systems are restricted to the Fortescue Valley and have high conservation significance (EPA 2013):

- Cowra – plains fringing the Marsh land system and supporting snakewood (*Acacia xiphophylla*) and Mulga shrublands with some halophytic undershrubs.
- Marillana – gravelly plains with large drainage foci and unchanneled drainage tracts supporting snakewood shrublands and grassy Mulga shrublands (van Vreeswyk et al. 2004).

The Environmental Protection Authority (EPA) (2013) recommended that the Cowra Land System should be added to the conservation reserve system. Most of the Cowra Land System is located along the northern flank of the Marsh and the northern part of reserve.

Soils

Van Vreeswyk et al. (2004) reported nine soil types within the reserve. In general, these comprise red loamy soils and earths, of varying depths; some with abundant cobbles and stony mantles. There are also areas of deep red/brown non-cracking clays. Many of these soil types are susceptible to erosion, particularly if the overlying stony mantle is removed (DEC 2011).

The soils of the Marsh are saline and comprise red/brown highly alkaline clays with a high gypsum content. Soils of the surrounding alluvial plain are typically fine textured with a sodic subsoil[7], cobbles and stones.

Managing impacts to geology, landforms and soils

Any disturbance activities within the reserve should be assessed for their impact on the key values. The specific requirements for assessment and/or approval will depend on the type of proposed activity and/or the relevant legislation that might apply. Applications to undertake a selection of proposed disturbance activities (excluding mining) within the reserve (by DBCA, KNAC and/or external proponents), including activities such as maintenance or establishment of infrastructure (e.g. utilities or roads) can be applied for online via DBCA's Disturbance Approval System. DBCA's *Corporate Guideline No. 45 Protect and Conserve Aboriginal Cultural Heritage,* provides guidance on the process to assess the risks associated with disturbance activities, to avoid or minimise impacts on Aboriginal cultural heritage.

Management objective: To protect and conserve geological features, landform units and soils.

Management strategies

1. Identify geological features and soil types vulnerable to environmental damage and protect such features from damage where possible, through the planning and assessment of management operations, managing access, and the provision of fencing and signage.
2. Monitor the effectiveness of erosion control techniques and incorporate new practices where appropriate.
3. Assess any disturbance activities within the reserve for impacts on the key values, with applications.

[7] Having a disproportionately high concentration of exchangeable sodium.

10. *Papa* (water)

Information collected by mining and consulting companies for environmental assessments under the *Environmental Protection Act 1986* (WA) (EP Act) has contributed significantly to the knowledge of the ground and surface water hydrology within and outside the reserve.

Hydrology

The Fortescue River catchment is divided, with the lower Fortescue River (western end of the Marsh) separated from the Marsh (middle) and upper Fortescue River by the Goodiadarrie Hills – drainage from the Marsh to the lower reaches is only expected to occur during extreme flooding events. The Marsh is the main hydrological feature of the reserve. It lies in, and receives drainage from, the upper Fortescue River catchment in the Hamersley Basin. Water predominantly enters the Marsh from direct rainfall and surface runoff including inflows from the upper Fortescue River and other drainage lines (Skrzypek et al. 2013). The main drainage lines from the Hamersley Range include the Fortescue River, Weeli Wolli Creek, Coondiner Creek and Mindi Mindi Creek, which flow into several deltas in the Fortescue Valley (DEC 2009; Skrzypek et al. 2013; MWH 2015). From the Chichester Range, runoff flows south towards the Marsh via a series of floodplains, alluvial fans and temporary creeks (e.g. Christmas Creek, Sandy Creek, Kulbee Creek and Kulkinbah Creek) (Skrzypek et al. 2013; MWH 2015).

Episodic inundation of the Marsh follows cyclonic or significant rainfall, where *yindas* (semi-permanent or permanent waterholes), lake beds and surrounding floodplains are filled with surface water. The surface area of the Marsh is approximately 1,000km^2, although the zone of potential inundation, which includes the adjacent alluvial flats, is up to 3,000km^2 (Skrzypek et al. 2013; EPA 2013). The area filled varies greatly between years. For smaller runoff events, isolated *yindas* form on the Marsh opposite the main drainage inlets (DEC 2009). The entire system may flood following larger runoff events, which occur on average once every five to seven years (DEC 2009). Surface water accumulates in the Marsh, but with minimal discharge from the system evaporative processes are dominant which causes salt accumulation. This process results in the progressive transformation of the Marsh from a freshwater ecosystem to a saline lake to a dry playa or flat lake bed (Aquaterra 2005; EPA 2013).

Shallow aquifer systems associated with drainages (e.g. Weeli Wolli Creek and Fortescue River alluvial aquifers) contribute to locally complex groundwater regimes within the Fortescue Valley. These are recharged following significant rainfall (Dogramaci et al. 2012) and may support persistent or permanent pools in some locations, such as 14-Mile Pool, outside of the reserve, near the eastern end of the Marsh (Skrzypek et al. 2013).

Wetland of significance

The reserve encompasses most of Fortescue Marsh, which is a large ephemeral (temporary) wetland recognised nationally for its geomorphic, hydrological and ecological features. The Marsh is listed on the Directory of Important Wetlands in Australia as it is: a good example of a wetland type occurring within a biogeographic region in Australia (criterion 1); a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex (criterion 2); important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions prevail (criterion 3); and is of outstanding historical or cultural significance (criterion 6) (DCCEEW 2021).

Management objective: To protect and conserve hydrological values and processes.

Management strategies

1. Identify and protect hydrological values vulnerable to environmental damage, where relevant and appropriate.
2. Protect waterbodies, particularly *yindas*, and fringing vegetation and banks, from damage and disturbance from management operations, unauthorised access, unmanaged cattle and feral herbivores.

Also refer to section 20 ***Papa* resources**

11. Native plants and vegetation communities

Broadly, the reserve covers the Marsh Land System, which consists largely of samphire vegetation, surrounding areas of spinifex grasslands, and eucalypt and mulga woodlands (Beard et al. 2013).

The Marsh Land System supports samphire shrublands, saltwater couch grasslands and halophytic shrublands. Vegetation on the lake beds of the Marsh and saline floodplains must cope with climatic extremes of hot, dry conditions, punctuated by periods of inundation (Markey 2017). Species zonation into the floodplains of the Marsh is driven by inundation frequency and duration, soil water and salinity and depth to the water table. Markey (2017) notes the proportion of chenopod taxa for the Marsh Land System (13 per cent) is double the proportion occurring in the wider Pilbara region, reflecting the unique habitat of the Marsh.

Markey (2017) completed a comprehensive floristic survey of the Marsh, with a focus on the halophyte-dominated samphire vegetation of the Marsh Land System and some consideration of other vegetation communities in adjoining land systems (Map 3). Markey (2017) also mapped the extent and distribution of individual vegetation communities within the Marsh Land System using aerial imagery and field observations. Vegetation mapping has been carried out by mining and consulting companies associated with development proposals. This mapping information has been combined in Map 3, with vegetation communities described in Appendix 1. Sourcing of detailed digital aerial imagery and mapping the vegetation for the remainder of the reserve, such as the Coondiner Pool area, is needed. This will help provide a baseline for future assessments and inform management and monitoring programs.

A total of 352 taxa (species, subspecies and varieties) were recorded across the study area (Markey 2017). Markey (2017) recorded 14 taxa of state priority conservation significance, including several endemic or near-endemic taxa for the Marsh – priority flora are listed in Table 2 (note: the list has been amended since Markey 2017, including new WA Herbarium records and removal of four species). For annual and short-term perennial conservation-listed species, Markey (2017) noted the need to consider seasonal variability when undertaking future targeted surveys.

Table 2. Flora of conservation significance recorded in and around Fortescue Marsh Nature Reserve

Species name: s*cientific name* (common name)	WA status
Calotis squamigera	Priority 1
^*Helichrysum oligochaetum*	Priority 1
^*Lindernia* sp. *Pilbara* (M.N. Lyons & L. Lewis FV 1069)	Priority 1
Myriocephalus scalpellus – identity to be confirmed	Priority 1
^*Rorippa* sp. Fortescue Valley (M.N. Lyons & R.A. Coppen FV 0760) – identity to be confirmed	Priority 1
Samolus sp. Fortescue Marsh (A. Markey & R. Coppen 9702) – currently being formally described	Priority 1
Tecticornia globulifera	Priority 1
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	Priority 1
Teucrium pilbaranum - located west of the Marsh	Priority 2
^*Isotropis parviflora*	Priority 3
Atriplex flabelliformis	Priority 3
Dysphania congestiflora (Marsh crumbweed)	Priority 3
Eleocharis papillosa	Priority 3
Eragrostis crateriformis	Priority 3
^*Eragrostis* sp. Erect spikelets (P.K. Latz 2122)	Priority 3
^*Eremophila spongiocarpa*	Priority 3
^*Euphorbia australis* var. *glabra*	Priority 3
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (O'Meara's goodenia)	Priority 3
Rhagodia sp. Hamersley (M. Trudgen 17784)	Priority 3
Stackhousia clementii	Priority 3
^*Streptoglossa* sp. Cracking clays (S. van Leeuwen et al. PBS 7353)	Priority 3
Tecticornia medusa	Priority 3
Eremophila youngii subsp. *lepidota*	Priority 4

^ an amendment since the Markey 2017 survey

Pinder et al. (2017) completed a survey of riparian flora biodiversity in the middle to upper Fortescue Valley (upstream and downstream of the Fortescue Marsh) to inform the management of wetlands on pastoral leases. The only wetland within the reserve to be surveyed was Coondiner Pool. The riparian vegetation community was dominated by annual herbs and grasses and is significant due to the particularly large number of rare and restricted flora species recorded here. In addition to those recorded by Markey (2017), notable range extensions (that represent new records for the Pilbara) included:

- *Cardamine* aff. *paucijuga* (this is to be confirmed as *Rorippa eustylis*, which was originally phrase-named as *Rorippa* sp. Fortescue Valley (M.N. Lyons & R.A. Coppen FV 0760)),
- *Isolepis congrua* (known to have a wide southern distribution) and
- *Lachnograstis filiformis* (known from temperate, arid and semi-arid parts of southern Australia).

Vegetation communities

Markey (2017) identified a total of 21 vegetation community units from the Marsh Land System. Several of these appear to be outside the boundary of the reserve, including those restricted to locations in the eastern part of the Marsh.

One feature of the Marsh which sets it apart from other generally bare salt lakes in WA is the extensive cover of samphire vegetation over most of the saline flats. Changes to groundwater and surface hydrological regimes associated with mining operations have increased concerns about the impacts on the healthy function of the Marsh and its unique samphire community (Shepherd and van Leeuwen 2011).

The reserve also contains floristically unique grove-intergrove mulga communities and snakewood woodlands and shrublands. Mulga communities are common on the northern and southern stony plains bordering the Marsh, and have been degraded by grazing pressure, altered fire regimes and invasion by the ecosystem transforming weed, buffel grass (*Cenchrus ciliaris*) (EPA 2013). Mulga is generally killed by moderate to high-intensity fires that can also destroy the seeds required for regeneration, making fire management a high priority for the mulga communities of the reserve.

Extensive spinifex (*Triodia*) hummock grasslands predominate along the southern perimeter of the Marsh, in the Calcrete Land System and the south-east section of the reserve. Hummock grasslands provide habitat for desert fauna and may be important for conservation significant species such the night parrot and greater bilby. More frequent fire is a characteristic of the more flammable hummock grasslands compared with other parts of the reserve.

Markey (2017) also identified several vegetation communities associated with the alluvial flats, floodplains, and river channels upstream and in the east of the Marsh. These distinctive communities are geographically restricted and vulnerable to threats (e.g. weeds, feral herbivores and unmanaged cattle) because of their small size. They are mostly located outside the reserve however, it is important for groups to work collaboratively with neighbouring land managers to consider and address relevant cross-boundary issues.

Ecological communities

The reserve contains two priority ecological communities (PECs) (Map 4):

- 'Fortescue Marsh (Marsh Land System)' – Priority 1 ecological community. The Marsh is a highly diverse ecosystem with samphire shrublands and groundwater dependent riparian ecosystems. As the largest ephemeral wetland in the Pilbara, this community supports a suite of biotic assemblages including endemic flora and fauna. The primary biological attributes that define the Marsh PEC is the presence of samphires and other halophytic plants (*Duma*, *Atriplex*, *Frankenia* and *Muellerolimon*) or communities dominated by or supporting them. Some of the more permanent pools (saline and/or fresh) grow thickets of *Acacia ampliceps*, *Eucalyptus camaldulensis* and *Eucalyptus victrix*. The Marsh PEC includes small outwash fans dominated by *E. victrix* with shrubby melaleucas or a *Melaleuca* thicket, and communities dominated or

supporting *Eremophila spongiocarpa*. The PEC does not include the fringing mulga woodlands, snakewood shrublands or the spinifex dominated hummock grasslands.

- 'Narbung Land System' – Priority 3(iii) ecological community. Alluvial washplains with prominent internal drainage foci supporting snakewood and Mulga shrublands with halophytic low shrubs.

Reviewing the status of these PECs, through surveys and analysing the monitoring data gathered by the resource companies, will help to determine whether they should be nominated as a threatened ecological community or downlisted as a Priority 5 (conservation dependent) ecological community.

Markey (2017) also noted several restricted ecological communities worthy of more investigation. The red Aeolian sand dunes overlying calcrete and Marsh sediments are only found in the south-eastern portion of the reserve. Aeolian sand dunes are uncommon landforms in the Pilbara but significant deposits next to the Marsh are outliers of the Little Sandy Desert. The taller dunes contain species typical of desert dunes east of the Pilbara and the lower dunes and sandy flats comprise *Melaleuca glomerata* and samphire with sparse *Melaleuca* spp. shrublands respectively. These were not surveyed in detail and Markey (2017) recommended more surveys to determine their distinctiveness and significance. Markey (2017) also noted the highly restricted and distinctive riparian community comprising *E. camaldulensis* subsp. *obtuse-A. ampliceps* woodlands and shrublands. This community is found to the north of the Marsh and, with its semi-permanent/ permanent fresh water, provides habitat for birds and a refuge for rare flora. These communities are small and geographically restricted and threatened by unmanaged cattle and feral herbivore grazing. Nomination of these communities as PECs should be considered.

Management objective: To protect and conserve native plants and plant communities, particularly culturally important and conservation significant plant species and ecological communities.

Management strategies

1. Improve baseline data, research and mapping to identify threatened plants, vegetation communities and ecological communities with a focus on culturally important and conservation significant plant communities and plant species and where there are knowledge gaps. Review their conservation status based on the baseline data.
2. Encourage the sharing of this data/information between joint management partners, mining and consulting companies, other State Government departments and other stakeholders and use information to adapt management accordingly.
3. Identify culturally important and conservation significant native plants and plant communities that may require protection; and implement appropriate strategies to minimise the impacts from threatening processes, such as climate change, weeds, pest animals, inappropriate fire regimes and unmanaged visitation.

Key performance indicators: Vegetation communities, and conservation significant plant species and ecological communities

Performance measure	Target	Reporting
Vegetation mapping of the small sections of the reserve not covered by the Markey (2017) mapping.	Vegetation mapping of the reserve completed within the next 10 years.	Every five years
Extent and condition of selected threatened or priority plant species and ecological communities.	No decline in extent or overall condition of selected threatened or priority plant species and ecological communities.	Every five years, or as per recovery plans if applicable

Maruntu (yellow-spotted monitor). *Photo – Melissa Pepper/KNAC*

12. Native animals and habitats

Native animals

Surveys conducted to date have identified 730 species of native fauna in the greater area (DBCA 2018): 34 mammals, 199 birds, 92 reptiles, three amphibians, two fish and 400 aquatic and terrestrial invertebrates (DBCA 2018). A large amount of survey effort has been associated with environmental impact assessments and monitoring around existing and proposed mining developments in the north and south-west of the reserve. It is anticipated that additional survey work in other locations will identify more species.

Nine fauna species of conservation significance that are known to occur or possibly occur in the reserve are listed under section 19 of the BC Act or under the EPBC Act (Table 3).

Table 3. Fauna of conservation significance recorded in or near Fortescue Marsh Nature Reserve

Species name: common name (*scientific name*)	Biodiversity Conservation Act	EPBC Act	IUCN Red List
Night parrot (*Pezoporus occidentalis*)	Critically endangered	Endangered	Endangered
Northern quoll (*Dasyurus hallucatus*)	Endangered	Endangered	Endangered
Australian painted snipe* (*Rostratula australis*)	Endangered	Marine (under *Rostratula benghalensis*)	Endangered
Greater bilby (*Macrotis lagotis*)	Vulnerable	Vulnerable	Vulnerable
Ghost bat (*Macroderma gigas*)	Vulnerable	Vulnerable	Vulnerable
Pilbara leaf-nosed bat (*Rhinonicteris aurantia*) (Pilbara form)	Vulnerable	Vulnerable	Least concern
Pilbara olive python (*Liasis olivaceus* subsp. *barroni*)	Vulnerable	Vulnerable	Not assessed
Grey falcon (*Falco hypoleucos*)	Vulnerable	Not listed	Vulnerable
Peregrine falcon (*Falco peregrinus*)	Specially protected	Not listed	Least concern

* Previously considered to be a subspecies of the species *Rostratula benghalensis* (DCCEEW 2021).

Nine priority species have also been recorded in or near the reserve as follows:

- Priority 1 – Gane's blind snake (*Anilios ganei*), pin-striped finesnout ctenotus (*Ctenotus nigrilineatus*)
- Priority 2 – spotted ctenotus (*Ctenotus uber* subsp. *johnstonei*)
- Priority 4 – brush-tailed mulgara (*Dasycercus blythi*), long-tailed dunnart (*Sminthopsis longicaudata*), western pebble-mound mouse (*Pseudomys chapmani*), Lakeland Downs mouse (*Leggadina lakedownensis*), striated grasswren (*Amytornis striatus* subsp. *striatus*), and Fortescue grunter (*Leiopotherapon aheneus*).

Night parrot

The night parrot is a nocturnal, ground-feeding species regarded as Australia's most enigmatic bird. Broadly, night parrots have been located in arid and semi-arid zones and prefer old-growth spinifex grasslands (especially ring-forming hummocks) and/or chenopod shrublands for roosting and areas of native grasses and herbs for foraging (Threatened Species Conservation Committee 2016; DPaW 2017; DBCA 2024). Spinifex communities occur throughout the reserve and mature spinifex plants (i.e. unburnt for at least 10 years) provide critical habitat for the night parrot.

In April 2005, three parrots were sighted drinking at Minga Qwirriawirrie Well at dusk (Davis and Metcalf 2008), outside the reserve. The sighting renewed hope that a viable night parrot population existed in the Pilbara region, and Davis and Metcalf (2008) concluded that the "juxtaposition of freshwater, spinifex and samphire may make the Marsh an important habitat for this species either permanently or as a refuge." During follow-up searches and surveys conducted at the Marsh since 2009, there have been no more night parrot sightings, however systematic surveys using Automated Recording Units have detected multiple night parrot calls across the spinifex-samphire transition zone. Ongoing monitoring is needed in these locations to inform management decisions in night parrot habitat.

Night parrots roost and forage in different habitats and can fly up to 40km in one night to forage. The best method of surveying is by identifying their calls as they leave roosting and nesting sites to forage and then return at the end of the night. Parrots are not known to call during foraging, and foraging sites can be dispersed over a large area, be highly seasonal and more difficult to define. Consequently, despite concerted survey efforts, night parrots can be difficult to detect, especially if none are found within likely roosting sites. More surveys are needed to establish the current presence of the night parrot within the reserve. In its advice to the Minister, the EPA recommended more surveys for night parrots and research to improve understanding of habitat requirements of this species as well as seeking to include habitat in future conservation reserves (EPA 2013).

Surveys and monitoring should follow the *'Guidelines for determining the likely presence and habitat usage of night parrot (*Pezoporus occidentalis*) in Western Australia'* (DBCA 2024).

Fortescue developed a night parrot research plan (Murphy 2014) which identifies the highest priority areas of research required for the species and focuses on improving detection strategies, understanding habitat preference and use, distribution and threats to night parrots. This plan has largely been implemented. A national Night Parrot Recovery Team, which includes DBCA, ensures a coordinated approach to night parrot research and management activities.

Northern quoll

There are records of the northern quoll in the reserve although they are more prevalent in complex, rocky areas in the north, central and west Pilbara, and are less likely to occur in the south and east of the Hamersley Range and the Marsh (Cramer et al. 2016a). Hill and Ward (2010) also recognise the importance of rocky landforms for the northern quoll, as these areas retain water, have a diversity of microhabitats, and cats, fire and livestock grazing are likely to have less of an impact within them. In 2014, DBCA began a 10-year monitoring program for the northern quoll in the Pilbara (Cramer et al. 2016a). While the reserve is not a stronghold for the species, undertaking surveys in and assessing the habitat suitability of certain land systems where northern quoll have been recorded (e.g. Calcrete Land System) will help understand the distribution and habitat requirements. The EPA recommended more surveys to identify suitable habitat for the northern quoll, seeking to include habitat in future conservation reserves and implementing feral predator control measures (EPA 2013).

Greater bilby

The greater bilby has been recorded at several locations across the reserve, but little is known about the population (e.g. population size and dynamics). Within the reserve, bilbies may occur in sand plains, isolated dunes and dune fields, alluvial and calcareous areas with sandy, sandy clay or sandy loam soils; along creek and drainage lines with red earthy and sandy soils and along rises with

lateritic, small gravel, stony matrix (Cramer et al. 2016b). Bilbies in the Pilbara are usually associated with stands of particular plant species, especially some *Acacia* spp. which support cossid moth larvae (grubs) in their root systems. This larva is a major food source for bilbies in the Pilbara. Preliminary distribution modelling identified soil type and depth, and elevation as major contributing variables to predict likely greater bilby habitat (Dziminski and Carpenter 2017). Bilbies can be highly mobile and individuals have large home ranges. Mean home ranges of male bilbies can be up to 316ha (Moseby and O'Donnell 2003). Unsuitable fire regimes, introduced predators, habitat degradation from trampling and grazing by unmanaged cattle and feral herbivores, and loss of habitat for development are the major threats to the species in and adjacent to the reserve.

A coordinated project in the Pilbara aims to improve the understanding of the distribution and demographics of bilbies across the region and refining techniques to allow greater bilby populations to be monitored over time. There is the potential to monitor populations within the reserve to examine the effects of management. Monitoring has found that populations in the Pilbara are geographically isolated and consist of a small number of individuals, making them vulnerable to threats. A national recovery plan for the greater bilby was published in April 2023 (DCCEEW 2023) and provides a framework for the conservation of this species. Fortescue Marsh is identified as a recovery plan action site, site no. 12 Manggurdu (DCCEEW 2023), which is the Banjima name for Fortescue Marsh.

Waterbirds

The Marsh has been recognised internationally as a Key Biodiversity Area for its large aggregations of breeding and visiting waterbirds (Dutson et al. 2009; BirdLife International 2023). Following inundation, the Marsh is one of three major inland wetlands in north-western Australia (along with Walyarta [Mandora Marsh] and Paraku [Lake Gregory]), which between them can support up to one million individual waterbirds (Halse et al. 2005), or over 20 per cent of the entire estimated Australian waterbird population of 4.6 million birds (Kingsford et al. 2012). This emphasises the importance of these arid zone wetlands as important breeding habitats and drought-period refuges for waterbirds (Bell et al 2014; Trainor et al 2016).

Aerial surveys of the site during 1999-2003 recorded approximately 47 waterbird species and an estimated 270,000 individuals, including ≥1 per cent of the estimated global population of 14 waterbird species (Trainor et al. 2016). More ground and aerial surveys during flooding could generate valuable information on waterbirds of the reserve (Trainor et al. 2016).

In addition to the species listed in Table 3, at least 11 other bird species recorded at the Marsh are listed as migratory under the BC Act and eight of these are also listed as migratory under the EPBC Act and are the subject of international agreements to which Australia is a signatory.

The Marsh is also considered to be an important breeding site for several species, including *jurtarra* or Australian pelican (*Pelecanus conspicillatus*) and *kalajitu* or black swan (*Cygnus atratus*) (in WA). A recent study (Karawita et al. 2023) concludes that *kalajitu* is extremely susceptible to the highly pathogenic avian influenza virus, therefore should the virus become established in waterbird habitat the survival of *kalajitu* would be at risk.

In its report to the Minister about the impacts of mining on the Marsh, the EPA recommended investment in feral herbivore and predator control, especially on the Marsh Land System to improve the quality of waterbird habitat and their survival (EPA 2013).

Aquatic species

Invertebrates

The reserve has a rich diversity of aquatic invertebrates, with approximately 70 species recorded at one survey site in the reserve, and 590 species for the larger Fortescue Valley area and nearly 1,000 species for the Pilbara region (Pinder et al. 2010; Pinder et al. 2017). In particular, the Marsh has a disproportionately large number of significant species compared to other Pilbara wetlands, with endemic or near-endemic invertebrates occurring in saline marsh and fringing freshwater claypan habitats (Pinder et al. 2010). In a study examining invertebrate diversity of wetlands upstream and

downstream of the Marsh, Pinder et al. (2017) found that the Marsh and Coondiner Pool contained the highest number of rare and restricted invertebrates within the survey area. Salinity is one of the most important influencing factors for aquatic invertebrates and the high salinities of the Marsh support numerous halophilic and halotolerant species, contributing to the highly diverse invertebrate fauna (Pinder et al. 2017).

Bennelongia (2015) identified the northern and eastern Marsh as an area of high stygofauna (groundwater fauna) richness. As with the rest of the Pilbara, many stygofauna species in the reserve are likely to be locally to regionally endemic. The conservation significance and need for preservation of these subterranean fauna is recognised by the EPA in the requirement for assessment and protection during developments that may affect their habitat (EPA 2013).

Fish

There have been few surveys for fish within the Marsh and additional surveys are required to provide baseline data. To date, the native species recorded within the Marsh are the spangled perch (*Leiopotherapon unicolor*) and western rainbow fish (*Melanotaenia australis*) (FMG 2009; Thorburn et al. 2018). The Fortescue grunter (*Leiopotherapon apheneus*) is also known from the Fortescue River system (DEC 2009). The spangled perch is a culturally significant food species that is likely to be impacted by the invasive redclaw crayfish and sailfin molly (refer to section 14 **Weeds and pest animals**).

Management objective: To identify, protect and conserve habitats and native animals, particularly culturally important and conservation significant animal species.

Management strategies

1. Undertake and/or support baseline surveys, research and mapping to identify fauna and habitats with a focus on culturally important and conservation significant species where there are knowledge gaps. Review their conservation status based on the baseline data.
2. Encourage the sharing of this data/information between joint management partners, mining and consulting companies, other State Government departments and other stakeholders and use information to adapt management accordingly.
3. Prepare and implement monitoring plans for key culturally important and conservation significant fauna species such as the spangled perch, greater bilby and night parrot.
4. Protect existing habitats and undertake habitat restoration or enhancement to support culturally important and conservation significant animal species.
5. Participate and contribute to the development and implementation of recovery plans for threatened animals as required.
6. Consider the re-introduction of fauna to areas where they are known to have formerly occurred, once threatening processes have been identified and ameliorated.

Key performance indicators: Culturally important and conservation significant animals

Performance measure	Target	Reporting
Presence of key culturally important and conservation significant fauna species.	The occupancy of key culturally important and conservation significant fauna species.	Every five years, or as per recovery plans if applicable
Extent and condition of habitat for selected threatened animal species.	No decline in extent or overall condition of important habitat for conservation significant animal species.	Every five years, or as per recovery plans if applicable

13. Right-way fire

Nyiyaparli People used fire for hunting, regenerating food and medicinal plants, and for ‘cleaning up’ Country (KNAC 2022) by removing dead or aging vegetation. Traditional fires were small and patchy and lit at the start of the dry season to keep fuel loads down (KNAC 2022). Changed land uses (e.g. livestock grazing) and fire regimes since European colonisation, as well as climate change have contributed to more frequent, intense and very large late dry season bushfires across the landscape. These changes have coincided with the decline of small to medium sized semi-arid and arid mammal species.

The main objectives of fire management within the reserve are to:

- reduce the bushfire risk to human life (protecting human life from fire is a priority)
- protect important cultural sites
- reduce the bushfire risk to adjacent mining and pastoral assets
- maintain and promote biodiversity by creating a mosaic of vegetation ages and structure across fire resilient communities and protecting fire sensitive communities (such as grove-intergrove Mulga and snakewood communities and long unburnt spinifex that may be important habitat for night parrots)
- communicate with neighbours and other stakeholders in fire management
- increase knowledge and adapt fire management through applying Nyiyaparli People fire management practices, fire research, operational experience and monitoring.

An annual burn program that incorporates traditional fire practices and involves a collaborative fire planning approach will be prepared, implemented and reviewed. The burn program will continue the work already undertaken through Working Together projects. DBCA will support Nyiyaparli Rangers to develop their capacity to assist with prescribed burns and wildfire response on Fortescue Marsh.

Strategic fire access for the reserve will be developed and implemented. This fire access will be maintained to ensure safe access for fire fighting vehicles and to permit effective fire management.

Management objective: To manage fire to protect lives, property, and the reserve's cultural and natural values.

Management strategies

1. Develop fire management guidance for the reserve, for inclusion in annual indicative burn programs, that identifies and considers risks (both safety/asset and cultural risks), priorities (both environmental and cultural priorities), Nyiyaparli People fire management practices, fire sensitive native plants, communities and animals, and cultural and natural values of the reserve.
2. Where feasible, establish, map and maintain a strategic network of access tracks, fire breaks, and low fuel buffers with a focus on protecting areas of important cultural and natural values.
3. Undertake fire mitigation, preparedness, response and recovery measures within the reserve in consultation with key stakeholders, the Department of Fire and Emergency Services and neighbouring land managers in accordance with the requirements of the *Emergency Management Act 2005*, *Bush Fires Act 1954* and other relevant legislation.
4. Integrate fire management with weed and pest animal control plans.
5. Establish post-fire monitoring sites to measure the impact of fire and to develop an understanding of ecological fire requirements of native plants and animals within the reserve.

Key performance indicators: Fire management

Performance measure	Target	Reporting
Diversity and distribution of post fire vegetation ages.	Maintain a fine-scale mosaic of post fire vegetation ages, including recently burnt and long unburnt patches that provide suitable habitat diversity for fauna such as the greater bilby.	Annually
Performance measure	**Target**	**Reporting**
Fire management guidance for the reserve that proposes fire prevention, preparedness, response and recovery measures to reduce the risk of bushfire to life, community and reserve's key values and maintain ecologically appropriate fire regime.	Fire management guidance for the reserve is developed and implemented.	Every five years

14. Weeds and pest animals

Weeds

Environmental weeds are plants that invade natural ecosystems and negatively affect the survival of native plants and animals through reducing biodiversity, competing with native species for space, light, nutrients and water, disrupting ecosystem processes, altering fire regimes, and changing and reducing animal habitat.

Within the reserve, weeds are particularly an issue in grazed areas and areas of disturbance such as along tracks, roads and railway lines. Floristic surveys in 2013 and 2014 (Markey 2017) of the Marsh Land System, which covers most of the reserve, recorded 12 weed species. The species considered significantly invasive and have the potential to occupy suitable habitats found on the Marsh are listed in Table 4.

Table 4. Significantly invasive weeds recorded within the Marsh Land System

Species Name	
Scientific name	**Common name**
Parkinsonia aculeata	parkinsonia (a prickle bush) – declared weed
Aerva javanica	kapok bush
Cenchrus ciliaris	buffel grass
Malvastrum americanum	spiked malvastrum
Rumex vesicarius	ruby dock
Solanum nigrum	black berry nightshade
Vachellia farnesiana	mimosa bush
Calotropis procera	calotropis

Note: Table 4 identifies weeds of highest priority for management, however, there is also ongoing management of declared plants which may not be included.

To prioritise the control of weeds a regionally-based *Weed Prioritisation Process*[8] will be applied. Indigenous-led weed management priorities for the reserve will also be identified to guide effective co-management. The prioritisation process focuses on weeds that pose a threat to important cultural sites and high value biodiversity assets; and weeds considered to be of high ecological impact, rapidly invasive and still at a population size that can feasibly be eradicated or contained.

Weed management for the reserve will be guided by DBCA's *Corporate Policy Statement No. 14 Weeds Management*, and take into account responsibilities to manage plants declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), which includes most *Weeds of National Significance*.

A coordinated approach is required to manage and successfully control weeds within the reserve and the region. To coordinate weed management on a regional scale, it is important to continue partnerships and projects with stakeholders and groups such as pastoralists, mining companies, Pilbara Mesquite Management Committee, Pilbara Regional Biosecurity Group and Pilbara Corridors Project. One such collaboration, the *Weed data aggregation and risk assessment for the Pilbara region* (Webber et al. 2017) project, collated weed data from hundreds of unpublished flora and vegetation reports for the Pilbara bioregion, to increase the understanding of weed distribution and abundance across the bioregion. This detailed aggregated data allows for improved weed management across the landscape and assists in identifying priority weeds for control in the reserve. The aim is to also develop a publicly available Pilbara bioregion weeds database for use in weed risk assessment.

As well as preparing and implementing weed control plans based on the priority process, it is important to develop and implement monitoring programs. These programs will monitor the

[8] The Weed Prioritisation Process (DPaW 2013) and other information on weeds, including resources on how to identify and managed weeds is available at: dbca.wa.gov.au/parks-and-wildlife-service/threat-management/plant-diseases/weeds

Removing calotropis from the Cook Pool area. *Photo – Melissa Pepper/KNAC*

Redclaw. *Photo – Melissa Pepper/KNAC*

success of weed control and detect any new incursions of weeds that are found in the region but not yet established within the reserve such as prickly pear (*Opuntia* spp.), onion weed (*Asphodelus fistulosus*), stinking passionflower (*Passioflora foetida*) and mesquite (*Prosopis* spp.). Early detection and control of weeds is important, with the control of small manageable outbreaks being a priority.

Pest animals

Pest animals are those species that have the potential to cause significant environmental, social and economic impacts on the reserve through effects such as predation, habitat destruction, competition for food and territory, introduction of disease and environmental degradation (e.g. overgrazing). Pest animals can be either native species that are impacting on natural values (e.g. from unsustainable populations) or introduced species that have become established as wild or naturalised populations. Native animals are protected under the BC Act, which places limits on the control of the pest species. The pests of most concern within the Marsh area are listed in Table 5., and to a lesser extent foxes and horses, which have been observed in the region.

Table 5. Pest animals recorded in or near Fortescue Marsh Nature Reserve and control options

Cat (*Felis catus*)
Feral cats* can be controlled with trapping (cage) and targeted shooting. Feral cats are successfully managed in the semi-arid environment through broadscale baiting programs using Eradicat® sausage baits (Comer et al. 2018). The manufactured baits are pre-injected with 1080 poison (*sodium fluoroacetate*), a naturally occurring toxin found in more than 30 species of native Australian plants, which dilutes into harmless compounds in water that are broken down quickly by bacteria in soil. From 2012, a landscape-scale aerial baiting and monitoring program across the Fortescue Marsh has been demonstrated to be an effective control method. A relatively new tool for feral cat management is the Felixer device, which is safe for use in the presence of endangered northern quolls (Dunlop et al. 2019).
European rabbit* (*Oryctolagus cuniculus*)
Rabbit control may be best achieved through: existing biological control such as the rabbit haemorrhagic disease virus (a type of calicivirus) and myxomatosis; warren fumigation and/or ripping; and/or rabbit-proof fencing at specific sites to protect important natural values or to protect rehabilitation sites. Baiting (using 1080 oat baits) may be used under strictly controlled circumstances.
Donkey* (*Equus asinus*)
Donkeys were first imported in substantial numbers in 1866 to be used as pack and draught animals in parts of WA until the 1930s, when they were replaced by motor vehicles. The unwanted donkeys were released into the wild, becoming feral and spreading across the state. Control measures for feral donkeys include aerial shooting and ground shooting. A Judas donkey program was undertaken on the Fortescue Marsh over a five-year period using 'Judas' donkeys fitted with radio collars, which helped to substantially reduce their numbers.
Feral honeybee (*Apis mellifera*)
Feral honeybees are found around permanent water, often nesting in tree hollows, especially in the *M. xerophila* tall shrubland and in woodlands of *E. victrix* and *E. camaldulensis* on the southern edge of the Marsh. They displace birds, bats, native bees (the honey of which is considered a medicinal remedy by Nyiyaparli People) and other fauna from hollows, compete for pollen and nectar, disrupt pollination services and impact fruit production and seed set in native flora. Where feral honeybee nest sites are found, the priority is management options such as fumigation, nest destruction or trapping with artificial hives.
Sailfin molly (*Poecilia latipinna*) and Redclaw *(Cherax quadricarinatus)*
The first record of an alien fish species in the Pilbara region was from a survey in 2017, and the capture of 19 sailfin molly in the Fortescue River (Thorburn et al. 2018). In 2023, Nyiyaparli Rangers recorded the sailfin molly at 22 Mile, outside the reserve in the eastern end of the Marsh. Redclaw crayfish is also a known freshwater pest in the northern regions of WA. This invasive species is spreading across the Pilbara region, with populations observed in pools adjacent to the reserve, the Upper Fortescue River and the broader catchment, including at Weeli Wolli Creek. It is of particular concern to Nyiyaparli People because of its likely impact on native fish such as spangled perch. Other potential ecological impacts include loss of aquatic plants and changes in invertebrate communities (Pinder et al 2017; Pinder et al. 2019). Further assessments of the potential impacts are required. The control of redclaw requires a coordinated landscape approach, with collaboration of relevant stakeholders and land managers. Pinder et al. (2019) states “management options for this alien species are limited in this remote area, but would require further surveys to better understand their current distribution and dispersion capability, setting up public education campaigns and targeted control measures to minimise their spread…”. Control of redclaw is through legal freshwater fishing methods including drop nets, scoop nets and pole snares (DPIRD 2020) and targeted control measures may include trapping and electrofishing (Pinder et al. 2019).

*Declared pest in WA under the BAM Act. agric.wa.gov.au/amphibians-and-reptiles/declared-animal-pests

Pest animal control is more effective with an integrated management approach, working with adjacent land managers, wherever possible, to optimise the benefits across the landscape. It is important to continue partnerships and projects with stakeholders and groups such as pastoralists, mining companies, neighbouring Traditional Owner groups, other government departments or agencies and the Pilbara Regional Biosecurity Group.

Priorities for pest animal programs will be based on their impact on important cultural sites, key assets/threatened species and feasibility of control. Pest animal control will take into account responsibilities to manage animals declared under the BAM Act.

As well as implementing control plans it is important to develop and implement monitoring programs to monitor the success of a pest animal control program and to detect any new incursions from other pest animals. Any new incursions of pest animals will be managed as a priority.

Unmanaged cattle

The reserve has a long history of pastoral land use, which included sheep grazing prior to the 1980s and more recent cattle grazing. Prior to mid-2015, the reserve was held under pastoral lease and the neighbouring pastoral properties remain subject to livestock grazing and are actively managed for beef cattle production.

Unmanaged cattle (*Bos taurus*) occur in large numbers and high densities around water (areas such as Coondiner Pool) and heavily impact the wetland, riparian zone and surrounding vegetation, especially during the dry season. Unmanaged cattle can damage cultural heritage sites and values, and contribute to the compaction and erosion of soil, and the loss of grazing-sensitive plant species. Grazing also alters vegetation structure and thus reduces habitat and food resources for native animals, and reduces vegetation cover, which can expose small native fauna to increased predation risk (Martin and Possingham 2005; Martin 2010). Indirect impacts of grazing include altered fire, nutrient and surface water flow regimes.

Strategic fencing of the reserve boundary, in conjunction with feral herbivore and unmanaged cattle management (e.g. decommissioning of water points) is a priority. Any new fences will be wildlife friendly. Barbed wire fences are to be avoided, however if barbed wire fences are constructed then bat/bird deflective/reflective devices should be installed. Consultation with neighbouring land managers/pastoral lessees about unmanaged cattle control (considering ownership), cattle mustering and stocking rates on adjoining pastoral leases will be important.

Research from sites with a history of pastoralism elsewhere suggests that ecological recovery depends on the level of grazing impacts and recovery timeframes can be quick or take many decades. For example, the species most susceptible to pastoral impacts may have long disappeared from the landscape and may not return (Watson and Novelly 2012; Legge et al. 2011; Woinarski and Ash 2002). Landscape-scale experiments involving the removal of stock are being undertaken across northern Australia to explore interactions of fire pattern with grazing regimes. Results from a study site in the central Kimberley indicate that mammal recovery after stock removal was only pronounced when fires were simultaneously managed to be lower in frequency, size and intensity (Ziembicki et al. 2015).

Pastoral operations will continue on surrounding land. Therefore incursion of livestock is a potential management issue for the reserve. A priority for management is excluding cattle from the reserve. Maintaining or realigning fences to exclude cattle from the reserve will be undertaken in consultation with neighbouring land managers/pastoral lessees.

Cattle and cattle damage near Minga Well (outside the reserve). *Photo – Grace Patorniti/DBCA*

Management objective: To minimise the impact of weeds and pest animals on the reserve.

Management strategies

1. Prepare and implement adaptive weed and pest animal control plans that consider prioritising weed and pest animal control based on the threat to the reserve's cultural and natural values and other factors including staff training, and with consideration to species listed in Table 4 and Table 5.
2. Determine the effectiveness of the release of the rabbit calicivirus by monitoring rabbit numbers and the abundance and distribution of bilbies.
3. Continue to work with neighbouring land managers to facilitate effective, coordinated management of weeds (weeds declared under the BAM Act such as mesquite and parkinsonia) and pest animals (pests declared under the BAM Act such as feral cats and rabbits).
4. Liaise with neighbouring land managers and other stakeholders in relation to the control of unmanaged cattle (considering ownership), cattle mustering and stocking rates to support more effective control.
5. Develop and implement monitoring programs for weeds and pest animals, to include early detection of priority alert or declared weeds, and new infestations and/or introductions of weeds and pest animals, and implement mitigation strategies if possible.
6. Work with other agencies and stakeholders (e.g. DPIRD, Biosecurity groups) to detect and respond to emerging biosecurity risks.
7. Decommission redundant water sources, considering animal welfare.
8. Develop and implement a Fortescue Marsh Nature Reserve Fence Plan to fence high value areas and/or the reserve boundary to protect the areas from grazing and trampling by feral herbivores and unmanaged cattle.
9. Monitor soil and vegetation condition, and native fauna populations to determine the effectiveness of the fence.

Key performance indicator: Weeds and pest animals

Performance measure	Target	Reporting
Weed and pest animal control plans.	Prepare and implement control plans.	Every two years
Presence of priority weeds.	1. Decrease in the area and/or density cover of priority weed infestations found within the reserve, especially infestations threatening cultural sites or high value biodiversity assets. 2. Local eradication of any priority weed threatening cultural sites or high value biodiversity assets.	Annually
Introduction and spread of new high priority weed species and infestations.	No new high priority weed species or infestations established in the reserve.	Annually
Presence of feral herbivores, after construction of the boundary fence.	A reduction in the presence of feral herbivores (including unmanaged cattle) following exclusion or removal as demonstrated by camera surveys.	Every two years
The improvement in soil and vegetation condition.	Construct a wildlife friendly boundary fence to reduce the impact of feral herbivores (including stray cattle).	Every five years

15. Climate change

The reserve is in a semi-arid region and experiences a desert climate of hot, dry summers, mild winters and low rainfall. Climatic data recorded from the Wittenoom weather station (Site No. 5026) for 1949-2019 showed that the mean minimum temperature ranged from 11.6°C in July to 26.0°C in January and the mean maximum temperature ranged from 24.3°C in July to 39.8°C in December (BoM 2022). The data recorded from the Marillana weather station (Site No. 5009, located about 20km south of the Marsh) showed a mean annual rainfall (1936-2020) of 324.1mm falling mainly between December and March (BoM 2022) but was highly variable between years. Climatic conditions are influenced by tropical cyclone systems that predominate between January and March. Most rainfall that occurs during these months is associated with cyclone and thunderstorm activity.

The biennial *State of the Climate* report (BoM and CSIRO 2022) draws on the latest climate research to describe continuing trends for Australia's climate, with the key trends including: northern Australia experiencing above average rainfall during the northern wet season (October-April); and heavy rainfall events associated with flash flooding becoming more intense.

Management strategies outlined in this plan aim to increase the resilience of species and ecosystems and decrease their vulnerability to a changing climate. Uncertainty about appropriate responses to the effects of climate change means that removing or minimising other pressures (e.g. bushfires, weeds and pest animals) is likely to be one of the best available options to conserve biodiversity in the immediate future. In some cases, the impacts from these pressures may far exceed those of climate change.

Climate vulnerability assessments and research will be important in better understanding climate change impacts at a species and community level, and management of the reserve should be adapted based on up-to-date information.

Management objective: To minimise the effects of climate change on the reserve's key values.

Management strategies

1. Consider up-to-date climate change information as it becomes available, and incorporate this into adaptive management strategies at the regional, community and species level.
2. Continue fire, weed and pest animal management programs to increase the reserve's ability to cope with future disturbances, including climate change.
3. Undertake and encourage research on the vulnerability of key habitats and values to climate change and, if necessary, identify additional indicators to monitor the effects of a changing climate.

Fortescue Marsh Nature Reserve with Hamersley Range in the background. *Photo – Steve Dillon/DBCA*

16. Visitor planning

DBCA's *Corporate Policy Statement No.18 – Recreation, Tourism and Visitor Services* and related guidelines outline the principles, operational guidelines, procedures and administrative arrangements in relation to facilitating recreation and tourism in conservation reserves across the State.

The reserve is mostly inaccessible to the public and currently there are no visitor facilities. Informal camping occurs around the Marsh, with Coondiner Pool being a known overnight stop for travellers as it is easily accessible by the Munjina-Roy Hill Road. No formal data regarding visitor numbers has been collected to date.

During the life of the plan, visitation to the reserve will be investigated and any proposed visitation and activities in the reserve must be compatible with the reserve's purpose of 'conservation of flora and fauna' and not adversely impact the cultural and natural values of the reserve.

Visitor planning must also ensure any proposed visitor areas do not restrict Nyiyaparli People's ability to access Country and carry out customary activities.

Visitor safety and information

The management of risks to visitors' safety on CALM Act lands is through the ongoing implementation of a visitor risk management program (*Corporate Policy Statement No. 53 Visitor Risk Management*).

There is an inherent risk in going to remote areas. The risks include dehydration, slips/trips, snakes and bushfire. Many visitor risks can be overcome through attention to personal safety (such as the registration of trip details with friends or family) and appropriate risk warning information.

Visitor information raises awareness about the reserve and its values, promotes support for its management, and encourages appropriate behaviour. Communication is also vital to managing visitor risk so that visitors have safe experiences.

Commercial operations (leases and licences)

Proposed concessions (licences and leases) must be consistent with the purpose of the reserve, the protection of its values and the plan's objectives.

Licences allow commercial operators to enter and use the reserve to conduct activities such as guided walks and tours, or for non-commercial purposes such as research organisations to undertake scientific monitoring. Leases allow the lessee to occupy land for commercial services that need exclusive rights of access and substantial infrastructure. Any proposed concession will be considered on a case-by-case basis.

Management objectives: To investigate and monitor visitor use and impact on the reserve's cultural and natural values.

To increase visitors' awareness, understanding and appreciation of the reserve and its management through the provision of appropriate information.

Management strategies

1. Plan and implement a monitoring program to gain better understanding of visitor use and impacts, especially around Coondiner Pool.
2. Ensure any proposed visitation to the reserve is compatible with the reserve's purpose of 'conservation of flora and fauna' and does not adversely impact the cultural and natural values of the reserve.
3. Consider appropriate information for visitors to the reserve, including visitor safety.
4. Evaluate, consider, and [if granted] manage, proposed leases and licences consistent with DBCA policy and guidelines, Nyiyaparli cultural safety protocols, licence/lease conditions, plan objectives, the purpose of the reserve, and the protection of key values.

17. Access

Visitor access

The remoteness of the reserve restricts access to the reserve. One public road, Munjina-Roy Hill Road, traverses the southern section of the reserve. During the life of the plan, visitor access to the reserve will be investigated.

Other access

The reserve does not currently have adequate access, which hinders Nyiyaparli People's ability to enter the reserve for cultural purposes and management activities. Establishing formal access to the reserve is a priority. Existing access tracks that are no longer needed for management purposes may be closed and rehabilitated to deter unauthorised use.

Where appropriate, work will be undertaken with relevant adjacent land managers or tenure holders to develop cross-tenure access protocols and document access routes to the Marsh so that practical access is maintained at all times.

Off-road vehicles are not permitted to operate in the reserve, except under exceptional circumstances (such as four-wheel drive bikes for research or monitoring purposes with lawful authority).

Anyone accessing the reserve, shall only do so in accordance with KNAC's 'Working on Nyiyaparli Country Guidelines'.

Management objective: To provide and maintain safe and structured access that minimises impacts on the reserve's key values.

Management strategies

1. Map and assess existing access tracks and determine their priority for management, customary activities and public access. Those that are not required should be closed and rehabilitated.
2. Investigate access requirements within the reserve for management, customary activities and other purposes [liaising with relevant adjacent land managers if cross boundary management applies]. Provide and maintain access [consistent with the DBCA road classification system (types and category)] where required.
3. Identify and rehabilitate eroded sections of tracks, cutlines, cleared areas and water points that are located outside of areas containing authorised development infrastructure.
4. Prohibit the use of 'off-road vehicle' as defined under the *Control of Vehicles (Off-road Areas) Act 1978* in the reserve, except where formal approval is obtained.

Using resources from *Yurlu* (sustainable economic and resource use)

18. Mineral exploration and development

There are several tenements adjacent to the reserve, where there are numerous, significant mineral deposits[9]. Any applications for mining tenements and mining proposals within or adjacent to the reserve will be assessed/processed under the Mining Act or EP Act and notified under the Native Title Act.

The reserve is adjacent to several operating mines, granted mining leases and extensive mineral deposits that are prospective for iron ore.

Existing and prospective mines

Existing mining and infrastructure adjacent to, or within the reserve, is based on activities and plans approved under the EP Act and where relevant authorisations under Mining Act and/or State Agreements. Several active mining operations adjacent to the reserve have ministerial conditions attached to them and companies are required to comply with conditions to ensure sustainable operations and the long-term environmental protection and management of the Marsh. The active mining operations include Roy Hill (Ministerial *Statement No. 1189*) and Marillana (Ministerial *Statement No. 855*), and Cloudbreak and Christmas Creek, which are detailed as follows.

Cloudbreak iron ore mine

The existing Cloudbreak Iron Ore Mine is located close to the boundary of the reserve. The area is subject to the *Iron Ore (FMG Chichester Pty Ltd) Agreement Act 2006* and *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004,* which are State Agreements between the State Government of Western Australia and Fortescue and outline the rights, obligations, terms and conditions for the development of the projects. For the parts of the reserve that are the subject of existing or potential future rights under State Agreements, DBCA acknowledges the existence of such rights and the State's obligations associated with them. The management of the reserve will be subject to the rights of the proponents and the obligations of the State under the relevant State Agreements and Ministerial Statements and other approvals under the EP Act that apply to mining developments near to or otherwise affecting the reserve.

Fortescue operates its Cloudbreak iron ore mine to the north of the reserve. Ministerial *Statement No. 899 – Cloudbreak Life of Mine, Pilbara* outlines the conditions associated with the conservation significant vegetation, flora and fauna and groundwater levels associated with the Marsh. The environmental offsets package that applies to Cloudbreak included land acquisition and a commitment by Fortescue to provide adequate funds to the then Department of Environment and Conservation (now DBCA) within three years following the commencement of mine operations. These would be to enable the purchase of lands (including the area nominated for conservation in the 2015 pastoral lease exclusions process) and extensions to the Fortescue Marsh Reserve system, for addition to the conservation estate. This is in recognition of the conservation importance of the Fortescue Marsh to WA and the potential for this area to be listed as a Ramsar wetland in the future.

[9] To view various resources datasets, including operating mines, mining tenements and mineral deposits [and for basic raw materials, to view the datasets for Extraction Sites and Significant Geological Supply areas] see GeoVIEW.WA online interactive mapping system.

Associated offset funds were also provided for weed management and pest animal control in the Marsh and for research projects to improve the understanding of local conservation values, in particular the night parrot and greater bilby. Much of this work has been implemented or is continuing to be implemented. The ongoing priorities are contained in this plan. Another condition of environmental approval for the Cloudbreak iron ore mine was the requirement for Fortescue to provide funding to DBCA for the fencing of ex-pastoral lease lands within the Marsh.

Christmas Creek iron ore mine

Fortescue also operates the Christmas Creek Iron Ore Mine, located north of the reserve and east of the Cloudbreak mine. This mine and the associated east-west railway operate under Ministerial *Statement No. 1033 – Pilbara Iron Ore Infrastructure Project (Christmas Creek Mine, East-West Railway and Mindy Mindy Mine).* This Ministerial Statement includes conditions associated with conservation significant flora, vegetation and fauna, subterranean fauna, hydrological processes and inland water quality, rehabilitation and decommissioning. The offsets package associated with this Ministerial Statement provide funding for operational work to conserve and protect values of the plan area and the development of the *Fortescue Marsh Management Strategy 2018*, which is superseded by this plan.

In 2012, the EPA approved the expansion of the Cloudbreak mine. Until that time, environmental offsets were determined on a case-by-case basis. However, the State Government recognised the need for a strategic, more coordinated way of allocating funds from environmental offsets. Consequently, offsets determined from conditions under this project and other subsequent resource and infrastructure developments may be pooled in the Pilbara Environmental Offsets Fund (the Fund). Contributions to the Fund are used to implement biodiversity projects that counterbalance the significant residual impacts of developments at a landscape level. The biodiversity projects chosen are based on existing conservation priorities and strategies and action plans for the Pilbara region. The Fund also provides additional resources to implement fire and visitor use management and more research and survey work.

Interaction of State Agreements with the reserve

Section 4 of the CALM Act provides that, subject to specific limited exceptions, nothing in the CALM Act shall derogate from the operation of any State Agreement or the Mining Act. However, resource development within and proximate to the reserve, whether by proponents under the State Agreements or otherwise, are subject to the requirements of the EP Act.

This plan, the ILUA and the JMA all acknowledge the potential for activities for, or related to, resource development within the reserve, in connection with the rights and interests held under or for the purposes of any State Agreements or the Mining Act.

The ILUA and JMA provide for the reserve to be jointly managed by KNAC and the CEO (DBCA) in accordance with this plan. They also acknowledge that joint management must not derogate from any existing or future rights and interests held under or for the purposes of State Agreements (as amended over time) and the Mining Act, and any activities on the reserve pursuant to such rights and interests.

Management actions on the reserve under this plan are consistent with the rights and interests of the proponents under their State Agreements, the Mining Act and any applicable Ministerial Statements under the EP Act.

Access to the reserve

In accordance with current Ministerial Statement conditions under State Agreements, mining companies are required to monitor (and manage) any changes (e.g. to groundwater, flora and vegetation, and fauna) that may impact the condition or conservation values of the Marsh. As a result, State Agreement proponents require access to locations within the reserve and the ability to implement monitoring and/or management measures to comply with their environmental obligations.

This plan supports the necessary environmental management and monitoring activities that are required in accordance with environmental approvals under the EP Act and does not include additional requirements over and above those stipulated by ministerial conditions.

Access and use of the reserve for environmental management and monitoring activities, including the installation and management of groundwater reinjection bores and water monitoring, may be accommodated through miscellaneous licences granted pursuant to the Mining Act or the State Agreement Act. Mining tenements will support mining related activities on the reserve required under the relevant Ministerial Statements that are consistent with or may be undertaken more consistently with achieving the conservation purposes of the reserve.

Basic raw materials

Basic raw materials such as sand and limestone should be preferentially sourced from outside the conservation reserve. However, the remote nature of the reserve makes it difficult to source these materials from elsewhere. Therefore, sourcing basic raw materials from within the reserve for use within the reserve's boundary for joint management partners' management operations (such as constructing vehicle tracks) may be considered if it is not feasible to bring in the material from elsewhere. Any proposals for extracting basic raw materials will be subject to the Commission's *Position Statement No. 12 Basic raw materials: State government and local government access to lands vested in the Conservation Commission* (under review) and relevant regulatory requirements, including the Aboriginal Heritage Act.

Management objective: To minimise the impact of mineral exploration and development on the reserve's key values.

Management strategies

1. Work with Department of Mines, Petroleum and Exploration, Department of Energy and Economic Diversification, Department of Water and Environmental Regulation (DWER) and EPA to provide advice on the potential impacts of development proposals on the reserve's key values and overall integrity of the reserve, and to provide advice on avoidance, minimisation and mitigation measures.
2. Where relevant, provide advice to industry operators and regulators on environmental management plans/programs, mine closure plans and related documents.
3. Assess, refer or recommend referral of exploration or development proposals with the potential to have a significant environmental impact on the reserve to the EPA for consideration of assessment under the EP Act.

19. Use of native plants

Firewood collection

Firewood collection is not allowed within the reserve unless for customary purposes (see section 7 **Nyiyaparli cultural heritage**). All firewood must be brought in by visitors, or they can bring and use their own gas fuel cookers, unless a total fire ban has been declared.

Wildflowers and other native plants

Taking of native plants (including flowers, seeds, whole plants, timber) from the reserve is not permitted, unless done under a lawful authority. Licensing arrangements apply to taking, supplying, processing and dealing in native flora. Various licences apply, such as licences for commercial purposes or inventory work (collecting specimens for identification purposes).

The collection of native seed may occur within the reserve with an appropriate flora licence, where Nyiyaparli People, community groups, farmers, mining companies and nurseries use native seed for revegetation, rehabilitation and propagation projects. Florabank's *Guidelines* are the Australian benchmark for best practice for seed collection and use, and the associated *Model Code of Practice*, if adopted, assures responsible and sustainable seed collecting practices, such as, collecting no more than 20 per cent of the fruit and removing no more than 10 per cent of plant material on any individual plant.

Bush tomato. *Photo – Vicki Long*

Vicks bush. *Photo – Vicki Long*

Bush plants (*marta* and medicinal plants)

Nyiyaparli People have the right to use bush plants (and animals) for cultural purposes such as food (*marta*) and natural medicine (see section 7 **Nyiyaparli cultural heritage**).

There is a need to protect the traditional knowledge and plant resources associated with bush plants in the light of the demand in biotechnology and genetic engineering, hospitality and health industries and as researchers, universities, companies and scientists seek to experiment and innovate using plants. Any use of traditional knowledge and/or plant resources (including genetic material) from the reserve will require approval from DBCA and prior informed consent from traditional knowledge holders.

Beekeeping

DBCA administers an apiary authority system that allows professional and recreational apiarists to gain access to land managed by DBCA under the CALM Act and certain other Crown lands (unallocated Crown land and pastoral leases) for the purpose of beekeeping activities. DBCA's *Corporate Policy Statement No. 41 Beekeeping on Crown Land* and *Corporate Guideline No. 21 Beekeeping on Crown Land* provide guidance on the management of beekeeping.

No sites will be permitted within the reserve due to its significant cultural and natural values.

Management objective: To facilitate the sustainable use of native plants and animals, and ensure that the use is consistent with maintaining the cultural and natural values of the reserve.

Management strategies

1. Ensure any use of traditional knowledge and/or plant resources (including genetic material) is only by departmental approval and prior informed consent from the traditional knowledge holders via KNAC.
2. Prohibit firewood collection within the reserve, unless for customary purposes.
3. Manage the taking and public use of native plants in accordance with relevant legislation, policies and guidelines, codes of practice and licensing systems.
4. Exclude new beekeeping activities from the reserve.

20. *Papa* (water) resources

Through the *Water Agencies (Powers) Act 1984*, DWER leads water resource management in WA by coordinating cross-government efforts to protect and manage water resources and water quality. Other water legislation also supports the sustainable management of water resources.

Water abstraction

The *Rights in Water and Irrigation Act 1914* provides for the regulation, management, use and protection of water resources through a licensing system for taking water and a permit system for activities that may damage, obstruct or interfere with water flow or the beds and banks of watercourses and wetlands in proclaimed rivers, surface water management areas and irrigation districts.

The proclaimed areas covering the reserve are the Pilbara Surface Water Area and the Pilbara groundwater area. The Hamersley-Fortescue aquifer sits under and feeds the Marsh and is part of the Pilbara groundwater area (DoW 2013). The proclaimed Pilbara groundwater area covers the reserve and water usage in the area is guided by the *Pilbara groundwater allocation plan* (DoW 2013). DWER's approach to allocation and licensing for the Pilbara region is set out in the Pilbara groundwater allocation plan (wa.gov.au/service/natural-resources/water-resources/pilbara-groundwater-allocation-plan).

Proponents of proposals for water abstraction from surface and ground waters from proclaimed areas need a licence from DWER. To be licensed, the proponent also needs approval to access the land for abstracting water. To take water from CALM Act lands, lawful authority is also required. For access to CALM Act lands, DBCA may, after consultation with the JMB and the Commission and approval from the Minister for Environment, issue a permit to authorise access. Where infrastructure is needed, a lease may also be issued.

Management objective: To minimise the impact of *papa* resource use on the key values.
To improve understanding of the ecological water requirements of the Marsh ecosystems.
To support a catchment management approach to maintain and protect natural surface and groundwater regimes and the hydrological values of the reserve.

Management strategies

1. With a focus on management needs, encourage more research and monitoring to:
   - review and update hydrological models of the reserve
   - improve understanding of the ecological water requirements of species and communities on the Marsh and
   - determine the extent of the cumulative hydrological impacts of approved and proposed developments and activities and adapt management accordingly.
2. Support the continued monitoring of surface and ground water flow and water quality by key stakeholders (e.g. mining companies, DWER) within and adjacent to the reserve. Support and encourage the sharing of the monitoring data.
3. Assess, collate and incorporate monitoring data relating to the hydrology of the reserve into the operational management, performance assessment against the objectives of this plan and adapt future management where appropriate.
4. Liaise with relevant water resource stakeholders and monitor activities to ensure that water use complies with conditions of approval.
5. Ensure water resource use operations consider the responsible management of fire, weeds and pest animals.

21. Public utility services

There are currently no public utility services (such as electricity, communications, water) within the reserve. There is private utility infrastructure associated with mining operations within and adjacent to the reserve. Utility infrastructure that is not servicing the reserve itself should be located outside the reserve. When this is not possible, the use of already degraded areas, pre-existing corridors or co-location with existing infrastructure is preferred.

This plan does not restrict access for providers to maintain utility services or associated infrastructure, however, permission is needed for access. Access to, and maintenance of infrastructure must consider the reserve's cultural and natural values. Access can lead to the spread of weeds and disease and therefore appropriate hygiene practices must be employed.

Moon over Coondiner Pool. Photo – *Melissa Pepper/KNAC*

Understanding *Yurlu* (evaluation, monitoring and research)

22. Performance monitoring and evaluation

The management objectives and strategies define the management direction for the reserve and are complemented by key performance indicators (KPIs). The KPIs (comprising target, performance measure, and reporting requirement) have been identified for selected key values and management issues and are presented throughout this plan. The KPIs reflect the highest conservation and management priorities. KPIs have been identified for the following sections of the plan:

- Section 6 Joint management
- Section 7 Nyiyaparli cultural heritage
- Section 11 Native plants and vegetation communities
- Section 12 Native animals and habitats
- Section 13 Right-way fire
- Section 14 Weeds and pest animals.

The JMB will provide strategic input into how management strategies are implemented and monitor implementation of the plan. Monitoring and evaluating the outcomes of management strategies and reporting against KPIs allows the implementation of the plan and management effectiveness to be assessed. This outcome-based approach provides a robust framework to support adaptive management of the reserve.

Monitoring should also include measurement of pressures, so that the condition of the value can be linked to impacts from natural or human influences. Linking cause-effect relationships is a key requirement of effective monitoring and is needed for evidence-based adaptive management. If there are declines in key values then knowing why (natural variation, climate change or local human pressures) will assist in determining whether a management response will be effective in mitigating the impact.

The Commission is responsible for conducting the periodic assessments of this plan in accordance with section 19(1)(g)(iii) of the CALM Act. Joint management partners will provide information to the Commission on request to enable an assessment of the plan's implementation as well as an assessment of how the plan is performing against the management objectives. Assessment is an important component of an adaptive management framework and can identify opportunities for improvement and signal where management may need to be altered if it is not successfully meeting the management objectives. A portfolio of evidence (such as quantitative data, photographs or imagery which show any spatial and temporal changes, or other written documents) will be maintained to help demonstrate management implementation and outcomes.

Management objective: To monitor and report on the implementation of this plan to track its effectiveness in meeting its objectives.
Management strategies 1. Monitor the KPIs and collate and report findings to the JMB and the Commission. 2. Assess and report on the overall effectiveness of the management of the reserve.

23. Research

Research is important to enable informed decisions on reserve management, and to successfully implement and determine the effectiveness of this plan. This will require integration, coordination and information sharing between joint management partners and government agencies, mining companies, universities, and other researchers and research organisations.

Cross-cultural, collaborative research provides an opportunity for western scientists to support and follow Indigenous research partners and engage in right-way research or science (McKemey 2022). It is a collaborative process of bringing Indigenous and western scientific knowledge and methods together to create ethical, productive and mutually beneficial research (McKemey 2022).

Research leads to improved knowledge and better understanding of the values and management issues of the reserve. Well-designed research is an essential component of adaptive management and improves management of the reserve. Research that provides valuable scientific and cultural knowledge to inform and improve management of the reserve will be prioritised.

Addressing gaps in knowledge will include (but not be limited to):

- collection of traditional ecological knowledge to inform management of the Marsh
- vegetation surveys and mapping of communities outside the Marsh Land System
- hydrological models of the reserve, the ecological water requirements of significant flora and vegetation communities in the Marsh and the extent of cumulative hydrological impacts of adjacent development projects
- surveys of culturally important and conservation significant fauna, in particular, the night parrot and greater bilby
- survey of aquatic species (e.g. invertebrates and fish) that use the Marsh
- fire management of the reserve, in particular:
  - using fire as a weed management tool
  - the interaction between fire, weeds and introduced predator behaviour
  - species and communities that require specific fire regimes and
  - changes in habitat diversity and structure associated with changes in fire regimes.
- the vulnerability of habitats and key values to the impacts of climate change
- visitor use of the reserve
- improved knowledge of feral herbivore behaviour, distribution and management and interactions between different species of pest animals (especially introduced predators) to inform control management; and
- improved knowledge of methods for the control of priority weed species (e.g. *Parkinsonia*) and impacts to the landscape.

Across WA, considerable time, money and effort is spent each year by mining and consulting companies collecting biodiversity data that supports environmental impact assessments under the EP Act. The data collected has contributed significantly to the knowledge and understanding of biodiversity values and systems within and outside the reserve. DWER in collaboration with the Western Australian Biodiversity Science Institute (WABSI) has developed the Index of Biodiversity Surveys for Assessment (IBSA) to capture and consolidate this biodiversity data and make it publicly available. IBSA was launched in May 2018 (see dwer.wa.gov.au/ibsa) and data associated with land-based biodiversity survey reports submitted to DWER, EPA and Department of Mines, Petroleum and Exploration under the EP Act are required to be submitted to IBSA. IBSA is of great value in contributing towards a better understanding of the Marsh and its management.

Another data repository is Dandjoo (see bio.wa.gov.au/). The Biodiversity Information Office developed this whole-of-state biodiversity data platform, which includes an online data submission portal and a map-based interface for data users. Dandjoo sources and provides data from a range of industry, research and government providers.

WABSI has also developed the Shared Environmental Analytics Facility (SEAF) project (wabsi.org.au/our-work/projects/seaf/) as part of its Biodiversity Data and Information Management Program. SEAF is a mechanism to draw on environmental data in portals and repositories for generating information products such as maps for use in research and decision making.

Management objective: To increase knowledge and understanding of the reserve's key values and management issues to inform and improve management.

Management strategies

1. Support, encourage, record and where necessary undertake research that facilitates management, establishes baseline information and contributes to management objectives, and adapt future management where appropriate.
2. Work with research organisations to facilitate greater sharing of research findings about the reserve between the joint management partners and mining and consulting companies, State Government agencies and other stakeholders, and to provide data to centralised databases or data platforms where appropriate.
3. Develop partnerships and programs with universities, and other external researchers and research organisations to encourage research projects that fill priority knowledge gaps.
4. Ensure relevant information gained through research in the reserve is available to joint management partners for management purposes.
5. Develop and implement a research program that:
   a. provides for the implementation of research priorities identified in this plan
   b. standardises data collection methods and mapping to help identify trends
   c. specifies outcome-based evaluation methods
   d. uses appropriate control sites and
   e. communicates the outcomes of high priority research projects to external groups and organisations.
6. Explore opportunities to integrate traditional knowledge with contemporary science programs and for Nyiyaparli People to participate in western science projects, with the provision of training and to encourage the uptake of traditional management knowledge.

Prescribed burning at the Marsh in 2023. *Photo – Noel Taylor/KNAC*

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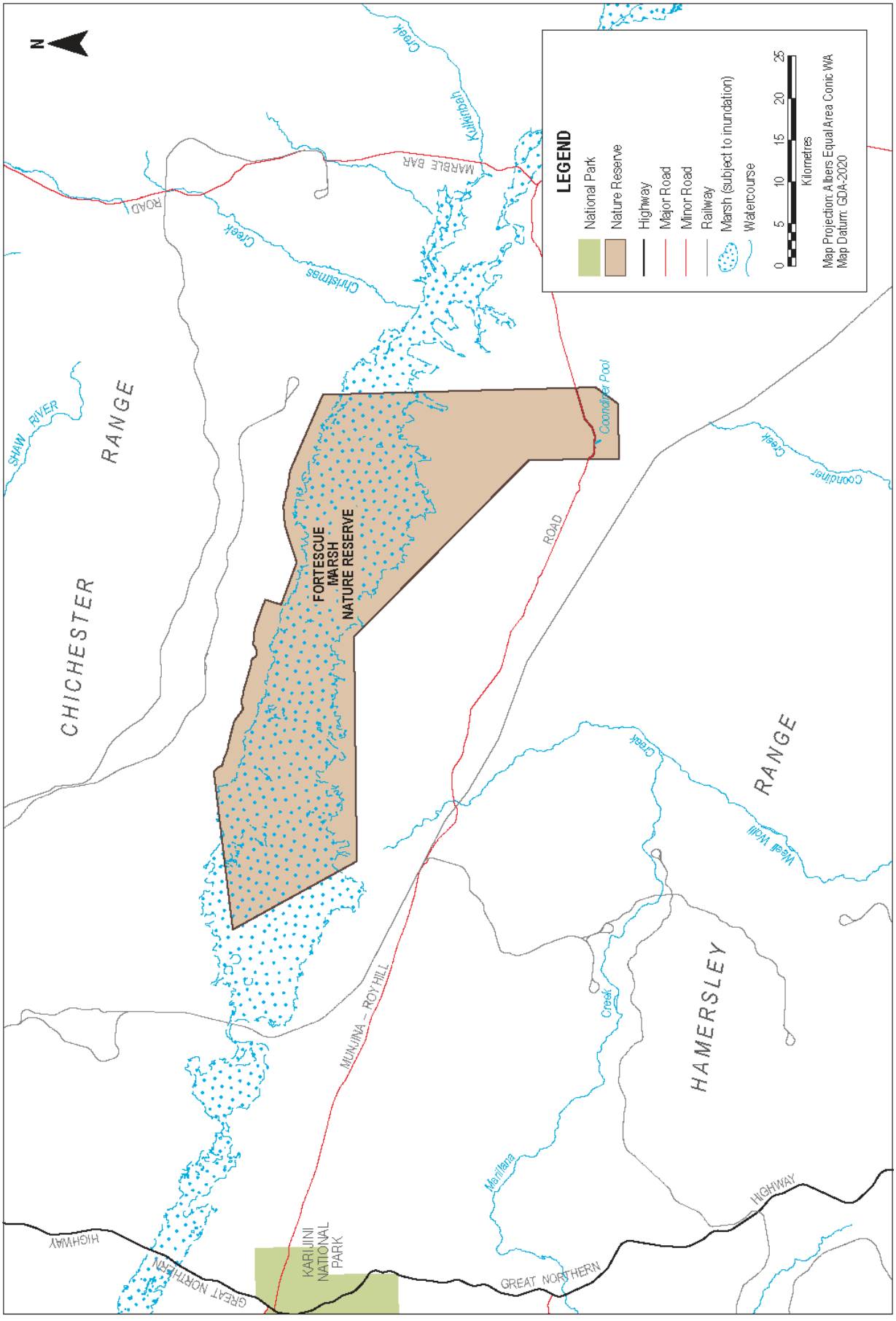
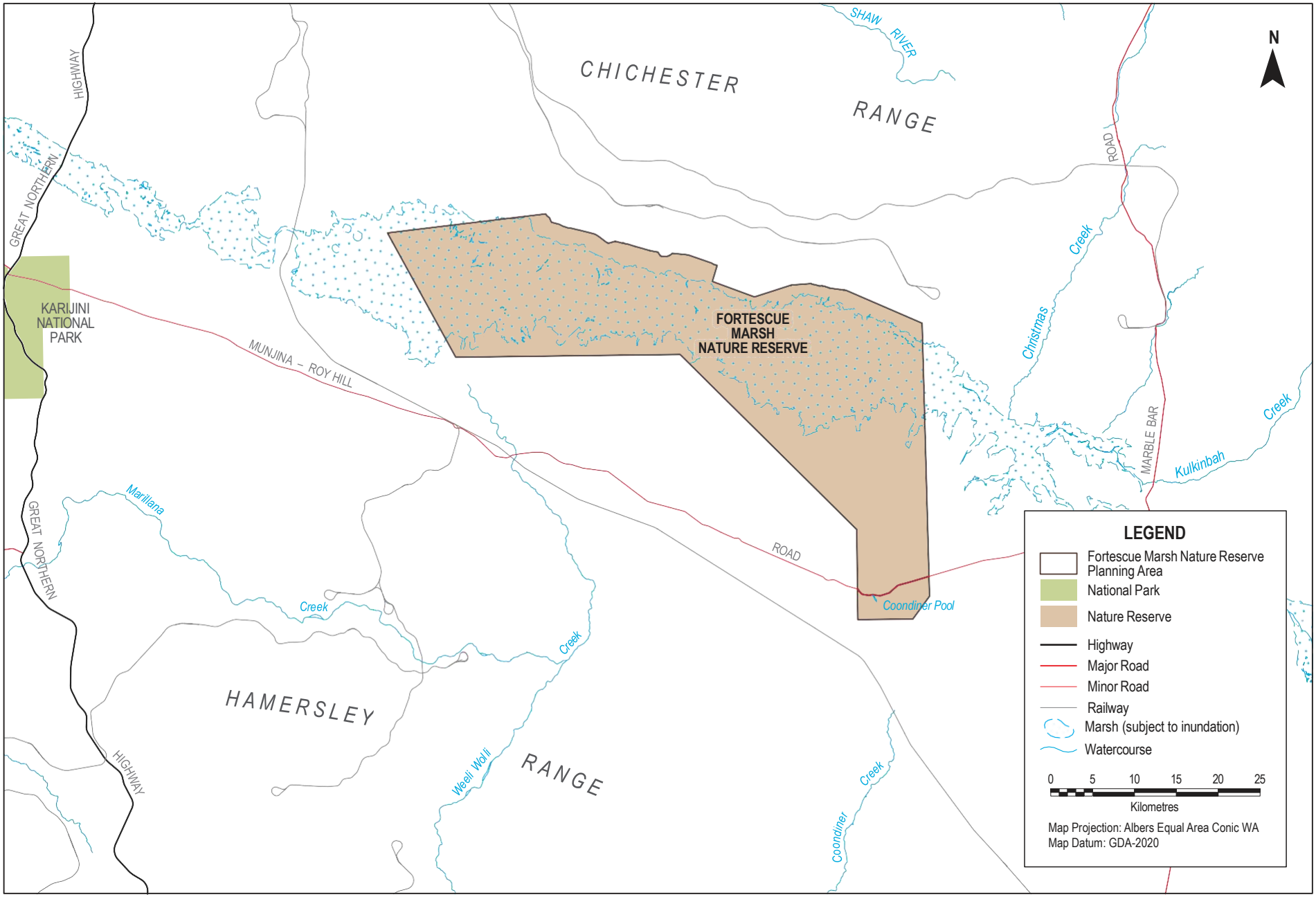
A chatter of native budgerigars in the southern area of Fortescue Marsh Nature Reserve. *Photo – Melissa Pepper/KNAC*

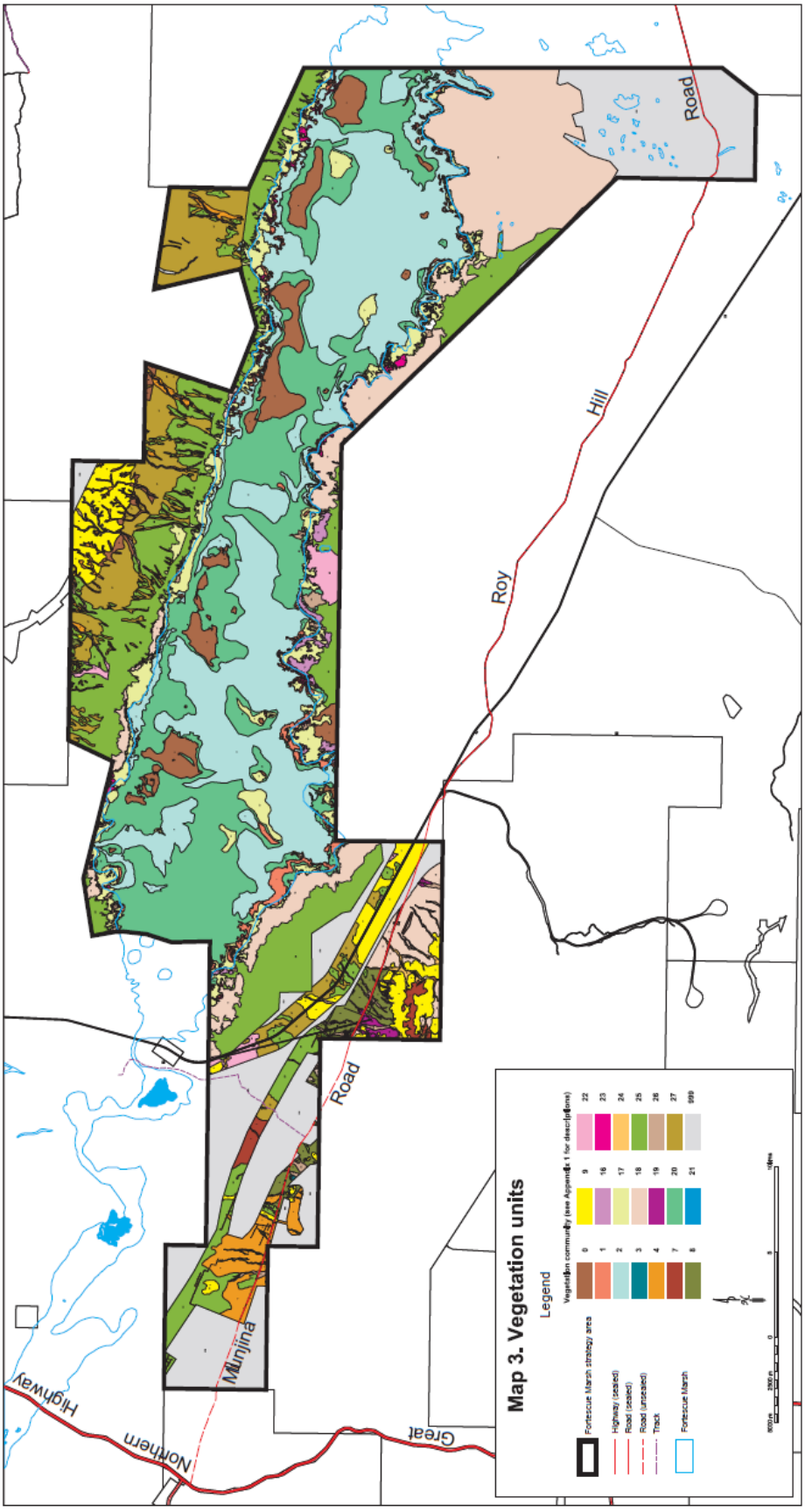
Map 2. Fortescue Marsh Nature Reserve: Plan area




N
CHICHESTER
RANGE
SHAW RIVER
HIGHWAY
GREAT NORTHERN
KARIJINI
NATIONAL
PARK
FORTESCUE
MARSH
NATURE RESERVE
MUNJINA – ROY HILL
ROAD
Christmas
Creek
MARBLE BAR
Kulkinbah
Creek
Marillana
Creek
Coondiner Pool
HAMERSLEY
RANGE
Weeli Wolli
Creek
Coondiner
Creek
LEGEND
Fortescue Marsh Nature Reserve Planning Area
National Park
Nature Reserve
Highway
Major Road
Minor Road
Railway
Marsh (subject to inundation)
Watercourse
0 5 10 15 20 25
Kilometres
Map Projection: Albers Equal Area Conic WA
Map Datum: GDA-2020

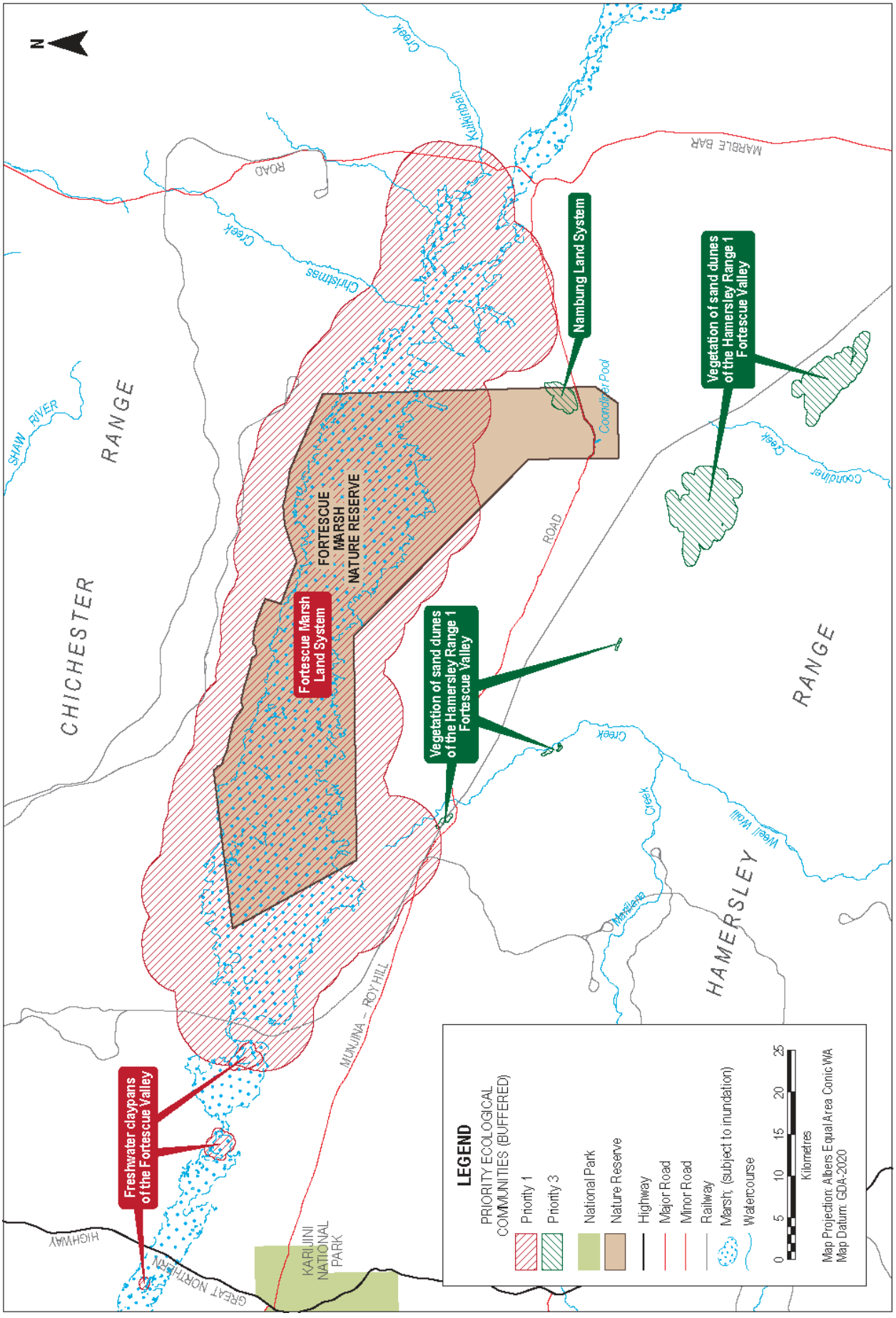
Map 3. Fortescue Marsh Nature Reserve: Vegetation units

Refer to Appendix 1 for the descriptions of the Vegetation Community codes.



Source: *Fortescue Marsh Management Strategy 2018-24*

Map 4. Fortescue Marsh Nature Reserve: Priority ecological communities



Appendix 1. Vegetation communities of the Fortescue Marsh

Vegetation community code – as shown on Map 3	Vegetation community description
0	Unvegetated landforms – Koodaideri Spring mosaic, bare lake bed, cleared or disturbed area, creeklines, freshwater channels, gypsum hillocks, narrow gorges, alluvial/colluvial fans or water.
1	Chenopod and samphire shrubland over tussock grasses
2	Chenopod and samphire shrubland
3	Hummock grassland
4	Mallee shrubland over shrubland over hummock grassland
7	Open *Eucalyptus* woodland over mallee shrubland over hummock grassland
8	Open *Eucalyptus* woodland over mallee shrubland over shrubland over hummock grassland
9	Open *Eucalyptus* woodland over shrubland over hummock grassland
17	Open shrubland over chenopod and samphire shrubland
18	Open shrubland over hummock grassland
19	Open shrubland over tussock grassland
20	Samphire shrubland
21	Shrubland over chenopod shrubland over hummock grassland
22	Shrubland over chenopod shrubland over tussock grassland
24	Shrubland over tussock grassland and scattered hummock grasses
25	Open Mulga woodland over shrubland over chenopod shrubland/hummock grassland
26	Open *Eucalyptus* woodland over shrubland over tussock grassland
27	Mulga woodland over shrubland over tussock grassland
999	No data

Source: *Fortescue Marsh Management Strategy 2018-24*