Department of the Chief Minister and Cabinet

Environmental Approvals Jabiru Power Station

26 March 2021

CDM Smith

Executive Summary

The Northern Territory Government, via the Department of the Chief Minister and Cabinet (CM&C), has finalised a major procurement process and selected Energy Developments Pty Ltd (EDL) as the private sector proponent to build, own and operate a new hybrid power station (diesel and solar) and supply electricity to the township of Jabiru through a long-term contract (the Project). The proposed location for the Project consists of an unused portion of Lot 2303 and disturbed areas adjacent each side of El Sherana Road (Lot 1428) in the industrial area of Jabiru township.

This Project is a key commitment by the Northern Territory Government under the Memorandum of Understanding on the Future of Jabiru Township (MoU) signed by the Commonwealth of Australia (the Commonwealth), the Northern Territory Government, Energy Resources of Australia (ERA) and Gundjeihmi Aboriginal Corporation (GAC) in August 2019. The MoU supports the Mirarr traditional owners' vision for the post-mining future of Jabiru as a vibrant and sustainable National Park town, tourism hub and regional services centre at the heart of Kakadu National Park (Department of the Chief Minister, 2019).

As the only town within the boundaries of Kakadu National Park (Kakadu), the MoU parties recognise the importance of Jabiru's future role in revitalising the region as an iconic sustainable tourism destination with dual World Heritage listing for environmental and cultural values. The MoU also supports a shared policy priority between the Northern Territory Government and the Commonwealth to empower Aboriginal traditional owners to pursue economic and social development through the granting of Jabiru as Aboriginal Land under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth). The two governments have committed a total investment of $351 million in the future of Jabiru and Kakadu (Department of the Chief Minister, 2019). Jabiru also houses Parks Australia's headquarters for its Kakadu operations.

The current power supply for Jabiru is provided by ERA via aging diesel generators that are part of the Ranger Uranium Mine. The mine entered its closure phase from 8 January 2021 and continued electricity supply from ERA's ageing generators is not an option in the medium to long-term. CM&C has an agreement with ERA to provide electricity to Jabiru until 31 December 2021. No guarantee of electricity supply beyond this date is in place.

The development of a new hybrid power station is critical to ensuring ongoing power supply for the town and will improve both Jabiru and Kakadu's sustainability and carbon emissions profile, by incorporating a minimum 50% renewable energy component. This is expected to reduce average annual carbon emissions of the power generated for Jabiru township by up to 54%, when compared with the existing diesel-only generation. The reduction in carbon emissions also supports the Mirarr traditional owners' vision for Jabiru as a sustainable tourism town and is consistent with the Northern Territory Government's renewable energy target of 50% by 2030 (Northern Territory Government, 2021).

The action is being referred to the Northern Territory Environmental Protection Authority (NT EPA) for consideration under section 48 of the *Environmental Protection Act 2019* (EP Act). This document provides the supporting information for the referral and has been prepared with reference to the guideline document *'Referring a Proposed Action to the NT EPA: Environmental impact assessment guidance for proponents* (2021).'

The proposed Project footprint consists of 15.28 hectares (ha) situated in the northern portion of Lot 2303 and 4.8 ha of largely disturbed areas adjacent each side of El Sherana Road (Lot 1428). The total Project area is 20.08 ha. Lot 2303 is freehold title held by the Director of National Parks and leased to the Jabiru Town Development Authority until 30 June 2021. Jabiru Township (including the Project area) is in the process of transfer to the Kakadu Aboriginal Land Trust pursuant to the Aboriginal Land Rights (Northern Territory) Amendment (Jabiru) Bill 2020 (Cth). Once this occurs, the site will become Aboriginal land subject to a township lease (or head lease) between the Northern Land Council and the Gundjeihmi Aboriginal Corporation (Jabiru Town) lease entity (GACJT).

Lot 2303 covers an area of 32.43 ha and is positioned at the north eastern corner within Jabiru township boundary. The Project area within Lot 2303 is zoned for Utilities, while the supporting utility lines for power, water, sewer and

telecommunications will follow an existing parcel covering El Sherana Road and traverse land zoned for Community Purpose, Public Open Space and Industrial uses under the Jabiru Town Plan 2019. The Project footprint in the northern portion of the Lot 2303 is bounded by a landfill to the west and treated effluent irrigation area in the southern portion of the Lot 2303. To the north and east are undisturbed portions of Kakadu. The Project area on Lot 2303 was identified in partnership key stakeholders, including GAC representing the Mirarr Traditional Owners, the Director of National Parks as the landowner, the Jabiru Town Development Authority as the head lease holder and West Arnhem Regional Council as the current sublease holder. The agreed siting of the Project aligns with the Mirarr Traditional Owners' town-wide footprint set out in the Jabiru Master Plan, which also informs the zoning areas specified in the Jabiru Town Plan.

Land disturbance is apparent across the Project area, including an old gravel quarry, surface excavations and numerous access tracks. Field investigation observed feral pigs, wild dogs, cane toads, and buffalo footprints particularly around the effluent irrigation area. A 1.8 m cyclone mesh boundary fence extends around the perimeter of Lot 2303 with access tracks/fire breaks on either side. The northern portion of Lot 2303, containing the Project area, includes vegetation consisting of predominately *Eucalyptus miniata* and *Eucalyptus tetrodonta* (approximately 14 ha).

Engineering, environmental surveys and evaluations were undertaken to assess if the Project's activities would have the potential to cause significant environmental impact when considered against the NT EPA's Environmental Factors. Specific detail regarding risks, impacts, mitigation and management measures is presented in Section 7 of this document; with key findings summarised here against the four relevant environmental factors:

- **Land** – A site-specific geotechnical study found that the Project area is not impacted by acid sulfate soils. The report indicated that the soils are non-dispersive and have a medium potential to erode. The report recommended that general erosion and sediment controls are put in place during construction and maintained through to completion of the work phase of the Project.

  An initial ecological assessment involving one site reconnaissance and two camera-trap field surveys was completed for the Project area and surrounds. Nine threatened fauna species listed under the *Territory Parks and Wildlife Conservation Act 1976* (NT) and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were identified as potentially occurring in the Project area. Two of these species, the Black-footed Tree-rat (*Mesembriomys gouldii gouldii*) and the Partridge Pigeon (*Geophaps smithii smithii*) were detected.

  The Black-footed Tree-rat was recorded at numerous locations in Lot 2303 during the August-September (late dry season) camera-trap field survey. However, data from this survey could not be used to determine the number of individuals using the habitat within Lot 2303. This could feasibly range from a single active and broad-ranging individual to a number of animals. Based on consultation with and supervision by the Department of Environment, Parks and Water Security's Flora and Fauna Division and species subject matter experts, a high-intensity trap-release survey was conducted to establish comprehensive population data for the Black-footed Tree-rat in the Project area and adjacent habitat in Kakadu.

  The trap-release field survey found no Black-footed Tree-rats, indicating that the Project area does not maintain a resident population of the species. Based on the findings, Black-footed Tree-rat individuals are expected to infrequently utilise the Project area for foraging in the late dry season when vegetation condition in the surrounding area is diminished.

  The Black-footed Tree-rat and Partridge Pigeon were considered against the significant impact criteria referenced in '*Matters of National Environmental Significance, Significant impact guideline 1.1* (Significant Impact Guidelines 1.1)' (Department of the Environment, 2013). The preliminary impact assessment determined the Project is unlikely to significantly impact the Black-footed Tree-rat or Partridge Pigeon.

  Despite the findings, it is recognised that the infrequent use of the Project area for late dry season foraging provides a benefit to the local population of Black-footed Tree-rat. As such, CM&C will be forming a works program as part of the overall Project development, that involves compensatory action to improve the condition of surrounding similar habitat. CM&C have liaised with Djurrubu Rangers and obtained an in-principle agreement to

actively work together on a range of actions that may improve the surrounding habitat, with a particular focus on late dry season vegetation condition. These actions may involve the provision of expert advice to update management plans and the resourcing of activities (e.g. revised controlled burn arrangements, weed management actions etc.). The proposed area for this voluntary compensatory action is provided in Figure 6-3.

- **Water** – A surface hydrology assessment determined that the Project area is unlikely to be affected from seasonal flooding events in the Baralil Creek Catchment. Surface flows from the Project area are unlikely to cause adverse effects to flow regimes in the Baralil, Gulungul and Magela Creeks. As with the land theme, the Project will need to implement general erosion and sediment controls during construction and actions during operation to prevent impacts to surface water and groundwater quality.

- **Air** – There is no existing available ambient air quality data for Jabiru. Air quality at the Project location is expected to be generally consistent with that of the Darwin airshed which experiences elevated particulate matter concentrations in the dry season attributed to seasonal burning and increased night-time atmospheric stability (Energy Resources of Australia, 2014). Other pollutants (e.g. ozone, sulfur dioxide and nitrogen dioxide) are expected to be low in the Project area due to its relative isolation and limited industrial activities.

  Although the Project involves diesel generators, the units are small-scale (five 0.908 megawatt units), and the Project is on the outskirts of Jabiru. Prevailing winds are from the west to north-west in the wet season and from the south-east in the dry seasons (Energy Resources of Australia, 2014). In both seasons, prevailing winds would direct emissions away from sensitive receptors, with the nearest residential sensitive receptor being approximately 1.3 kilometres (km) to the south-west of emissions generation point. Emissions testing will be completed during commissioning to benchmark emissions against manufacturer specifications and confirm optimal operation. The highest risk of air quality impacts is likely during the temporary construction period with the potential for dust lift-off and deposition. A range of management measures are proposed to prevent or limit dust generation and particulate deposition during construction.

- **People** – While the Project area has been previously disturbed, Kakadu is culturally significant. A cultural heritage survey was completed for the Project area and did not identify any sites of cultural or heritage significance and an Aboriginal Areas Protection Authority Clearance Certificate has been obtained for the Project. Nevertheless, measures will need to be employed should unknown sites or artefacts be unearthed during the construction phase.

  Preliminary noise calculations for the operational phase identify noise levels at the closest residential receptor up to 17 dBA LAeq,15min under neutral weather conditions and 21 dBA LAeq,15min under adverse conditions. These values are significantly less than the 35 dBA $L_{Aeq,15min}$ referenced in Table 3.4 of the NT EPA Noise Management Framework Guideline (2018).

  Given the remote location and distance from sensitive residential receptors the risk to human health is considered low. General management measures should be employed during construction and operation to minimise Project associated risks to people and communities (e.g. vehicle movements). However, the Project will also deliver a range of positive impacts including reduced carbon emissions compared to current power generation, local employment opportunities, and critical infrastructure for the continued functioning of Jabiru township, Parks Australia's Kakadu operational headquarters and tourism related to Kakadu.

CM&C is working closely with EDL to deliver the Project and has engaged with EDL in the development of this referral document. CM&C will obtain EDL's compliance with the mitigation and management measures presented in Section 7 of this document as part of its contractual framework with EDL.

Table of Contents

Figures

Tables

Appendices

Document History & Status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
Draft	23/09/2020	S. Horsnell	S. Horsnell	23/09/2020	Working
Draft	26/10/2020	S. Horsnell	S. Horsnell	27/10/2020	Draft
Final Draft	24/12/2020	S. Horsnell	S. Horsnell	24/12/2020	Final Draft
Final	12/02/2021	T. Kinny	P. Davey	25/03/2021	Final

Distribution of Copies

Version	Date issued	Quantity	Electronic	Issued to
Rev 0	25/01/2021	1	Word & pdf	Karl Hell (CM&C)
Rev 1	29/01/2021	1	Word	Karl Hell (CM&C)
Rev 2	02/02/2021	1	Word	Karl Hell (CM&C)
Rev 3	08/02/2021	1	Word	Karl Hell (CM&C)
Rev 4	12/02/2021	1	Word & PDF	Karl Hell (CM&C)
Rev 5	26/03/2021	1	PDF	Rowan Reilly (CM&C)

Last Saved:	26 March 2021
File Name:	Jabiru Hybrid Power Station NT EPA Referral_26032021
Authors:	Jaime Marr
Project Manager:	Paul Davey
Client:	Department of the Chief Minister and Cabinet
Document Title:	**Environmental Approvals Jabiru Power Station**
Document Version:	Rev 5
Project Number:	1000765

Front cover photo is taken by Peter Keepence Photography (2020).

Glossary

Abbreviations	Definitions
AC	Alternating Current
AHD	Australian Height Datum
ARLA	*Aboriginal Land Rights (Northern Territory) Act 1976 (Cth)*
AS	Australian Standards
BESS	Battery Energy Storage System
BOM	Bureau of Meteorology
CAMBA	China- Australia Migratory Bird Agreement
CEMP	Construction Environmental Management Plan
DC	Direct Current
CM&C	Department of the Chief Minister and Cabinet
EIA	Environmental Impact Assessment
EP Act	*Environment Protection Act* 2019 (NT)
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999 (Cth)
ERA	Energy Resources of Australia
ESCP	Erosion and Sediment Control Plan
JTDA	Jabiru Town Development Authority
Kakadu	Kakadu National Park
kV	kilovolt
GAC	Gundjeihmi Aboriginal Corporation
GACJT	Gundjeihmi Aboriginal Corporation (Jabiru Township) lease entity
GWh	Gigawatt hours
ha	Hectare
HV	High Voltage
IUCN	International Union for Conservation of Nature
JAMBA	Japan- Australia Migratory Bird Agreement
L	Litre
ML	Megalitres
MNES	Matters of National Environmental Significance
MoU	Memorandum of Understanding
MW	Megawatt
NAFI	North Australia and Rangelands Fire Information
NBN	National Broadband Network
NoI	Notice of Intent
NT EPA	Northern Territory Environment Protection Authority
PER	Public Environmental Report
PV	Photovoltaics

Glossary

PWC	Power and Water Corporation
REF	Renewable Energy Fraction
SOCS	Sites of Conservation Significance
SCADA	Supervisory Control and Data Acquisition
UV	Ultra- Violet
TPWC	*Territory Parks and Wildlife Conservation Act* 1976 (NT)
WM Act	*Weeds Management Act* 2001 (NT)
WONS	Weeds of National Significance
ZDO	Zero Diesel Operation

Section 1 Introduction

The Department of the Chief Minister and Cabinet (CM&C, formally Department of the Chief Minister) engaged CDM Smith Australia Pty Ltd (CDM Smith) to develop the necessary documentation to support environmental assessment and approvals for the development of the Jabiru Hybrid Power Station located within the township of Jabiru, Kakadu National Park (Kakadu), Northern Territory (the Project) (Figure 2-1). The Project area covers 20.08 hectares (ha) within the north-eastern boundary of the Jabiru township (Figure 2-2).

The proposed Project will require separate environmental referrals to the Northern Territory and Commonwealth government agencies for assessment. The Northern Territory environmental approval requirements involve providing a referral document to the Northern Territory Environment Protection Authority (NT EPA) with the necessary information as per section 48 of the *Environment Protection Act 2019* (EP Act).

For the Commonwealth assessment, a separate referral is required in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to determine whether the activity has the potential to have an impact on Matters of National Environmental Significance (MNES). Section 4.1 lists MNES under the EPBC Act and Section 6 includes an assessment of the Project against the MNES.

In addition to considerations of MNES, the EPBC Act also provides for activities in Commonwealth reserves which includes Kakadu and the Project area. The EPBC Act referral is separate to this document. It is noted that the site is excluded from the current Bilateral agreement made under section 45 of the EPBC Act relating to environmental assessment between the Northern Territory Government and the Commonwealth of Australia, as it falls within a Commonwealth area, Kakadu (refer to Clause 4.2(c) of the Bilateral Agreement). This does not consider any proposed amendments under the Environment Protection & Biodiversity Conservation Amendment (Streamlining Environmental Approvals) Bill 2020 (Cth) which is currently before Parliament.

1.1 Background

1.1.1 Overview

Jabiru Township is located within the UNESCO[1] World Heritage listed Kakadu and was established in 1982 to support uranium mining in the region (Department of the Chief Minister, 2019).

Power to Jabiru township is provided by Energy Resources of Australia (ERA) through aging diesel generators that are part of the Ranger Uranium Mine (the Mine). This aging infrastructure is due to be retired, and electricity supply from ERA is no longer an option for the medium to long-term, as the mine entered its closure phase from 8 January 2021. CM&C has an agreement with ERA to provide electricity to Jabiru until 31 December 2021. No guarantee of electricity supply beyond this date is in place (CM&C has already extended the original date for termination of supply from 30 June 2020).

Although the township was established to support the mine, it has since become a hub for tourism and services for greater Kakadu, cementing the requirement for continued power supply. On behalf of the Mirarr Traditional Owners (TO), Gundjeihmi Aboriginal Corporation (GAC) has developed a Masterplan defining the vision of the TOs on the future

[1] United Nations Educational, Scientific and Cultural Organisation

of Jabiru. This Masterplan is a guiding document during planning stages to transition Jabiru from a mining town to a tourism hub.

One of the first strategic planning documents informing this Project was an agreement between the Commonwealth and Territory Governments, ERA and the GAC signed in August 2019 (Department of the Chief Minister, 2019). The purpose of this agreement, the Memorandum of Understanding on the Future of Jabiru Township (MoU), was to improve tourism visitation to Kakadu and support the Mirarr vision for the future of Jabiru as an internationally renowned sustainable tourism and services hub (Department of the Chief Minister, 2019). As part of the MoU, the Commonwealth and Northern Territory Governments have pledged $351.7 million of funding for infrastructure projects, including a commitment by the Territory Government to ongoing power supply for Jabiru.

1.1.2 Procurement Process and Contract Management

In advance of the MOU's signing, CM&C commissioned initial advisory work on the condition of the Jabiru electricity system, likely future demand profile and potential generation solutions to support its commitment to ongoing power supply. This work was undertaken by Ekistica, a specialist technical consultancy firm that is a subsidiary of the Alice Springs-based Centre for Appropriate Technology. Ekistica produced a final report that provided the evidence base to support a diesel/solar hybrid power system with a target Renewable Energy Fraction (REF) of 50% as the solution best able to meet affordability, reliability and sustainability objectives.

Immediately after the signing of the MoU, CM&C commenced planning for a major procurement process to select a private sector proponent to build, own and operate a new hybrid power station. This major procurement process has involved:

- An Expression of Interest (EOI) phase that was conducted from November 2019 – February 2020;
- A second stage select tender process with five shortlisted proponents from the EOI stage, undertaken March – August 2020;
- A competitive negotiation process with the top two proponents from the second stage select tender process, undertaken September – December 2020; and
- Contract finalisation with Energy Developments Pty Ltd (EDL) as the preferred proponent undertaken December – February 2020.

CM&C has now finalised its procurement process and selected EDL as the successful proponent for the Project.

The procurement model for the Project is a Build-Own-Operate (BOO) solution. Under this model, EDL will design and construct the power station with its own funding for capital costs, and then operate the facility for up to 25 years. The Northern Territory Government, via Power and Water Corporation (PWC), will enter into a long-term electricity supply contract under which EDL will recoup its capital investment plus a margin.

The contract structure for this Project reflects a BOO procurement model that involves three parties:

- The Generator (EDL);
- The Customer (PWC); and
- The Northern Territory Government (CM&C) as the Project facilitator.

This structure involves two main contracts:

- A Project Development Agreement (PDA) between CM&C and EDL that governs the construction stage of the project; and
- A Power Purchase Agreement (PPA) between PWC and EDL that commences when the power station reaches completion and commences operation.

As the Project facilitator under the PDA, CM&C has taken on responsibility for securing tenure and approvals for the Project site, including environmental approvals under both the EP Act and EPBC Act. CM&C commenced preparing referral documents in early 2020 in order to expedite the timeframes for environmental approvals following contract award.

The PDA includes a detailed technical work specification that sets out design parameters and relevant Australian Standards that EDL must comply with in construction. The scope of works provided in the works specification considers the full system development from detailed design through to construction and commissioning. Specifically, this includes detailed engineering investigations, design, procurement and supply, demolition, delivery, storage, construction and installation, testing and commissioning and supplying all relevant documentation.

The works specification details a series of Project and design documents that EDL must submit to CM&C for review and approval. One of the key Project documents is a Construction Environmental Management Plan (CEMP), which EDL must submit three weeks prior to site mobilisation. CM&C will work with EDL to ensure risk mitigation measures outlined in this referral document are also included in EDL's CEMP. Drafts of EDL's CEMP and subordinate Erosion and Sediment Control Plan are attached at Appendix H and I, respectively. These documents are still under review by CM&C and its supporting technical experts, including Ekistica. Once approved, these plans will continue to be updated by EDL as live documents over the life of the construction stage.

CM&C is being supported in the construction stage contract management with expert technical expertise provided by:

- The Department of Infrastructure, Planning and Logistics (via its contract project manager for the Future of Jabiru and Kakadu program, Harris Kmon Solutions);
- Ekistica, operating as an Owner's Engineer reporting to Harris Kmon Solutions and CM&C; and
- Power and Water Corporation.

1.2 Proponent Details

As the project facilitator under the PDA, CM&C is identified as the Proponent for this referral, even though EDL is the proponent who will build, own and operate the new hybrid power station. The proponent details are outlined in Table 1-1.

Table 1-1 Proponent Details

Business name	Department of the Chief Minister and Cabinet	
Contact Person	Project Manager – Rowan Reilly	
Postal Address	GPO Box 4396, Darwin, NT, 0801	
Phone/ Email	0498 184 644 Rowan.Reilly@nt.gov.au	

1.3 Environment Consultant Details

The environment consultant nominated to prepare this Notice of Intent is CDM Smith Australia Pty Ltd (CDM Smith). The key contact for CDM Smith and the suitably qualified person responsible for the documentation is outlined below in Table 1-2.

Table 1-2 Environment Consultant Details

Business name	CDM Smith Australia Pty Ltd	
Contact Person	Principal Environmental Scientist – Paul Davey (MEM, BS, AssDip, RABQSA)	
Postal Address	Level 1, 48-50 Smith Street, Darwin, NT, 0800	
Phone/ Email	0429 925 538 daveyp@cdmsmith.com	
Supporting Sub-Consultants	Ecology – Connect Environmental and Low Ecological Surface Water – Surface Water & Erosion Solutions	

1.4 Cross-Reference of Referral Requirements

Referral reports must be sufficient to address information required under the *Environment Protection Act 2019* (EP Act) and Environment Protection Regulations 2020 (EP Regulations) to inform the Northern Territory Environmental Protection Authority (NT EPA) decision on whether the proposal has the potential to have significant impact on the environment. Section 3 of the document *'Environmental impact assessment, Guidance for proponents'* (Northern Territory Environmental Protection Authority, 2020) outlines the structure and information required in the referral. Table 1-3 provides a cross-reference with the NT EPA referral requirements and the location where the information is addressed in this documentation.

Table 1-3 Cross-Reference of Referral Requirements

Requirement	Location Addressed in Document
Publication Statement	Section 1.3 – Environmental Consultant Details
Executive summary – overview of the proposal and potential environmental impacts	Executive Summary
Introduction – introduction of the proposal and proponent	Section 1 – Introduction
Proposal description – key components addressing physical and operational components	Section 3 – Project Description
Proposal description – location and regional context	Section 2 – Site Description
Proposal description – site selection and alternatives / options	Section 3.7 – Alternatives
Proposal description – principles of environmental protection and management	Section 7 – Preliminary Environmental Impact Assessment Section 8 – Consideration of Ecologically Sustainable Development
Consultation	Section 5.10.2 – Community
Environmental factors – presence or absence of environmental values	Section 5 – Existing Environment
Environmental factors – environment protection and management	Section 7 – Preliminary Environmental Impact Assessment Appendix A – Preliminary Risk Assessment
Environmental factors – cumulative impacts	Section 7 – Preliminary Environmental Impact Assessment Appendix A – Preliminary Risk Assessment

Section 2 Site Description

2.1 Locality

2.1.1 Regional Context

The township of Jabiru is located within Kakadu, 250 kilometres (km) south east of Darwin in the Northern Territory (Figure 2-1). Access is via the sealed Arnhem Highway which is one of two entrances into the National Park and accessible all year round. Kakadu National Park covers an area of 1,981,600 ha.

Jabiru is a hub for many services for interstate and international visitors and the 1,081 residents who reside in the town (Australian Bureau of Statistics, 2016). Services and amenities include a school (pre-school to year 12), childcare centre, health clinic, fuel and mechanical services, police station, supermarket, bank facilities, library, Olympic sized swimming pool, airport, Charles Darwin University Training Area, newsagent and many food and accommodation services.

2.1.2 Project Area

The Project area consists of the following:

- A 15.28 ha unused portion of Lot 2303 located within the Infrastructure Zone of Jabiru Town Plan zoned for Utilities (UJ). Lot 2303 is positioned in the far north eastern corner of Jabiru town boundary, adjacent to the town industrial area, and has a total area of 32.43 ha (refer to Figure 2-3 and Figure 2-4); and
- A 4.8 ha portion of Lot 1428 which is an existing parcel along containing El Sherana Road.

Project access is via the Arnhem Highway, Whites Road and El Sherana Road (Figure 2-2). Each of these roads are all-weather bitumen sealed.

Lot 2303

The Project will be situated in the northern portion of Lot 2303 covering an area of 15.28 ha. This includes land clearing of approximately 14 ha for the hybrid power station infrastructure footprint and augmentation of an existing access track of 1.28 ha for road access and utilities within Lot 2303 western boundary (see red area in Figure 2-3).

Lot 1428

To connect the hybrid power station to Jabiru's existing power distribution and other utilities, outside of Lot 2303, will involve accessing the existing El Sherana Road parcel on Lot 1428. This activity will involve installing utilities lines (high and low voltage lines, potable water, sewer and telecommunication cables) beyond Lot 2303 for 1.5 km to connect to existing infrastructure and power distribution services on Whites and El Sherana Roads. Placement will be within existing disturbed portions of the parcel (e.g. road verges) and no significant clearing is required for this infrastructure. The disturbance footprint is 0.75 ha.

Within the Project area of 20.08 ha, the maximum anticipated disturbance footprint is 16.03 ha across both Lot 2303 and Lot 1428. Table 2-1 provides specific details for each of the lots that incorporate the Project area.

Table 2-1 Project Area Details

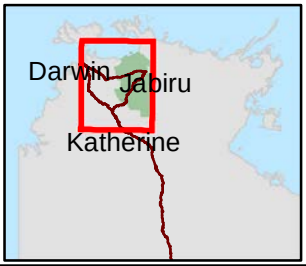
Category	Lot 2303	Lot 1428
Coordinates (Lat, long) (GDA 94)	*Lot 2303*-12.654490, 132.855267 32 *Proposed hybrid power station site* - 12.652737, 132.855378	-12.65888, 132.84673
Current Land Use	Treated effluent spray irrigation area and gravel excavation	Existing power distribution services and vehicular access to Jabiru landfill and the wastewater treatment plant
Address	Lot 2303, unnamed road, Jabiru, Northern Territory	El Sherana Road, Jabiru
Tenure Type	Freehold	Freehold
Title (Volume/ folio)	705/746	705/726
Lot number	2303	1428
Survey ID	LTO84/045	LTO84/045
Town planning code	JABSP	-
Town Planning Zone	Utilities (UJ)	Main Road (MJ)
Area (ha)	32.43 ha	4.8 ha
Local Government Area	West Arnhem Region	West Arnhem Region

N

0 15 30

Kilometres

Scale @ A4 1:1,250,000
Date: 11/11/20
Author: MARRJL



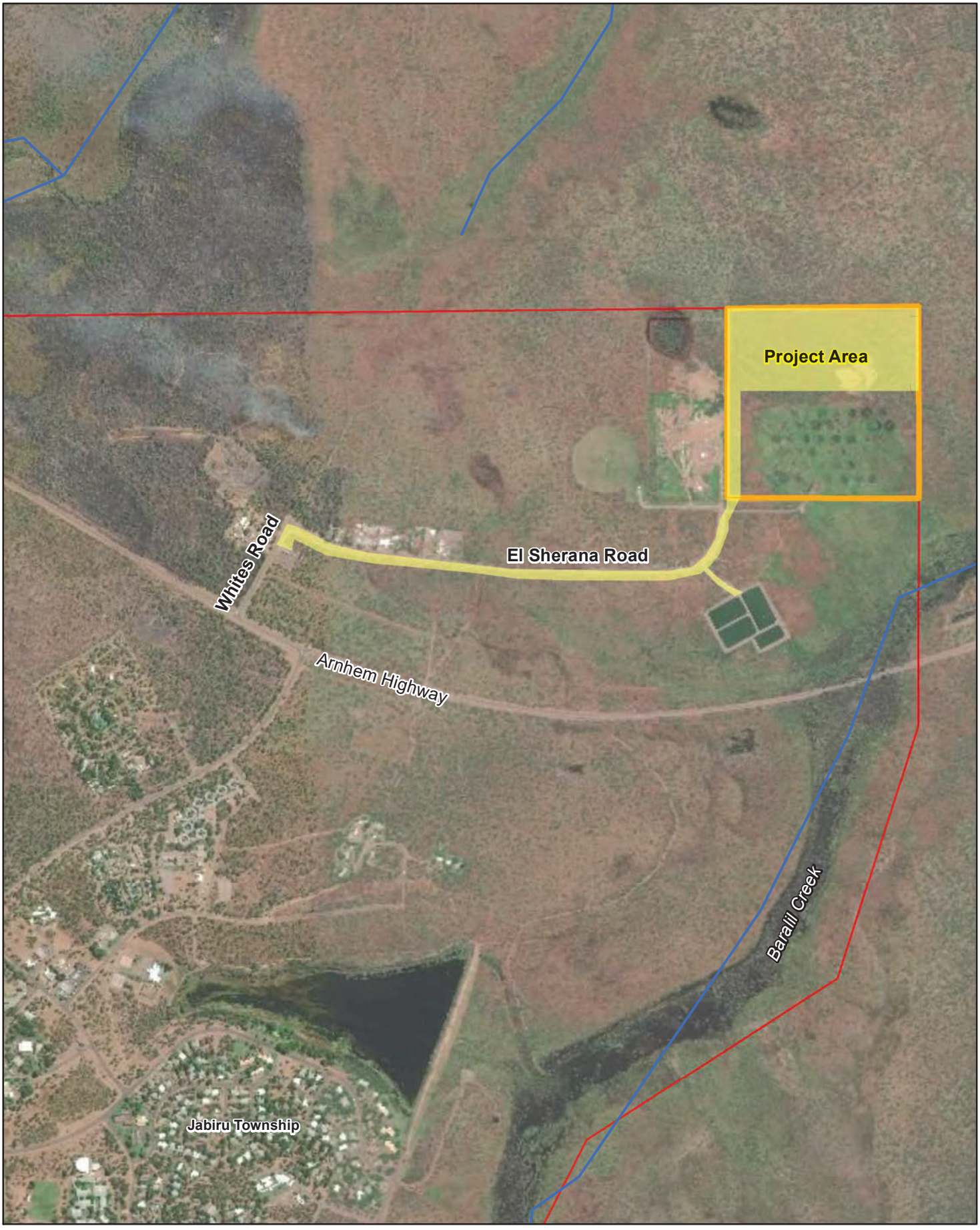
Legend

Kakadu National Park

Figure 2-1
Regional Location

CDM Smith

MARRJL G:\jaime\Projects\1000765- Jabiru Environmental Approval\02 MXD\1000765_Regional Map.mxd 11/11/2020

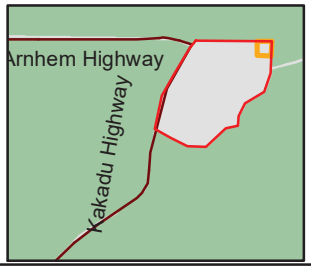


N

0 200 400

Metres

Scale @ A4 1:15,000
Date: 09/02/21
Author: BROTHERSSM



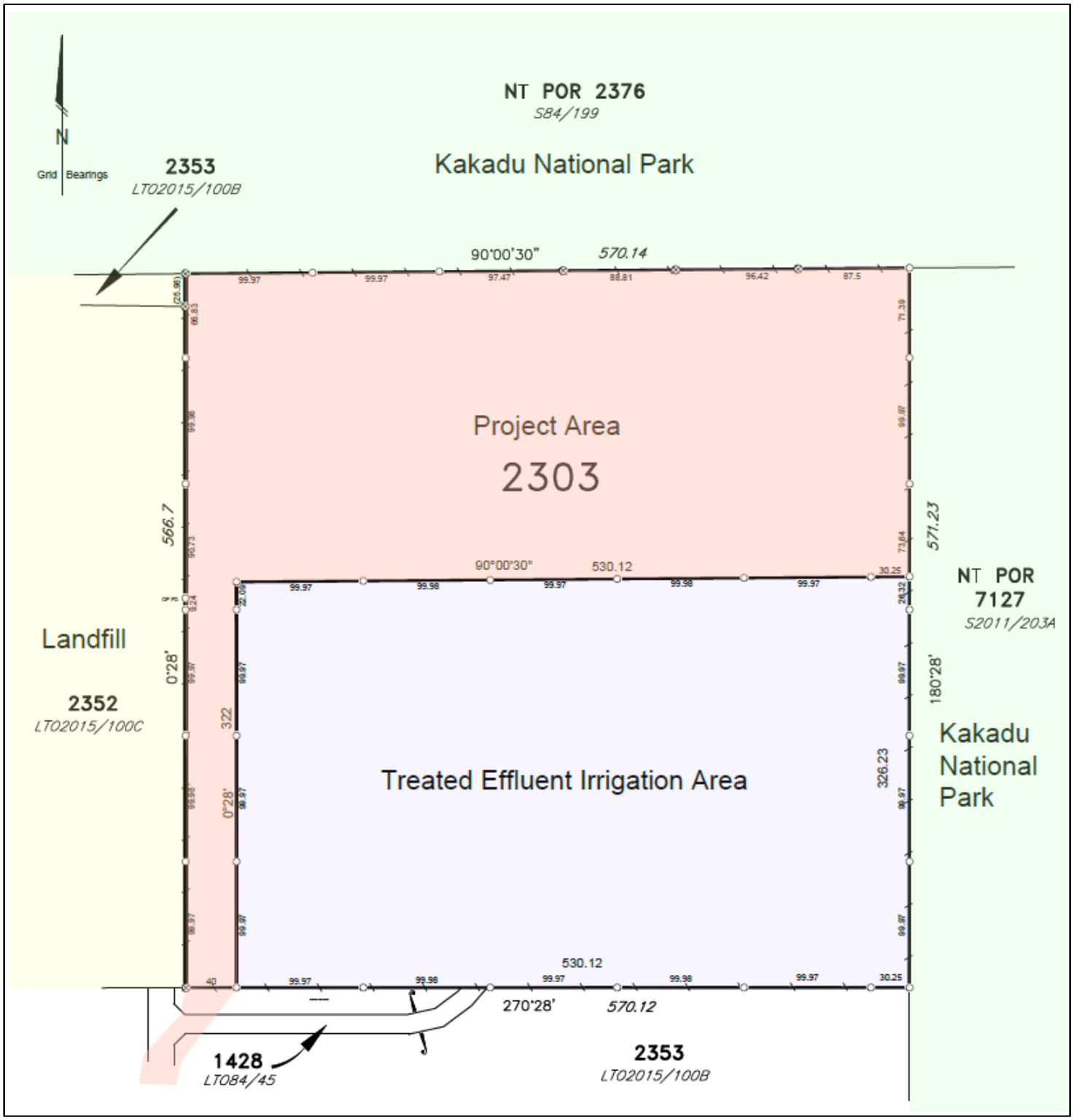
Legend

- Project Area
- Lot 2303
- Jabiru Town Boundary

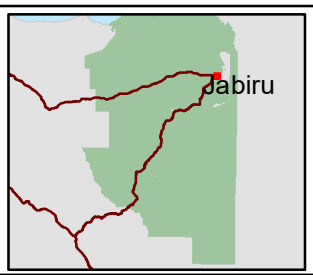
Figure 2-2
Project Location

CDM Smith

BROTHERSSM G:\Jaime\Projects\1000765- Jabiru Environmental Approval\02 MXD\1000765_Project Area.mxd 2/9/2021



DATA SOURCE
Cross Solutions 2020:
NT Open Source Data, 2015; Geofabric Product Suite V2.1.1
Bureau of Meteorology (BoM) 2011;
1 Second SRTM v1.0 © Commonwealth of Australia (Geoscience Australia) 2011.



Legend

- ○ - Boundary Peg Placed/found
- ⊗ - Fence Post

Figure 2-3
Project Area Extent on Lot 2303

Not to Scale
Date: 19/03/21
Author: BROTHERSSM

BROTHERSSM G:\Jaime\Projects\1000765- Jabiru Environmental Approval\02 MXD\Template.mxd 2/24/2021

2.2 Site Description

2.2.1 Land Use (Previous and Current)

Previous and current land uses within the Project area adjacent portions of Lot 2303 are listed below and illustrated in Figure 2-4:

- An existing 1.8 metre (m) high chainmesh cyclone boundary fence with 5 m wide fire access trails on all boundaries of Lot 2303;
- The southern half is currently used as a treated effluent irrigation area for Jabiru wastewater treatment plant and managed by the Western Arnhem Regional Council. This grassland area covers a large extent of Lot 2303, has been cleared and maintained without vegetation (Figure 2-4);
- Gravel excavation within Lot 2303 and stockpiles along the western boundary;
- Some pumping infrastructure is located near the southern boundary of Lot 2303, adjacent the existing site entrance;
- Frequent hazard reduction burns roughly every one to two years on Lot 2303;
- Windblown rubbish along the western boundary fence likely from the Jabiru Waste Disposal Facility located west of Lot 2303;
- Several tracks are present within Lot 2303; and
- El Sherana Road parcel is currently used for vehicular access and utilities.

2.2.2 Land Tenure and Zoning

Kakadu is freehold title land which is generally held in two forms. One form is Aboriginal land held in Aboriginal Land Trusts, the other is held by the Director of National Parks and is subject to land claims under the Aboriginal *Land Rights (Northern Territory) Act 1976* (Cth).

Lot 2303 and Lot 1428 are currently freehold title held by the Director of National Parks; a corporation established under the EPBC Act. These Lots and all Jabiru town land is leased to the Jabiru Town Development Authority (JTDA) until 30 June 2021.

The freehold title of the site, along with the rest of Jabiru township, is in the process of being transferred to the Kakadu Aboriginal Land Trust pursuant to the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth). Once this occurs, the site will become Aboriginal land subject to a township lease (or head lease) between the Northern Land Council, the Kakadu Aboriginal Land Trust and the newly established Gundjeihmi Aboriginal Corporation (Jabiru Township) lease entity (GACJT).

Under the existing tenure arrangements up to 30 June 2021, CM&C has secured appropriate Construction Licence arrangements for the Project. Beyond 30 June 2021, a further Construction Licence and sub-lease will be sought by CM&C from the GACJT. The exact terms of this future agreement are not known, but the intention is for the Northern Territory Government to hold a sub-lease over Lot 2303 that covers the term of GACJT's head lease (67 years) and issue an underlease to EDL for the Project area that covers the life of the Project (25 years).

Lot 1428 and other road parcels over which the public has a right of way are expected to be excluded from the land grant and will remain freehold title with the Director of National Parks in the first instance. Appropriate arrangements to enable relevant NT Government agencies and entities [including PWC and West Arnhem Regional Council (WARC)] to access and maintain roads and essential services networks running in road parcels will be put in place.

Despite the changes in ownership, the site remains in Kakadu, and will remain a Commonwealth reserve under the EPBC Act. Though initially declared a national park under the *National Parks and Wildlife Conservation Act 1975*, section 388 of the EPBC Act provides for land use in Kakadu including Jabiru and states the town must be used and developed in accordance with Kakadu management plans and the approved town plans. At the time of writing, the adopted and approved documents under section 389 of the EPBC Act are:

- Kakadu National Park Management Plan 2016 – 2026; and
- Jabiru Town Plan 2019 which was made under the *Planning Act 1999* (NT) and approved by the Director of National Parks under the EPBC Act.

The Jabiru Town Plan 2019 is managed by the Minister for Infrastructure, Planning and Logistics, on behalf of the Director of National Parks. It addresses section 8.2 of the Kakadu National Park Management Plan 2016 – 2026 and is consistent with the requirements of the EPBC Act (Department of Infrastructure, Planning and Logistics, 2019).

The main portion of the Project area (within Lot 2303) is within the Infrastructure Zone of the Jabiru Town Plan 2019 and is designated 'Utilities'. The portion of the Project area including El Sherana Road land zoned for 'Community Purpose', 'Public Open Space' and 'Industrial' (Figure 2-5). Clause 11.4 of the Jabiru Town Plan 2019 outlines the following purpose the utility zoned land:

1. To ensure the use or development of land in the utilities zone does not prejudice the future development of the utility;
2. Land in the utilities zone may be used or developed for a utility in accordance with the requirements of the Government Agency or service authority responsible for the utility on the land without consent;
3. Land in utilities zone may be used or developed other than for a utility only with consent and in accordance with the requirements of the Government Agency or service authority responsible for the utility on the land; and
4. In sub-clauses 2 and 3 a utility may include trunk sewers, sewerage ponds, trunk water mains, water storage facilities, electricity transmission and substation facilities, gas pipelines, low impact solar arrays, and the like (Department of Infrastructure, Planning and Logistics, 2019).

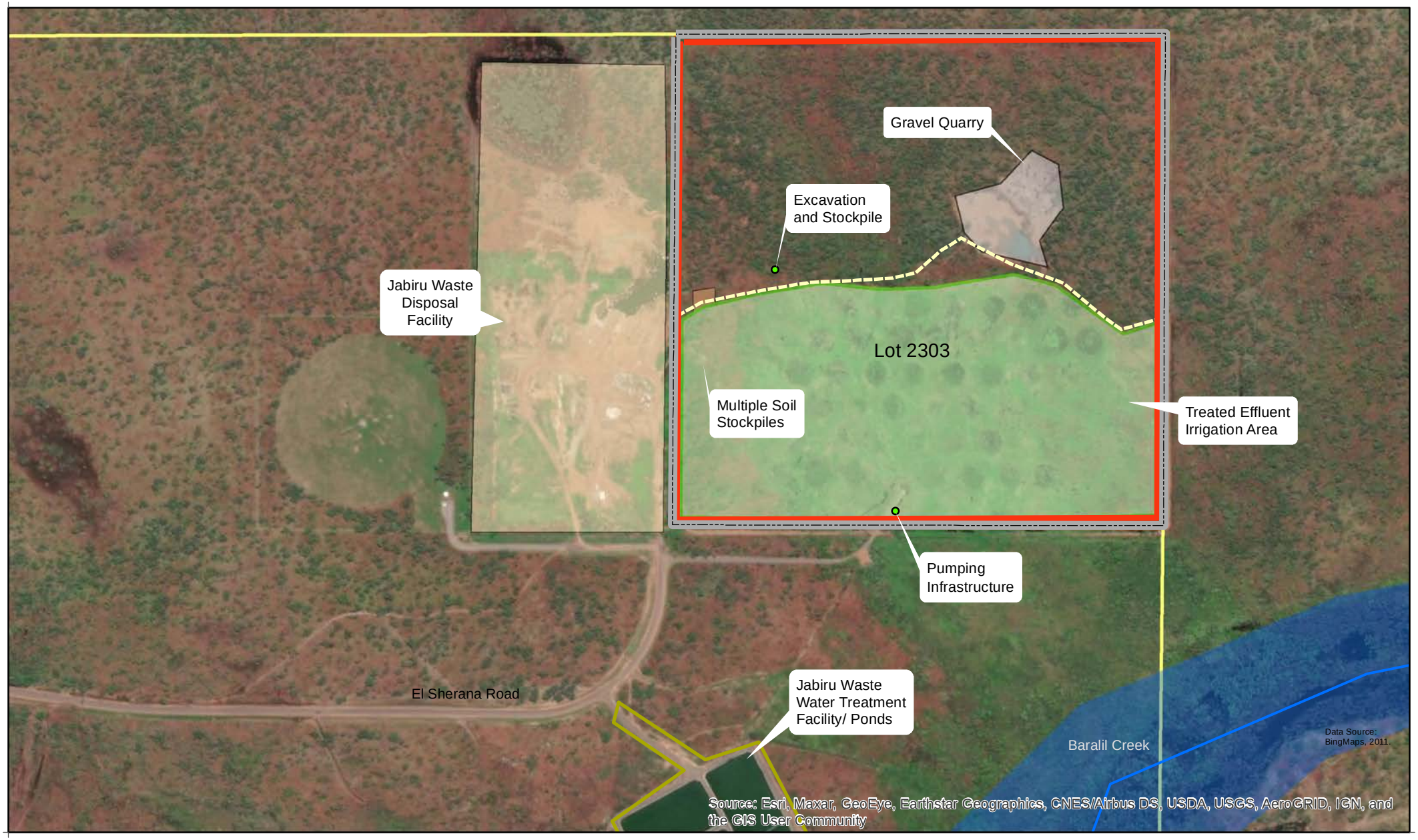
Accordingly, the development may be carried out without consent under the *Planning Act 1999* (NT), provided it satisfies the requirements of the responsible Minister under the *Electricity Reform Act 2000* (NT) including licencing requirements, and the Attorney-General requirements under safety regulation.

2.2.3 Eventual Rehabilitation of the Site

CM&C's contract with EDL contains provisions requiring remediation of the site at the end of the underlease to bring it back to a condition suitable for generic utilities purposes, which is aligned to the zoning of Lot 2303.

It is expected that the sub-lease issued by GACJT to the NT Government will contain eventual rehabilitation clauses. Therefore, any residual rehabilitation responsibility beyond those required of EDL to bring the site back to a condition suitable for generic utilities purposes will rest with the NT Government.

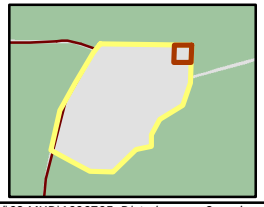
While these provisions will be in place, it is highly likely that Lot 2303 will continue to host power station infrastructure beyond EDL's underlease term for the foreseeable future.



0 60 120
Metres

Scale @ A4 1:6,000
Date: 21/12/20
Author: MARRJL

N



Legend

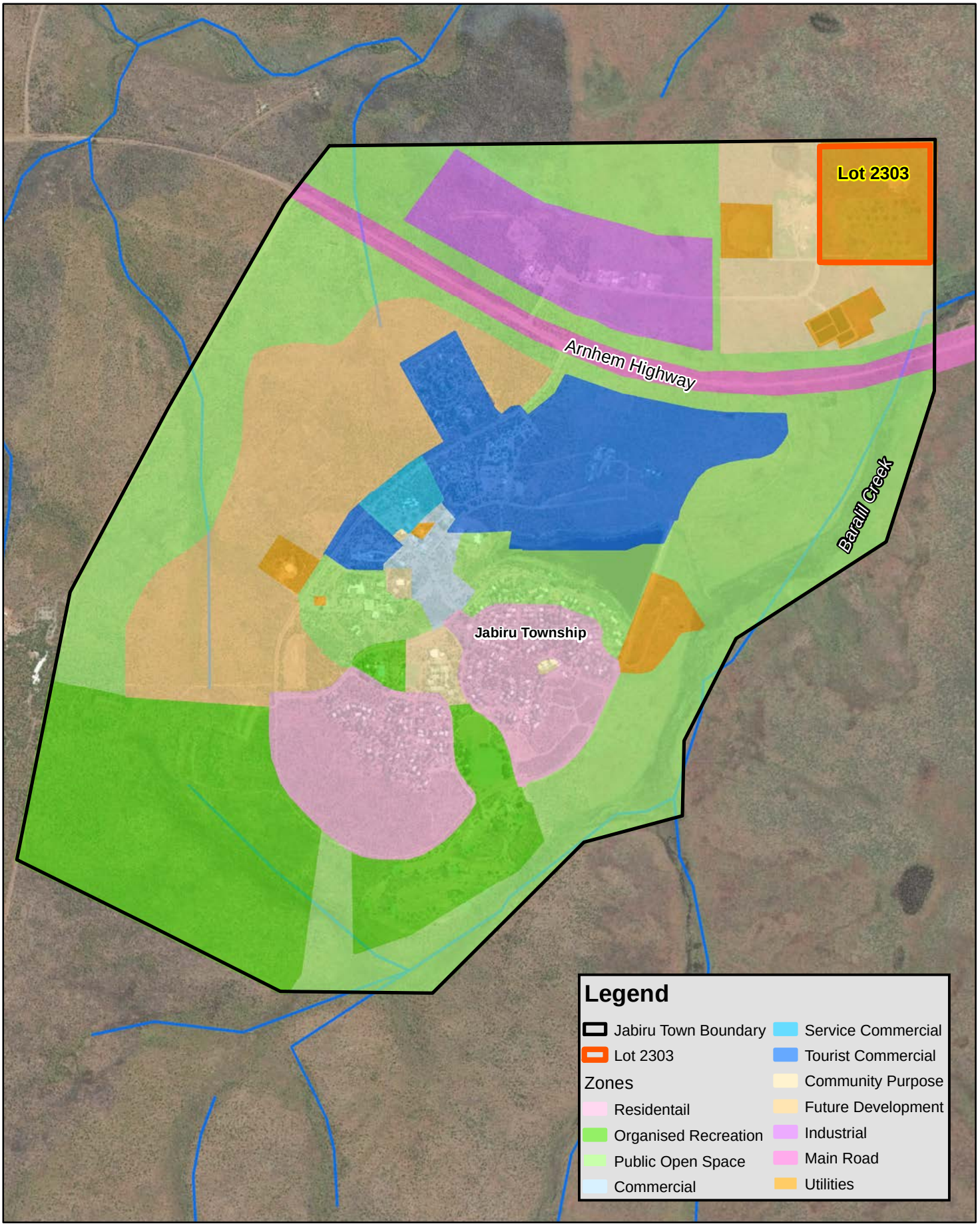
- Access Track
- Cyclone Boundary Fence
- Fire Break 5 m
- Watercourse
- Wetlands of Importance
- Jabiru Town Boundary
- Lot 2303

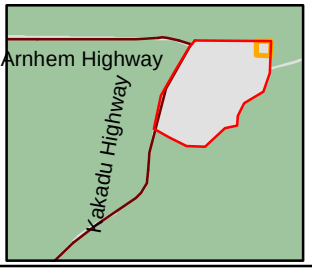
Figure 2-4
Existing Disturbance

CDM Smith
cdmsmith.com

G:\Jaime\Projects\1000765- Jabiru Environmental Approval\02 MXD\1000765_Disturbances_2.mxd

Date (12/21/2020)





0 330 660
Metres

N

Scale @ A4 1:25,000
Date: 24/02/21
Author: shooe

shooe P:\Project\1000765 - Jabiru\02 MXD\Jabiru Town Plan.mxd 24-Feb-21

Figure 2-5
Jabiru Town Plan 2019 Zones

CDM Smith

Section 3 Project Description

The main objective for this Project is to develop a hybrid power station providing long-term, reliable, environmentally sustainable and affordable electricity to the Jabiru township whilst targeting the NT Governments 50% annual Renewable Energy Fraction (REF) across the 25-year life of the Project. More specifically the Project will:

- Replace the existing and aged diesel power supply infrastructure for the Jabiru township with modern environmentally efficient hybrid technology;
- Meet Jabiru's estimated annual electricity demand of 14.4 Gigawatt hours (GWh) and maximum peak demand of 3.35 Megawatts (MW);
- Provide highly reliable electricity supply with system availability of at least 99.95%; and
- Be operational within the required timeline for first supply, which has been defined as 31 December 2021 in the Northern Territory Government's contract with EDL.

This Project has been identified as an essential part of ensuring the future of Jabiru beyond the scheduled closure of the Mine. The Project will also support the transition of Jabiru from a mining town to a vibrant and sustainable regional service and tourism hub for Kakadu.

3.1 Project Overview

3.1.1 Power Generation

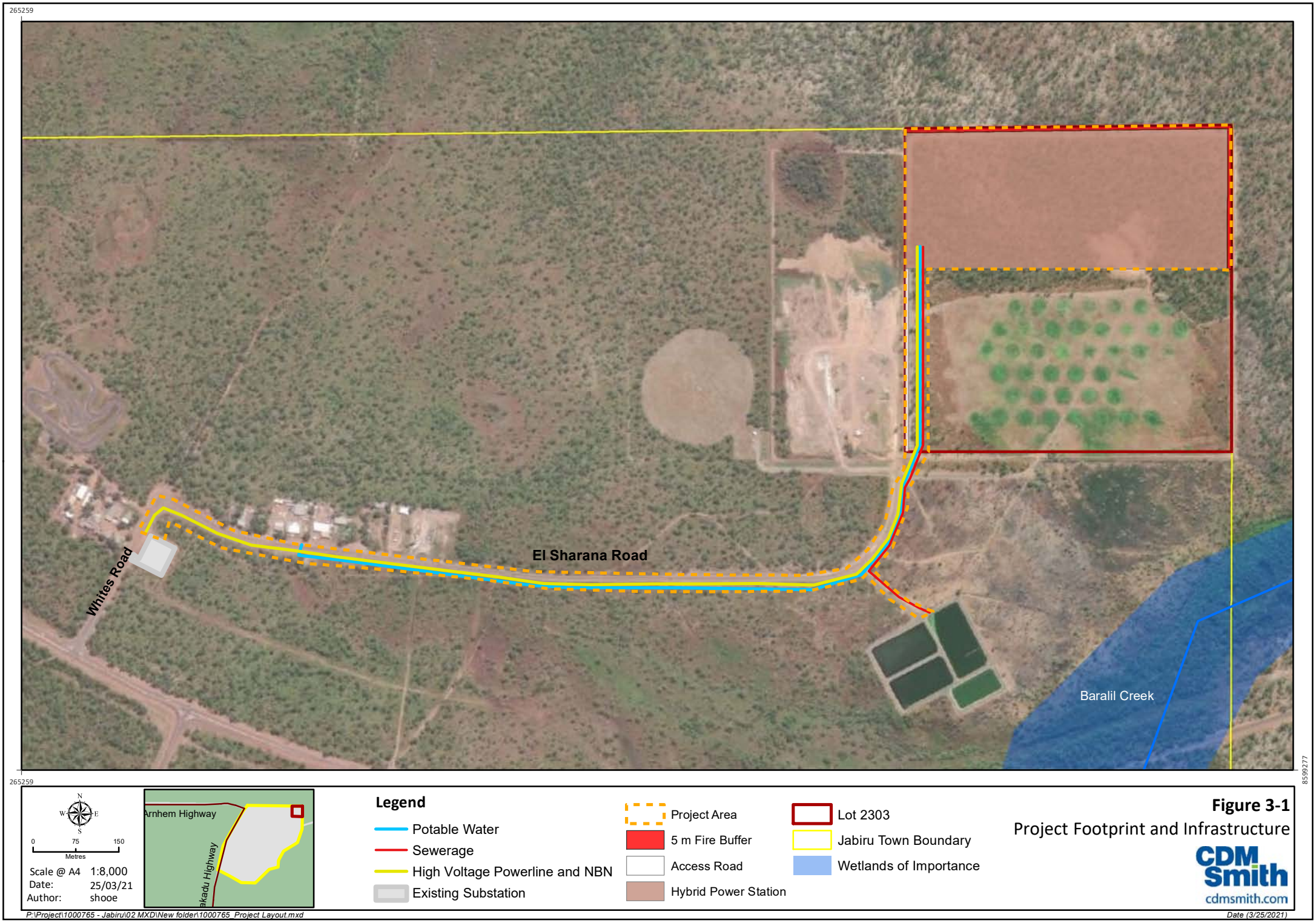
The Project will meet the demand from the Jabiru township and key specifications identified during detailed design through the following infrastructure components:

- Five 0.908 MW diesel generators with low-load capability[2];
- A 3.89 MW ground-mounted, single axis tracking solar photovoltaic (PV) array;
- A 4.0 MW Battery Energy Storage System (BESS) that provides both load-smoothing and load-shifting capabilities;
- 321,000 litres (L) capacity diesel storage infrastructure to ensure the power station can operate for a sufficient period of time during peak wet season events that may impact fuel deliveries;
- System integration and control systems that bring generation and storage elements together; and
- Balance-of-plant infrastructure that meets Australian Standards, supports a high level of safety, security and reliability and provides and real-time remote control and monitoring.

The hybrid power station will be capable of operating in Zero Diesel Operation (ZDO) mode, which provides the potential for its REF to grow significantly above 50% over time as renewable energy technologies evolve and improve. Once the Project is complete Jabiru is expected to be one of only a few towns across Australia sourcing at least 50% of its electricity from renewable sources in an islanded microgrid setting (i.e. not connected to the National Energy Market).

New high-voltage transmission lines will also be constructed to connect the hybrid power station to the Jabiru electricity network (Figure 3-1). A concept design illustrating the proposed layout of the hybrid power station including the solar array is provided in Figure 3-2.

[2] Low-load refers to power load below the design capacity of the generator.



N
W E
S
0 75 150
Metres

Scale @ A4 1:8,000
Date: 25/03/21
Author: shooe

Legend

- Potable Water
- Sewerage
- High Voltage Powerline and NBN
- Existing Substation
- Project Area
- 5 m Fire Buffer
- Access Road
- Hybrid Power Station
- Lot 2303
- Jabiru Town Boundary
- Wetlands of Importance

Figure 3-1
Project Footprint and Infrastructure

CDM Smith
cdmsmith.com

P:\Project\1000765 - Jabiru\02 MXD\New folder\1000765_Project Layout.mxd

Date (3/25/2021)

DATA SOURCE:
Prepared by: EDL
Supplied by: Northern Territory Government, Department of the Chief Minister and Cabinet, 2020

N

Scale @ A4
Date: 24/02/21
Author: shooe

Figure 3-2
Jabiru Hybrid Power Station
Concept Layout

CDM Smith

The Project will have a minimum corrosion category of 3 (urban and industrial atmosphere) for the prevention of corrosion on exposed steelwork, metal surfaces and parts. All fittings exposed to weather (except where enclosed in sealed cabinets) will be either hot-dipped galvanized, stainless steel or aluminium. This will ensure longevity of parts and equipment.

All cables used for the Project will be housed in trays, direct buried or buried in conduit. Cables that remain above ground will be ultraviolet light protected and sealed against wildlife and termites. Underground cabling will be dug to depths in accordance with Australian Standards and relevant legislation.

Electrical earthing will be installed on all buildings and equipment within the Project area. Earthing wires attached to infrastructure will transfer all electrical surges into the ground. Installing this earthing wire ensures the safety of all personnel under normal and abnormal operating conditions, reducing the risk of electric shock and transfer potential.

As well as testing and commissioning of all equipment, the Project will also undergo environmental tests as part of the commissioning process. These tests will measure noise levels at various modes of operation and emissions between the systems minimum generation and maximum continuous rating. These tests will be aligned with NT EPA regulations and in accordance with Australian Standards. EDL must pass these commissioning tests to the satisfaction of the CM&C to reach practical completion of the Project.

During operations the Project will have several remote monitoring technologies installed for reliable operation and advanced maintenance. These technologies will detect faults within the generation system, monitor site security, offer cyber security, metering and real time remote monitoring on key equipment through a Supervisory Control and Data Acquisition (SCADA) system.

3.1.2 Project Generated Emissions

Although the Project involves diesel generators, the units are small-scale (five 0.908 megawatt units) and are certified to comply with International Organization for Standardization (ISO) 8528 standards for design and performance of internal combustion engines and generating sets. The selected units are also compliant with the United Stated Environmental Protection Authority tier 2 emission standards which restrict emissions of carbon monoxide (CO), oxides of nitrogen (NOx) and particulate matter (PM).

The Project is on the outskirts of Jabiru and prevailing winds are from the west to north-west in the wet season and from the south-east in the dry seasons (Energy Resources of Australia, 2014). In both seasons, prevailing winds would direct emissions away from sensitive receptors, with the nearest residential sensitive receptor being approximately 1.6 km to the south-west of emissions generation point. Emissions testing will be completed during commissioning to benchmark emissions against manufacturer specifications and confirm optimal operation. The highest risk of air quality impacts is likely during the temporary construction period with the potential for dust lift-off and deposition. A range of management measures are proposed to prevent or limit dust generation and particulate deposition during construction.

Preliminary noise calculations for the operational phase of the Project have been completed. Accounting for the five diesel gensets, and applying noise propagation calculations via the CONWAVE algorithm with a 2D model (i.e. excluding terrain), the calculated noise level at the nearest noise sensitive receptor (located approximately 1.6 km south west of the facility) is 17 decibels, A-weighted sound pressure level (dBA) $L_{Aeq,15min}$. This is under acoustically neutral weather conditions; whereas the Project achieves 21 dBA $L_{Aeq,15min}$ under adverse weather conditions (i.e. temperature inversion). These calculated noise levels are less than the minimum intrusive Project background noise level noise criterion of 35 dBA $L_{Aeq,15min}$ referenced in Table 3.4 of the NT EPA Noise Management Framework Guideline (2018). Figure 3-4 shows the neutral and adverse weather scenarios and the location of the closest residential receptor.

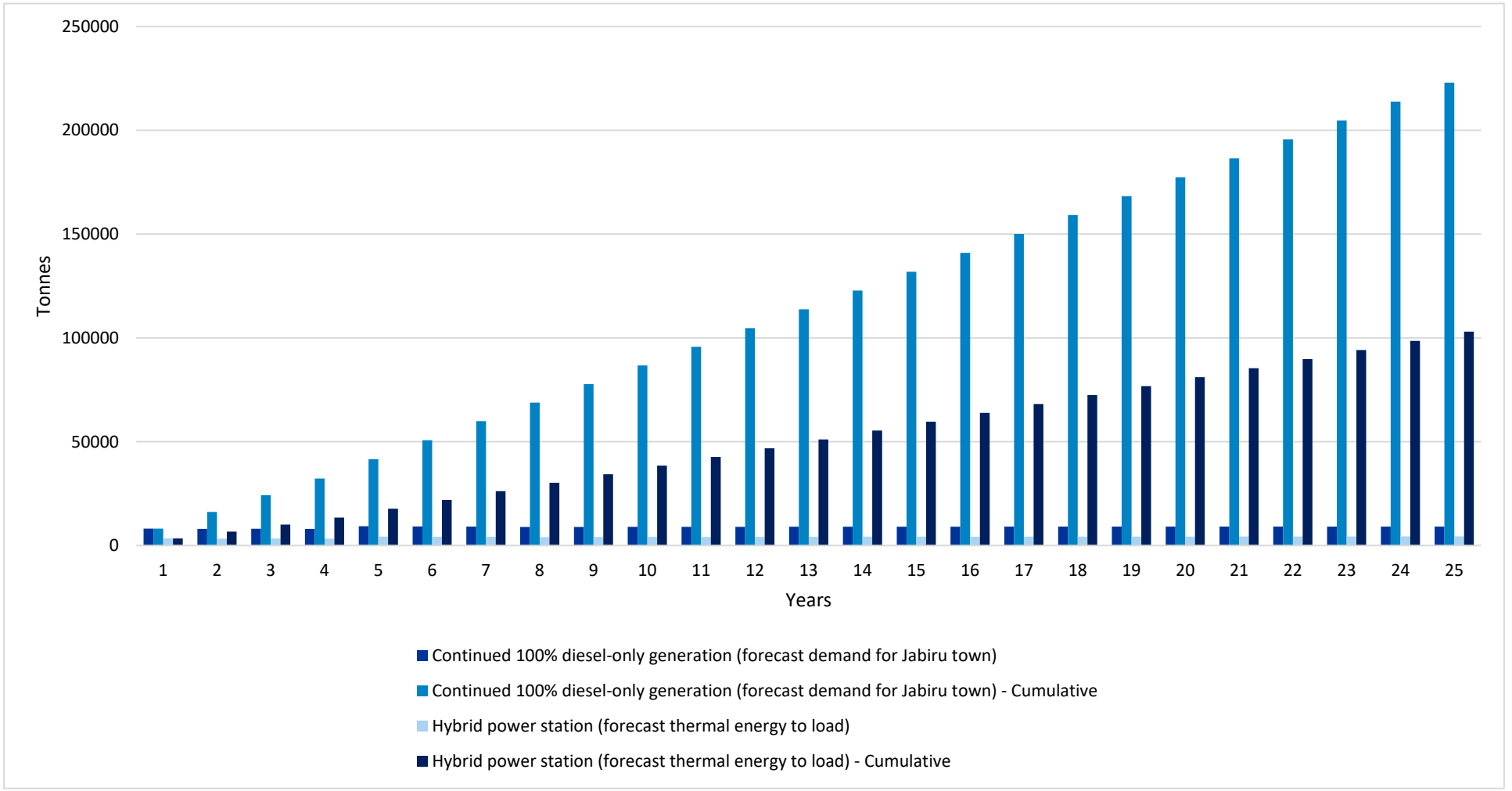
Anticipated carbon emissions for the Project have been calculated and compared to continued power generation using only diesel generators (Figure 3-3). The Project is expected to generate a total of 102,999 tonnes of carbon emissions over its 25-year life-span. Some level of continued carbon emissions is unavoidable in order for the town of Jabiru to

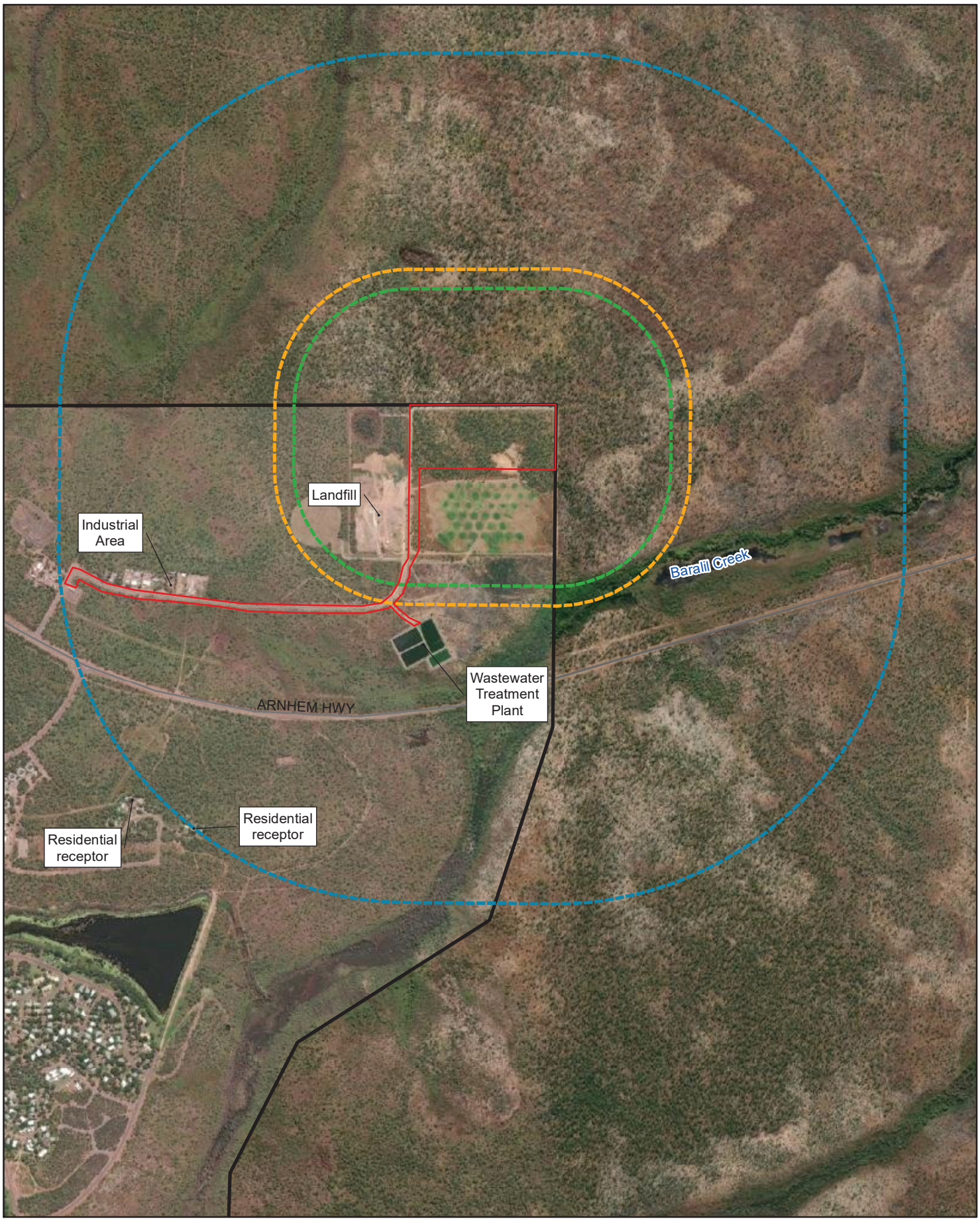
have ongoing electricity supply, as achieving affordable and reliable electricity generation from 100% renewable energy in Jabiru is not technically feasible at this point in time.

The ZDO capability of the hybrid power station also means that while its REF is currently set at just over 50% over the life of the Project, the opportunity exists for technology upgrade in the future as BESS and PV innovations continue to evolve. This could lead to a significantly higher REF for the hybrid power station in the future.

However, compared to the continued operation of a diesel-only power station, the Project will result in a 119,950 tonne net reduction of emissions over 25 years with an average emission reduction of 54% each year. The yearly and cumulative emissions are presented in Figure 3-3.

Figure 3-3 Carbon Emissions Generation Comparison



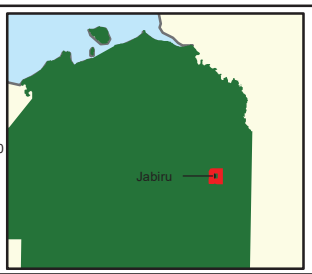


DATA SOURCES
© Northern Territory Fauna Atlas
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
* Locations of markers slightly dispersed for illustration

N

0 275 550
Metres

Scale @ A4 1:20,000
Date: 25/03/21
Author: D.Bayliss



- Project area
- Road
- Jabiru town boundary
- Kakadu National Park
- 35dBA LAeq,15min in neutral weather conditions (450 m)
- 35dBA LAeq,15min in adverse weather conditions (525 m)
- Closest residential receptor (1,600 m)

Figure 3-4
Preliminary Noise Calculation Results

CDM Smith

EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_X_X_Noise_Mod_Results.mxd 25/03/2021

3.1.3 Building Infrastructure

The Project layout will include temporary infrastructure such as a dedicated construction compound which will provide a muster area, lunch- room, offices and amenities. Buildings installed will be constructed appropriately to suit site and climatic conditions. Permanent infrastructure will include:

- Solar PV array;
- Housed BESS;
- Housed converter;
- Housed diesel generators;
- Bunded long term diesel storage facility (tanks);
- A permanent building will house a switch room for all associated switchboards and electrical equipment, staff amenities room including toilet facilities and storage room for spare parts and all operational equipment;
- Access roads; and
- Fence line.

All structures, security and access will be appropriate for all workers on site. Necessary measures such as upgrade and installation to the boundary fence will ensure site security and public safety.

Appropriate signage will be installed at regular intervals along the fence. Gates to accommodate fuel deliveries, site access and emergencies will be also installed.

A 5 m wide fire buffer will be maintained along the northern and eastern boundary. A 25 m vegetation buffer will be retained and augmented where necessary within the liquid effluent irrigation area to the south of the Project area's southern fence line, protecting the power station infrastructure and personnel from spray drift from the irrigation activities.

3.1.4 Timeframe

First supply of electricity is expected by 31 December 2021 which coincides with the cessation of ERA's current agreement with CM&C to provide electricity to the township. As the successful proponent, EDL will be responsible for the overall Project during design, installation, commission, operation and maintenance.

Table 3-1 lists important stages of commencement progress with the final full operation of the hybrid power station commencing before 31 December 2021. The milestones listed below are subject to the timing and outcomes of referral assessment – if Supplementary Environmental Report or Environmental Impact Statement assessment processes are triggered, these milestones will need to be adjusted.

Table 3-1 Timeframes

Target Date	Target Action
April-May 2021	Site mobilisation and establishment, vegetation clearing activities
24 May 2021	Solar farm installation commences, thermal plant mobilisation and site establishment

Target Date	Target Action
15 June 2021	Thermal plant civil works commences
28 July 2021	Thermal plant mechanical and electrical installation commences
11 November 2021	Hybrid power station plant and equipment mechanically complete
12 November 2021	Commissioning process commences
31 December 2021	Thermal generation plant commissioning complete, first supply to town of Jabiru
31 January 2022	Renewable generation commissioning complete, full system operation

3.2 Transport

The main access to site will be compacted with clean gravel and suitable for service vehicles, emergency services and fuel deliveries that will be supplied from a 3-trailer road train. A 5 m wide dirt or gravel perimeter surrounding the Project area will provide access and act as a firebreak during fire season. Permanent dirt or gravel access tracks will also be created through the solar PV arrays.

Transport of equipment and machinery to site will be via the Stuart Highway, Arnhem Highway, Whites Road and El Sherana Road. The location of the site allows all deliveries to bypass the township of Jabiru and remain within the zoned industrial area.

Deliveries of diesel fuel for the generators will travel the same route. During contingency, whereby the solar PV array cannot maintain daytime demand (e.g. monsoon events), the diesel generators will be used continuously for power generation. During these times, it can be expected the usage of diesel will require fortnightly deliveries.

Staff will provide their own means of travel between the Project area and accommodation. Local traffic from staff temporarily residing in the township is not expected to increase or congest roads during both peak and low tourism seasons.

Access to the adjacent landfill will however be obstructed during the installation of potable water pipes, power lines and telecommunication cables along El Sherana Road. The power lines will be used to connect the power generation facility to the existing grid. Disruptions to motorists using El Sherana Road during installation will be temporary and traffic management arrangements will be utilised. A Traffic Management Plan will be developed and included in the CEMP.

3.3 Social and Economic

Site preparation and construction is expected to see a higher labour demand in comparison to operations and maintenance. An estimate of 20 - 25 full time contractors and sub-contractors will be required throughout the preparation and construction stage of the Project. Construction will follow the typical Northern Territory Government guidelines under the Buy Local Plan, requiring EDL to maximise the employment of local and indigenous employees and provide opportunities to local businesses where possible. The construction phase is expected to generate approximately $6.9 million worth of local content in the Northern Territory through identified works packages. During the operational phase, the Project is expected to generate around $1 million in local content each year.

EDL will maintain operation of the station once complete and staff will visit to undertake onsite maintenance when required. Staff will be accommodated in the town of Jabiru which will provide economic benefit to the small businesses through the purchase of goods and services. A summary of workforce at the varying phases is estimated in Table 3-2.

Table 3-2 Workforce estimate

Phase of Project	Workforce (Full time employee)	Timeframe
Preparation and construction	20- 25	45 weeks
Permanent and ongoing operation and maintenance	1- 2	25 years

3.4 Water and Energy

A modest amount of construction water (up to 40,000 litres per day) is expected to be required during site preparation and construction activities for dust suppression, amenities and other general use. Water will be sourced from the town water supply. CM&C has confirmed with WARC that this amount of water is available and will not produce any strain on the town water supply system.

An additional water pipe will be installed along the El Sherana Road parcel and connect to the Project area to supply the ablution blocks and a crib room at the power station during its operational phase. Water use can be expected to be similar to a single residential dwelling, with only one operator regularly onsite.

Temporary diesel generators will be used during the construction phases to provide power until permanent supply is established. Diesel usage will be monitored, and all generators will be maintained, bunded and located away from the Project boundary.

3.5 Hazardous Substance Storage and Transport

A bulk diesel storage area used for the generators during operations will be designed to ensure compliance with all safety and environmental requirements of suppliers and regulators. Three diesel tanks with capacity of 107,000 litres (L) each will be housed, appropriately bunded and located away from drainage lines, providing a total storage 321,000 L of diesel. Provision will be allowed in the design for a fourth tank with capacity of 107,000 L to be added in the future. A register will be maintained on site of all hazardous substances used during construction and operation. Correct spill kits will be maintained at all chemical storage areas. Other than oils, lubricants and diesel fuel, there will be no other hazardous substance stored on the Project area.

The three diesel tanks are designed to comply with AS1940 – The Storage and handling of flammable and combustible liquids. The standard specifies a default position that diesel storage tanks are fitted with a free vent that discharges to atmosphere which is being adopted for the Project in line with industry practices. Donaldson Breathers will be fitted to the vents on each tank to remove particulates and moisture from air that will be drawn into the diesel tanks which operate at atmospheric pressure conditions. The use of flanged connections in the diesel pipework is also being minimised to prevent potential leak sources. A diesel spill containment bund is also being provided beneath where the tanks filling hose connects to the diesel tankers that are used to refill the diesel tanks.

Diesel fuel for the generators will be delivered as required by a fuel supplier. The supplier will be qualified and equipped with appropriate spill response equipment.

3.6 Wastewater and Solid Waste

Wastewater from the portable ablutions used during construction, and permanent ablution block for the operational phase, will report to Jabiru's wastewater treatment plant located in Lot 2302, south of Lot 2303. A sewerage pipe will extend along the Project area access track, onto El Sherana Road parcel and into the existing treatment plant. The additional services will not overburden the existing facilities and ponds, which have a design capacity for at least 3,000 residents (Jabiru's residential population is currently around 1,081).

Solid waste will be transported to a licensed waste management facility. General and construction waste will be disposed of in skip bins on site and taken to an appropriate waste disposal facility. All waste storage areas will be secure prevent rubbish from becoming windblown and discourage fauna scavenging.

All empty drums and oily rags will be taken to a licensed waste management facility for correct disposal. All drums with oily residue will be segregated from general waste, appropriately stored and bunded until taken off site.

Surface water runoff from construction and operations areas will be captured in accordance with the site erosion and sediment control plan (ESCP) to prevent sedimentation into Baralil Creek. Clean surface water will be diverted away from the main activities to minimise soil surface erosion. The draft Project ESCP is provided in Appendix I.

3.7 Alternatives

Alternative options were addressed during the planning phase of the Project through several assessments and modelling completed by Ekistica. Of the six reports produced, site selection and power generation options have been determined to have the greatest environmental risk and impact and thus explained in further detail below.

3.7.1 Site Selection

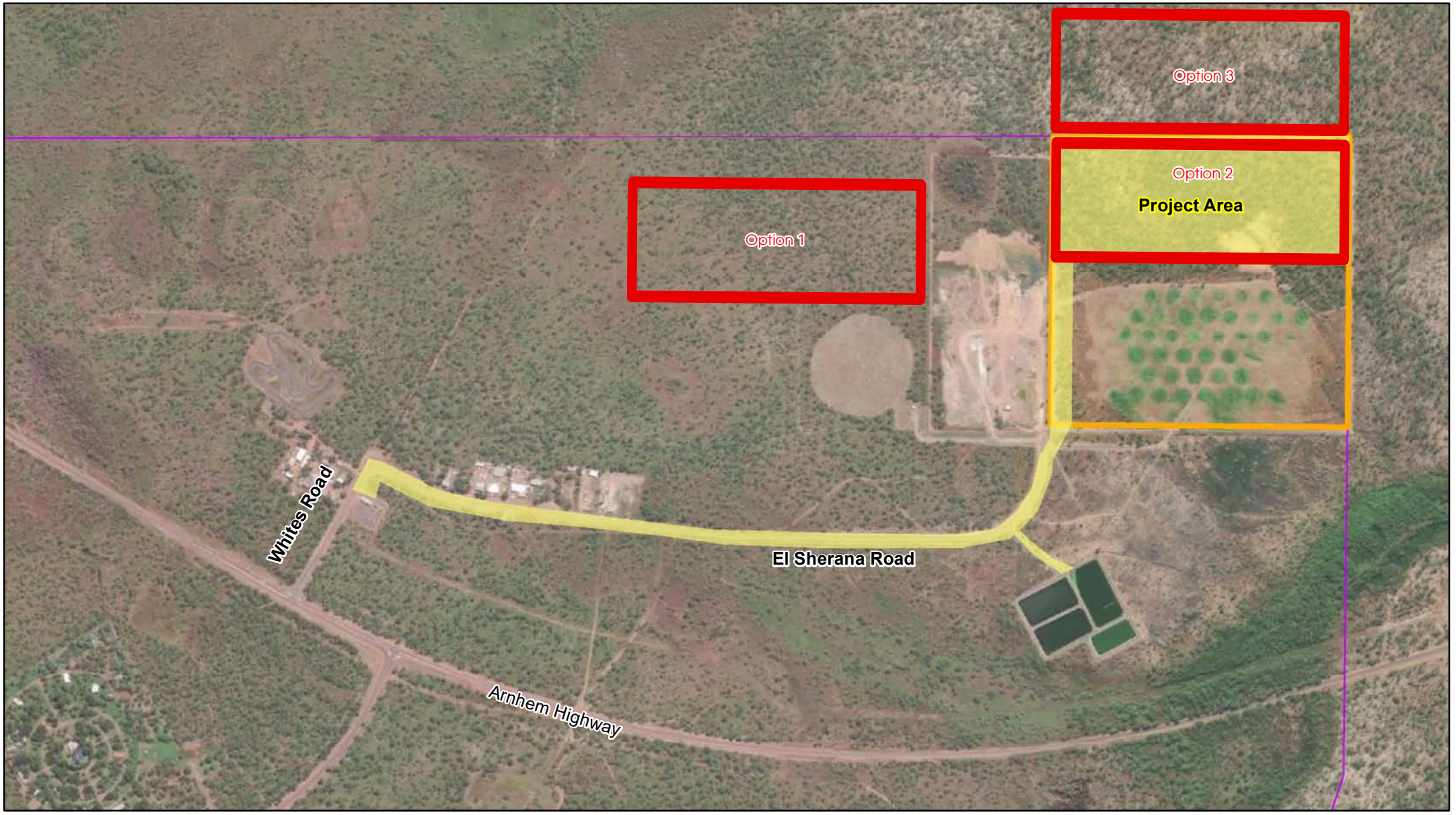
As outlined in Section 2.2.2, the tenure arrangements in Jabiru are complex and are currently in transition. There is a general constraint on land availability for the Project that limits options to the Jabiru town area displayed in Figure 2-5. Development outside the town area would occur within Kakadu and would require extensive consultation and approval processes that could take several years and carry no guarantee of success.

A further limiting factor is the zoning areas set out in the Jabiru Town Plan 2019, which came into force on 31 October 2019 and was designed to align with the Mirarr Traditional Owners' vision set out in the Jabiru Master Plan. All lots currently zoned for Utilities under the Jabiru Town Plan 2019 are already used for existing utilities, with the exception of the unused area in the northern portion of Lot 2303 (the southern portion is currently used for liquid effluent irrigation purposes and will continue to be utilised into the future).

At the time of its revision, the Jabiru Town Plan 2019 did not contemplate allocating additional Utilities-zoned lots for a future hybrid power station with a footprint of 14 ha (previous assumptions about ongoing power supply had contemplated diesel-only generation, which requires a much smaller footprint and could have been housed at the existing zone substation). There has been little prospect of revising the Jabiru Town Plan 2019 or subdividing land in Jabiru, given the complexity involved in the tenure transition process and consultation and approval processes for revising the Jabiru Town Plan 2019.

With these challenges in mind, CM&C worked closely with relevant stakeholders to consider site selection options, including Ekistica as its technical advisor, GAC, NLC, JKL, JTDA, WARC, the Executive Director of Township Leasing (previously slated to become the new lease entity in Jabiru before the creation of GACJT), the Director of National Parks and relevant NT Government agencies.

Three preliminary areas of 100,000 square metres were identified as potential sites for the Project, which were suggested in and surrounding the industrial area of Jabiru township (Figure 3-5).

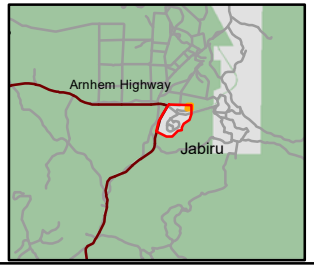


N

0 130 260

Metres

Scale @ A4 1:10,000
Date: 23/03/21
Author: shooe



Legend

- Alternative Site Locations
- Project Area
- Lot 2303
- Jabiru Town Boundary

Figure 3-5
Alternative Site Locations

CDM Smith

shooe P:\Project\1000765 - Jabiru\02 MXD\New folder\Figure 3.4 Alternative Site Locations.mxd 23-Mar-21

Aspects assessed to determine an appropriate location included:

- Topography;
- Soil characteristics;
- Flooding risk;
- Solar efficiency;
- Anticipated environmental impacts and risks;
  - Noise pollution effecting residential and tourist areas
  - Stormwater and location near water courses
  - Fuel management
  - Flora and Fauna disturbances
  - Cultural heritage disturbances.
- Access and ease to connect to the existing network;
- Leasing arrangements and land ownership; and
- Environmental approvals.

All sites offered different advantages and disadvantages, and in the absence of specific survey information were assessed as having similar risks in terms of soil conditions, flora and fauna disturbances (including for listed threatened species known to occur in the Jabiru area), cultural heritage disturbances, fuel management and stormwater management. All sites were assessed as requiring environmental approval processes.

Option 2 was determined the all-round most suited location for a hybrid power station because it is zoned for utility purposes and was further from sensitive receptors for potential air and noise pollution. Option 2 was the only site that is more than the recommended 1,500 m from the nearest planned residential development, at which point no or very minimal mitigation measures are needed. It was not the most suitable site from a technical perspective due its increased distance from the existing zone substation on the corner of Whites and El Sherana Roads, but offered suitably flat topography, solar efficiency and flood immunity.

Option 1 was considered the most technically suitable site for the hybrid power station, given its close proximity to the zone substation in the industrial area and flat topography which is ideal for a solar array. However, Option 1 was ruled out due to its incompatible zoning (split across Industrial and Open Space zoning) and closer proximity to sensitive receptors for noise and air pollution.

Option 3 was included for initial assessment and consultation with stakeholders but was ruled out due to the significant complexity and timeframes involved in securing approval for developments outside of Jabiru town area within Kakadu, and its potential to trigger compensation under the *Native Title Act 1993*. It offered similar technical and environmental characteristics to Option 2 due to its similar location.

In its call for EOIs released in November 2019, CM&C included both Option 1 and Option 2 as potential sites. However, it was necessary to lock in certainty for a single site in the second select tender process, which was released in March 2020. CM&C secured consensus support from all key stakeholders as listed above to proceed with Option 2, through a range of avenues including formal letters of support or agreement and confirmation from principal

representatives in MoU forums. At that point the Project area was effectively locked confirmed, with the exception of environmental approvals. While it may still be possible to identify an alternative location for the project, this would trigger a complex and costly variation process under CM&C's contract with EDL and significant delays to the project completion.

Generation Options

Comparative assessments were undertaken to determine the most cost effective and technically suitable generation option for the township of Jabiru. Information from previous reports by Ekistica such as future electricity demand and evaluation of the existing grid, was used to inform the decision process. Further high-level review of the potential generation options was conducted and included a range of resources as follows:

- Diesel Generation: Fuel supplied by road freight from Darwin.
- Gas (CNG) Generation: Fuel supplied by road freight from Darwin.
- Gas (LNG) Generation: Fuel supplied by road freight from Darwin.
- Gas (NG) Pipeline. Pine Creek to Jabiru following the existing road easement.
- Wind: As integrated hybrid with either diesel or gas generation.
- Solar PV: As integrated hybrid with either diesel or gas generation.
- Solar Thermal or Concentrating Solar PV: As integrated hybrid with either diesel or gas generation.
- Hydropower: As integrated hybrid with either diesel or gas generation.
- Biomass: As standalone or integrated hybrid with either diesel or gas generation.
- Grid connection: Pine Creek to Jabiru, or via Mary River to Jabiru (Ekistica, 2019a).

Each option was further assessed during technical and financial modelling over the 25-year operational period. Aspects covered during the modelling addressed recommended REF levels, financial and economic costs, technical innovation and complexity, deployment within expected timeframes, ability to flexibly respond to changing daily and annual demand profiles and uncertainty around future demand and social and environmental costs, benefits and risks. Ekistica (2019a) determined the most effective power generating option is a single axis tracking, 4 MW, Solar PV arrays/ BESS/ diesel hybrid system. This system and system size were identified to adapt to any likely change in demand and reduce the risk of high operational costs through the input from the solar PV generation to a REF of 50%.

Section 4 Legislative Context

4.1 Environment Protection and Biodiversity Conservation Act (Cth)

The EPBC Act provides protection of the environment, heritage and biodiversity conservation. Under the EPBC Act, actions that are likely to cause a significant impact on a MNES require referral to the Commonwealth Government Minister for the Environment for consideration. There are nine MNES listed under the EPBC Act, being:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas;
- Great Barrier Reef Marine Park;
- Nuclear actions; and
- A water resource in relation to coal seam gas and large coal mining development (the 'water trigger').

Under the EPBC Act, any action that is likely to have a significant impact on MNES must be:

- Undertaken in accordance with an approval from the Minister for the Environment; or
- Approved through a process accredited by the Minister for the Environment, such as approval through a bilateral agreement with a State or Territory.

The purpose of a referral is to determine whether the proposed action will need formal assessment and approval under the EPBC Act. If the action is declared a 'controlled action', assessment will be carried out by the Commonwealth Department of Agriculture, Water and the Environment as the site is within the Kakadu and therefore excluded from bilateral agreement with the Northern Territory Government (refer to Section 1).

The EPBC Act implements obligations under international conventions and treaties, such as the protection of migratory species under the Migratory Bird Agreement and Bonn Convention and the protection of world heritage area values under the World Heritage Convention.

In addition to considerations of MNES, the EPBC Act also provides for activities in Commonwealth reserves which includes Kakadu and the site. The activity may only be carried out in accordance with the Kakadu National Park Management Plan 2016 – 2026 including carrying out excavation, erecting buildings and structures, carrying out works and taking any action for commercial purposes (section 354 of the EPBC Act). Section 10.11 of the Kakadu National Park Management Plan 2016 – 2026 provides for infrastructure and works and section 8.2 provides for Jabiru matters (Director of National Parks, 2016). It is noted the Management Plan is out of date in respect of the Jabiru Town Plan references (which was approved in 1981).

4.2 Environment Protection Act 2019 (NT)

The EP Act and associated regulations has recently replaced the *Environmental Assessment Act* 1999 on 28 June 2020. The EP Act aims to protect the environment through sustainable development and manage significant disturbances through an environmental approval process. Under the act, the NT EPA regulates the environment impact assessment process to identify potential environmental impacts of development proposals. This initial step is undertaken through a referral in which the NT EPA determines if further assessment is required (i.e. the tier of assessment). The first tier of assessment would involve the NT EPA assessing the Project based on the referral information; whereas, a determination for further assessment would require the submission of either a supplementary environmental report (SER), Environmental Impact Statement (EIS) or assessment by inquiry.

4.3 Other Relevant Legislation and Policies

Table 4-1 lists other Federal and Northern Territory legislation and regulation relevant to the Project.

Table 4-1 Relevant Commonwealth and Territory Legislation

Act	Administered by	Description
Local Government Act 2008 (NT)	NT Department Infrastructure, Planning and Logistics	The Act establishes local councils. The WARC was established under the act to provide municipal services.
Aboriginal Land Rights (Northern Territory) Act 1976 (Cth)	Commonwealth Attorney-Generals, Prime Minister and Cabinet	The Act was established for granting Northern Territory lands to recognised traditional owners through Kakadu Aboriginal Land Trusts. This Act also establishes aboriginal land councils. Under this Act, the Mirarr people have been recognised as the traditional owners of the site and the Land Claim settlement is currently being finalised, meaning is the site is recognised as aboriginal lands and will be transferred to the Kakadu Aboriginal Land Trust.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)	Commonwealth Attorney General's Agriculture, Water and the Environment	The Act protects and preserves areas and objects within Australia that are of particular importance to Aboriginals in accordance with Aboriginal traditions.
Bushfires Management Act 2016 (NT) and Bushfires Management (General) Regulations	NT Department of Environment and Natural Resources	The Act assists landowners to mitigate impacts of fire by implementing fire management strategies. Bushfires NT was established to carry out and guide landowners on best fire management practices. Kakadu falls within the Arnhem management zone. Fire management is undertaken in collaboration with the Bininj/ Maungguy and other landholders in line with the Kakadu National Park Management Plan 2016- 2026 and provisions/ permits provided by Bushfires NT.
Electricity Reform Act 2000 (NT) and associated Regulations	NT Department of Treasury and Finance; NT Department of Attorney General and Justice; NT Minister for Renewables, Energy and Essential Services	The Act regulates electricity supply industry, to make provisions for safety and technical standards for electrical installation.

Act	Administered by	Description
Heritage Act 2011 (NT) and heritage regulations	NT Department of Tourism, Sport and Culture	The Act provides for the conservation of the NT's cultural and natural heritage. The Heritage Council established under the Act makes assessments and regulate work on heritage places. All sites on the NT Heritage Register and yet to be discovered sites are protected under this Act. There are no registered heritage areas within the Township of Jabiru. An archaeological assessment also noted no existing heritage areas present on Lot 2303 or El Sherana Road parcel.
Jabiru Town Development Act 1978 (NT) and regulations	NT Department of the Chief Minister and Cabinet	The Act established the statutory body the Jabiru Town Development Authority. The main function of the JTDA is to develop the town of Jabiru, give leases of land and premises, protect the environment subject to construction and operation. In the exercise of its powers the JTDA must act in accordance with the EPBC Act. The JTDA holds the head lease of the Jabiru township from the Director of National Parks and sub- leases to other parties.
National Greenhouse and Energy Reporting Act 2007 (Cth)	Commonwealth Industry, Science, Energy and Resources	The Act introduces a national framework for the reporting of information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production.
Northern Territory Aboriginal Sacred Sites Act 1989 (NT) and regulations	NT Minister for Environment, Parks and Water Security	The Act depicts the need to preserve and promote Aboriginal tradition in relation to land in the NT. This Act establishes procedures for the protection and registration of sacred sites. The Act establishes offences for entry onto, work on or, desecration of, sacred sites without appropriate certification or in contravention of the certification. CM&C obtained an Aboriginal Areas Protection Authority certificate for proposed works to be undertaken on Lot 2303 (Certificate number RA2020/117). No registered sacred sites or restricted work areas were determined.
Planning Act 1999 (NT) and regulations	NT Department of Infrastructure, Planning and Logistics	The Act provides framework of controls for the orderly use and development of land. Any proposed development in Jabiru must submit a development application to the Development Consent Authority. The consent Authority are a regulating agency established under the Act. The Jabiru Town Plan 2019 was established under a special planning scheme under the Act.
Territory Parks and Wildlife Conservation Act 1976 (NT) and Territory Parks and Wildlife Conservation Regulations	NT Department of Tourism, Sport and Culture	The Act forms a framework for the establishment and management of parks and reserves. It also aims to manage the protection, study, conservation and sustainable utilisation of wildlife. There are several threatened species listed under the Act that are potentially found on the Project area.

Act	Administered by	Description
Traffic Act 1987 (NT) and regulations	NT Department of Planning, Infrastructure and Logistics	The Act regulates traffic and for other purposes. A permit is required where construction will occur within an NT road reserve. A permit is required to work within a road reserve, this includes the land parcel for the installation of services along El Sherana Road.
Waste Management and Pollution Control Act 1998 (NT)	NT Department of Environment, Parks and Water Security	The Act protects the environment through the encouragement of effective waste management and prevention and control practices of pollution. Applicable to this project common contaminants and waste that may be generated from site without any mitigation measures may include and not limited to spills, soil erosion, sedimentation, construction waste, light pollution and dust emissions.
Water Act 2007 (Cth)	Commonwealth Agriculture, Water and the Environment	The Water Act provides for the investigation, allocation, use, control, protection and management of surface water and groundwater resources, as well as the administrative process for licensing these activities. The act also considers the protection and use of water resources for purposes such as recreational, social and cultural.
Weeds Management Act 2001 (NT)	NT Department of Environment, Parks and Water Security	An Act to prevent the spread of weeds in and out of the Territory and to ensure that the management of weeds is an integral part of land management. Using the NR Maps tool, there were several declared statutory weeds that could potentially occur within the Project area.

Section 5 Existing Environment

Processes such as climate, geomorphology and regional-scale hydrodynamic and hydrological processes, together have shaped the topography and freshwater flow regime and other important aspects of the site. At the local habitat scale, there is a mix of physical (fluvial hydrology, fire regimes) and chemical processes (water quality) as well as biological processes (reproduction) that control the area habitats and associated biota.

5.1 Climate

Jabiru lies 31 m above sea level. The regional climate is tropical and is composed of 2 distinct seasons, wet and dry. The wet season occurs from November to April and is characterised by high temperature and humidity with monsoonal rains and storms. The dry season is defined by cooler temperatures, lower humidity and minimal to no rainfall. Seasonal temperatures and rainfalls at the Jabiru Airport station 014198, from Bureau of Meteorology (BOM) display a temperature average of 29.7 °C for the time period 1971 to 2020 with annual rainfall of 1553.7 mm (Figure 5-1).

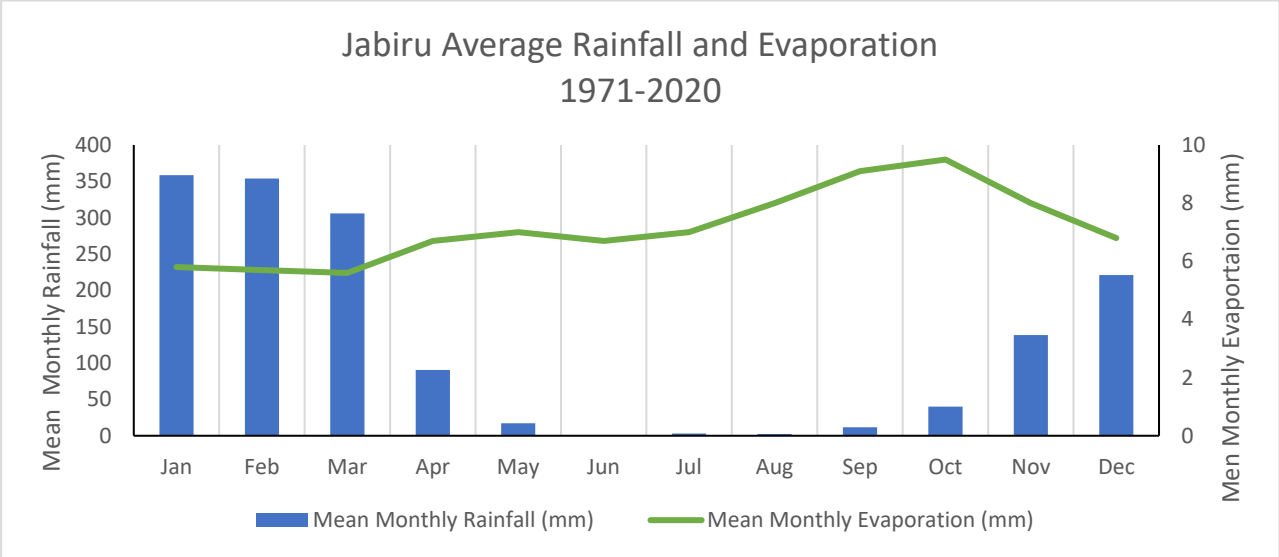


Figure 5-1 Jabiru Average Rainfall and Evaporation 1971-2020

5.2 Landforms and Soils

5.2.1 Landforms

Land system descriptions provide information in relation to the main features of the landscape (Lynch, et al., 2012). They are based on detailed information collected at specific sites. They have been mapped and described for the northern part of the NT by Lynch *et al.* (2012) at a scale of 1:250,000. The Project area lies in the Kay land system, which is described in further detail in Table 5-1.

Table 5-1 Description of Kay Land System[3]

Kay Land System	Description
Landscape Class	Lateritic plains and rises
Landscape class description	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products, sandy and earth soils
Landform description	Level to gently undulating plains on deeply weathered rocks
Soils	Lateritic red and yellow earths
Vegetation description	Eucalypt woodland

The Project area is on the Koolpinyah Surface. This landform is a Tertiary peneplain, comprising a sandy erosional surface dissected by lowland streams. The peneplain is being exhumed by retreat of the Arnhem Land Plateau.

Three other landforms surround the region and are described below and presented in Figure 5-2:

- Alluvial plains developing as over-bank deposits of mainly ephemeral streams dissecting the Koolpinyah Surface (Williams, 1969);
- The Arnhem Land Plateau escarpment, rising from about 30 m Australian Height Datum (AHD) to 300 m AHD (Erskine & Saynor, 2000) comprising cliff faces, colluvial fans, large sandstone block collapses and scree slopes; and
- The Arnhem Land Plateau, comprising quartz sandstone, that is deeply dissected along fault and joint lines through which water and sediments debouch through deep ravines or waterfalls to the Koolpinyah surface.

No land units have been described for the Project area.

[3] (Connect Environmental, 2020)

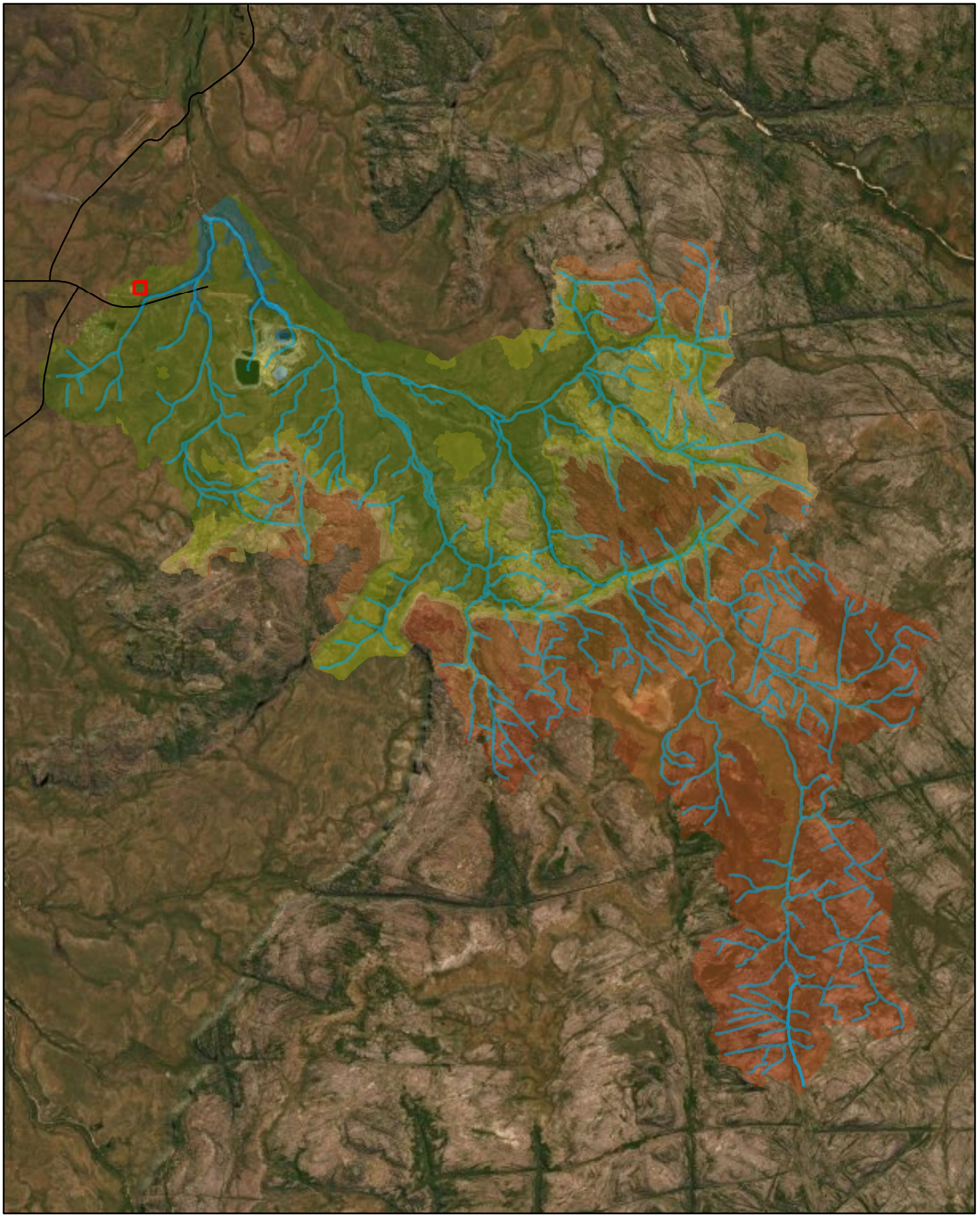


Figure 5-2
Study Region Landforms

CDM Smith

5.2.2 Soils

A geotechnical assessment of Lot 2303, determined the subsurface profile to be consistent across the site. It consisted of gravelly sandy topsoil followed by gravel with sand residual soil, underlaid by extremely weathered material (lateritic). The laterite was excavated as sandy gravel with a low plasticity clay portion. This was followed by an extremely weathered material (lateritic) which was excavated as silty sandy clay at further depth (Construction Sciences, 2020). The lowlands of the nearby Gulungul Creek catchment, containing Baralil Creek, are part of the Koolpinyah Surface. This area is vegetated with open woodland and comprises a sandy plain covered by skeletal soil (Surface Water Erosion Solutions, 2020; Needham, 1988). The soils have been described as rudisols and are uniformly coarse textured sandy soils (Surface Water & Erosion Solutions, 2020).

The main findings of the geotechnical investigation were:

- Soil samples test results: Emerson Class 5;
- Soils across the site are non-dispersive;
- Medium potential for erosion and a high potential to cause environmental harm if disturbed; and
- Given the medium potential to erode, it is recommended that all general erosion and sediment controls are put in place during the construction.

In line with the Geotechnical Report, general erosion and sedimentation control measures, relevant for clearing and trenching operations, will be installed and maintained for the duration of construction. Adequate drainage of all working areas shall be maintained throughout the period of construction to ensure run-off of water can only pond as provisioned for in a planned erosion and sedimentation control system. A draft ESCP for the Project is provided in Appendix I.

Results of the quantitative laboratory chromium suite tests indicate that the soils scheduled for disturbance are not impacted by acid sulfate soils. A site-specific Acid Sulfate Soil Management Plan is not considered necessary for works to proceed in the Project area.

A contaminated land assessment was also undertaken by Greencap (2020) to determine if the sub surface soil profile was contaminated (Appendix J). The results indicate all potential contaminants of concern in the near surface soils were reported below adopted guidelines. Overall, the risk of significant exposure to future users of the Project area to the identified chemicals of concern in the soils is considered low.

5.3 Surface Water and Hydrogeology

5.3.1 Hydrology

Due to the strong seasonality in rainfall in the region, catchment runoff follows a pronounced seasonal pattern with distinctive wetting up of the catchment in the early wet season followed by large flood flows between January and March. Stream flows can vary to a large extent due to the wet season rainfall patterns. Typically, wet season stream flows comprise a series of peak flows superimposed on a base flow beginning about mid-December and ceasing about end of June (Press, et al., 1995).

By the end of the dry season perennial creeks still flow albeit at a much-reduced level, whilst annual creeks are generally dry but may still contain patches of stagnant water as well as billabongs within the creek bed (Petty, et al., 2008). Major streams in the catchment cease to flow for several months of the year at the end of the dry season and high evaporation during the dry season quickly reduces the water levels in pond waterbodies.

The Project area is situated within the East Alligator drainage basin and the Magela creek catchment just downstream of Jabiru township (Figure 5-3). Baralil, Gulungul and Magela Creeks are ephemeral primary surface water bodies that may influence or be influenced by activities in the Project area. These creeks also form part of the Kakadu directory of important wetlands.

The Project area is located on the left bank of Baralil Creek sub catchment at a level of 30 m AHD (Surface Water Erosion Solutions, 2020) and is the closest creek and sub catchment to the Project area (Figure 5-3). Baralil Creek is a tributary of Gulungul Creek that enters approximately 2 km downstream of the Project area. Upstream of the confluence with Gulungul Creek, a build- up of sand deposition has created a backflow billabong/floodplain during flow events (Figure 5-4).

Gulungul Creek is a tributary of Magela Creek with headwaters receiving runoff from the Arnhem Plateau. Similarly, backflow from Magela Creek during the wet season has created a sand deposition which dams water received from Gulungul Creek, creating a perennial backflow billabong of approximately 11 ha in area (Surface Water Erosion Solutions, 2020). Magela Creek is a left bank tributary and main surface water body to the East Alligator River. In its lower reaches, Magela Creek has wetlands of international significance (Erskine & Saynor, 2000).

The closest Site of Conservation Significance (SOCS) to the Project is the Alligator River Floodplains (Figure 6-1) situated 5 km downstream and north-east of the Project. A Project-specific surface hydrological and erosion analysis determined that Project activities are unlikely to adversely affect flow regimes entering Magela Creek and the site is above the probable maximum flood level for Baralil Creek (Appendix B). Mitigation and management recommendations including an ESCP and Surface Water Management Plan are included in the Project commitments (refer to Section 7 and Appendix A).

5.3.2 Hydrogeology

Groundwater aquifers in the vicinity of Jabiru are found in typically fractured and weathered rocks with minor groundwater resources and yield (Figure 5-5) (BMT WBM, 2010). Groundwater quality is fresh and potable with total dissolved solids ranging from 0-500 mg/L (Greencap, 2020).

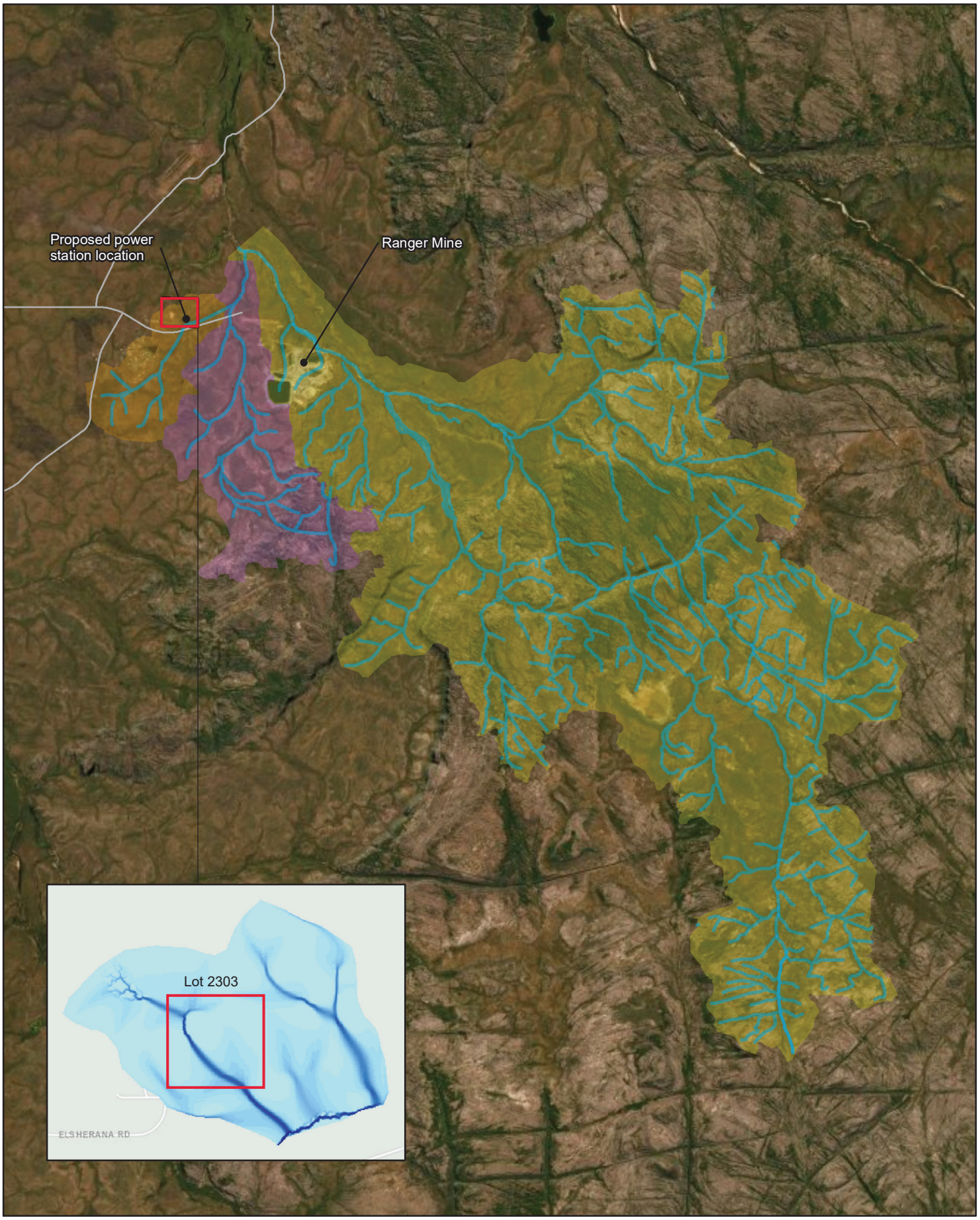
Groundwater from shallow aquifers generally maintain flows in Magela Creek mainly during the wet season through surface water infiltration. The aquifer is a local scale aquifer, i.e. groundwater flows through the aquifer is less than 5 km from recharge to discharge point.

Regionally, Jabiru aquifers are shallow with unconsolidated soils, or a deep aquifer in weathered bedrock material within fractured rock. The recharge of the uppermost aquifer likely occurs because of seasonal rainwater infiltration. Evapotranspiration likely causes a rapid decline in water level of the shallow aquifer during dry season (Greencap, 2020).

Groundwater is used for the town water supply. The potable water is supplied from town bores approximately 20 km west of Jabiru along the Arnhem Highway, outside the catchment of Magela Creek. Additionally, there are bores within the town that are used for non-domestic purposes (Greencap, 2020).

A geotechnical investigation carried out on Lot 2303 in July 2020, encountered groundwater on average at 3.9 metres below ground level during bore drilling. The shallowest groundwater intersected was at 1.85 m. This test pit was located in the south east section of Lot 2303 and the nearest test pit to Baralil Creek (Construction Sciences, 2020).

Groundwater levels can be influenced by many factors including regional groundwater level, local and regional drainage, geology, rainfall and changes in land use and groundwater extraction (Construction Sciences, 2020). The full geotechnical investigation is provided in E and measures to prevent impacts to groundwater are provided in Section 7 and Appendix A.

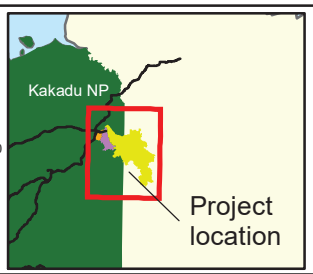


DATA SOURCES
BMT WBM 2010
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, © OpenStreetMap contributors and SWES 2020.

N

0 3,450 6,900
Metres

Scale @ A4 1:260,000
Date: 25/02/21
Author: Deanna Bayliss



Waterway
Road
Baralil Creek Catchment
Gulungul Creek Catchment
Magela Creek Catchment

Flow accumulation
High
Low

Figure 5-3
Baralil Creek Catchment

CDM Smith

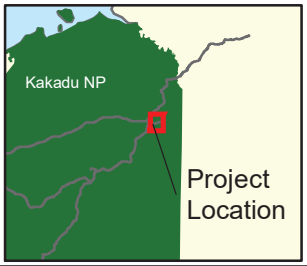
EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_5_3_Baralil_Catchment.mxd 25/02/2021

DATA SOURCES
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 500 1,000
Metres

Scale @ A4 1:40,000
Date: 03/03/21
Author: D. Bayliss

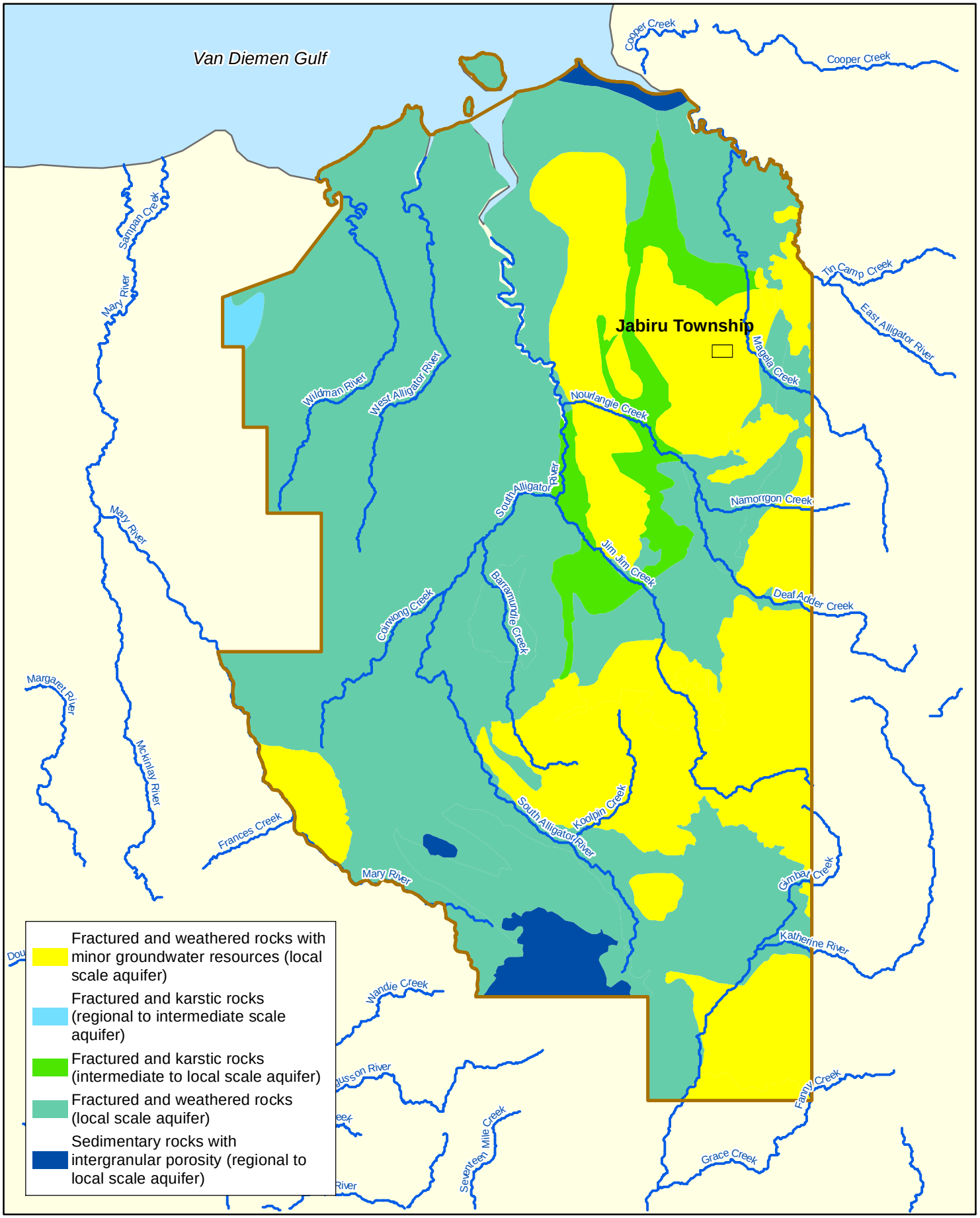


- Major Waterway
- Road
- Lot 2303
- Project Area in Lot 2303
- Gulungul Floodplain
- Baralil Floodplain

Figure 5-4
Local Creek Systems within the Baralil Catchment

CDM Smith

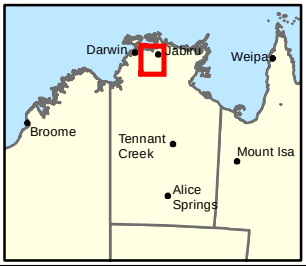
EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_5_4_LocalCreek_System.mxd 3/03/2021



N

0 13,750 27,500
Metres

Scale @ A4 1:1,050,000
Date: 25/02/21
Author: D. Bayliss



Kakadu National Park boundary
Major waterway

Figure 5-5
Aquifer Types of Kakadu National Park

CDM Smith

5.4 Terrestrial Ecology

Kakadu is a Commonwealth reserve under the EPBC Act. Kakadu's wetlands are registered as a Ramsar site and listed under the Convention on Wetlands of International Importance (the Ramsar convention) for their outstanding ecological, botanical, zoological and hydrological features.

The terrestrial ecology depends on four main landforms (soil landforms described in Section 5.2) covering Kakadu: Koolpinyah Surface, alluvial plains, Arnhem Land plateau escarpment and the Arnhem Land Plateau. The terrestrial habitats support a variety of fauna species, many of which use resources from a combination of terrestrial and wetland habitats. Terrestrial flora and fauna species are an integral part of the Kakadu ecosystems, contributing significantly to habitat functions and processes such as energy and nutrient cycles.

The immediate terrestrial ecology of the Project area was initially assessed by local consultant, Connect Environmental, and later supplemented by Low Ecological, through a range of assessment processes. This was undertaken to determine the presence of threatened species and the potential impacts from Project activities. The processes include:

1. Initial desktop studies using online atlases, EPBC Protected Matters Search Tool and any publicly available environmental assessment information for nearby areas to determine presence of threatened species, weeds, feral animals and areas of significance. Ranges of 5 km (Figure 5-6) and 50 km were used.

2. A reconnaissance survey was undertaken on 22 June 2020 to inform knowledge gaps found during the desktop study. The survey specifically assessed suitable habitat that may be used by threatened species, the presence of weeds, anthropogenic disturbances (within the Project area and wider Lot 2303) and species composition of the primary vegetation community.

   Assessments were subsequently undertaken to determine the likelihood and level of threats posed to threatened species:

   a. Based on findings from the reconnaissance survey and desktop study the likelihood of threatened species occurring on the Project area was determined with the following occurrence classes and results are included in Table 5-2:

      - **Unlikely**: species or ecological community is not expected to occur in the Project area based on the apparent lack of suitable habitat and/or local records;
      - **Possible**: species or ecological community may occur in the Project area based on the occasional or potential presence of suitable habitat, however there is no obvious indication of this; and
      - **Likely**: species or ecological community is expected to occur in the Project area based on the apparent presence of suitable habitat and number / proximity of local records.

   b. Threatened species with the likelihood of occurring within the Project area were part of a preliminary risk assessment (Table 5-4) to determine the level of potential inherent risk to species and their habitat as a result of proposed activities. Categories addressed within the risk assessment included population, habitat connectivity, critical habitat, breeding cycle and invasive species (Connect Environmental, 2020).

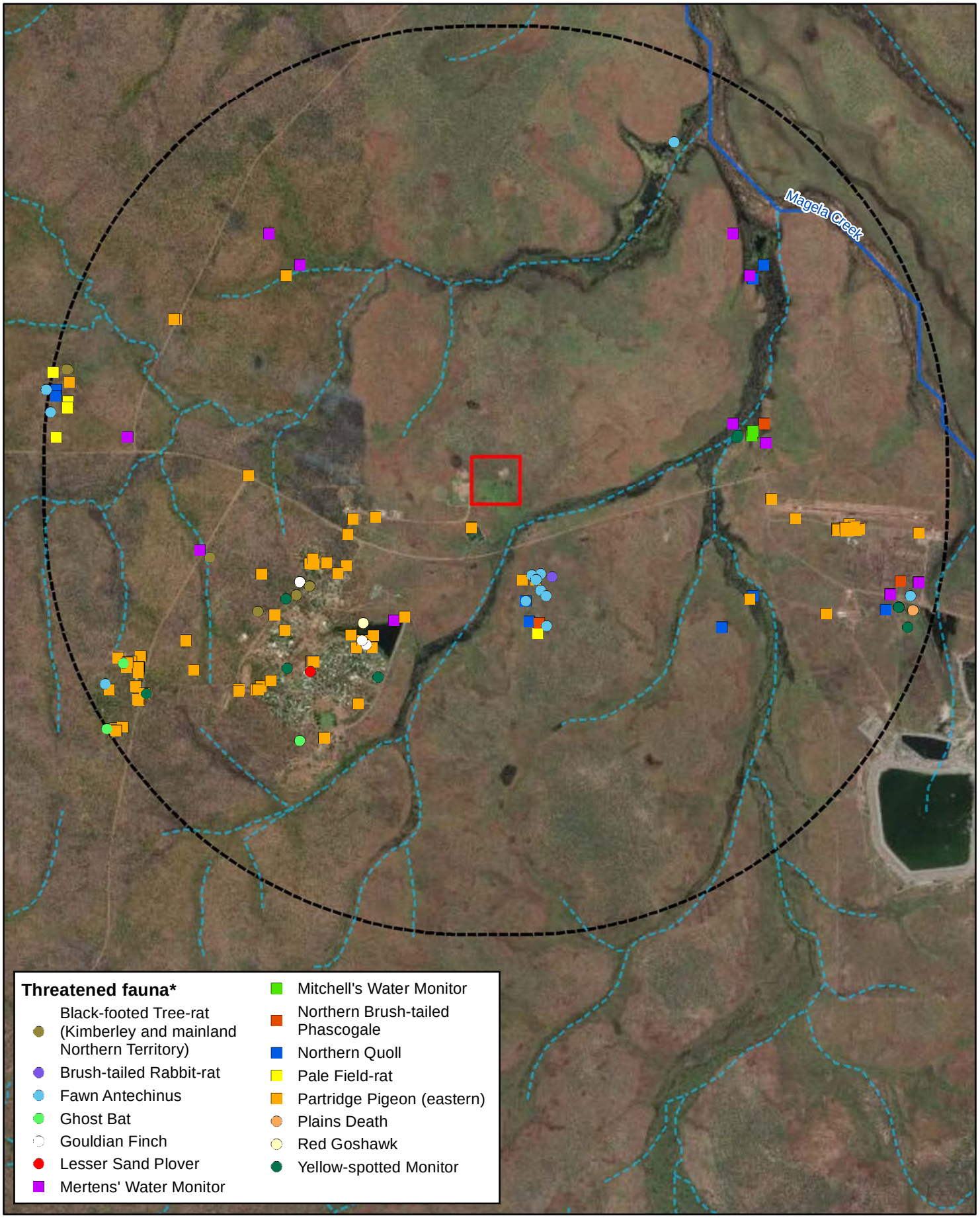
3. A preliminary field and camera-trap survey (first survey event) was undertaken from August to September to determine the presence and quality of habitats for threatened species. The species of focus with an identified inherent risk during the preliminary risk assessment were the primary target during monitoring. The *Territory Parks and Wildlife Conservation Act 1976* (TPWC) Act and EPBC Act listed threatened species of focus included:

- Partridge Pidgeon (*Geophaps smithii*);
- Crested shrike- tit (*Falcunculus frontatus whitei*);
- Masked owl (*Tyto novaehollandiae kimberli*);
- Northern quoll (*Dasyurus hallucatus*);
- Fawn Antechinus (*Antechinus bellus*);
- Black-footed Tree-rat (*Mesembriomys gouldii gouldii*);
- Northern brush- tail phascogale (*Phascogale pirata*);
- Pale field- rat (*Rattus tunneyi*); and
- Yellow spotted monitor (*Varanus panoptes*).

The preliminary survey coincided with peak breeding periods for Black-footed Tree-rat. Twenty baited (mixture of oats, peanut butter and honey) camera traps were deployed exclusively within the Project area and adjacent areas of Lot 2303 (Figure 5-7).

4. Further camera-trap survey work was undertaken (second survey event) to address knowledge gaps and to determine the relative significance of the Black-footed Tree-rat individuals detected within Lot 2303 in the initial field survey. This survey was undertaken in November to December and focused exclusively on areas surrounding Lot 2303 and within the township of Jabiru. A total of 35 baited camera sites were established in similar vegetation structures to Lot 2303 (e.g.*Eucalyptus Miniata* and *E. tetrodonta* woodland) (Figure 5-8). The aim of this survey was to obtain more data on the local distribution of Black-footed Tree-rat given the paucity of records in the NT Fauna Atlas (Department of Environment and Natural Resources, 2020a) and the apparent lack of formal fauna surveys in the local area. The Biodiversity Assessment Report provided in Appendix C is based on the results of the work up to this stage of the program. However, based on consultation with the Department of Environment, Parks and Water Security's Flora and Fauna Division and species subject matter experts, it was determined that a further survey utilising trap-release methods within the site and broader surrounds was necessary to establish comprehensive population data.

5. A third survey event (trap-release) was undertaken in March 2021 with the aim of determining the population size and spatial use of Black-footed Tree-rats within and adjacent to the Project area. To ensure appropriate survey design and techniques, the Flora and Fauna Division of the Northern Territory Department of Environment, Parks and Water Security were consulted throughout preparation and implementation of the survey. The Division provided the survey design and supervised the field program. One hundred and ninety-one traps were set for five nights (totalling 955 trap nights) within the vegetated portion of the Project area and the surrounding woodland (Figure 5-9).

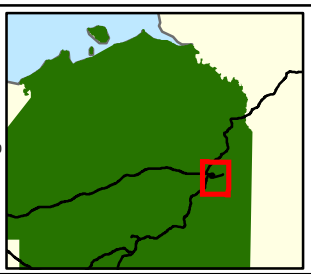


DATA SOURCES
© Northern Territory Fauna Atlas
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
* Locations of markers slightly dispersed for illustration

N

0 800 1,600
Metres

Scale @ A4 1:60,000
Date: 25/02/21
Author: D. Bayliss



Lot 2303
5 km buffer from Lot 2303
Major waterway
Streams
Road
Kakadu National Park

Figure 5-6
Threatened Fauna Recorded within 5 km of Lot 2303

CDM Smith

EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_5_6_ThreatenedSpecies.mxd 25/02/2021

5.4.1 Threatened Fauna

Outcomes of the initial desktop study are detailed in Table 5-2 and records presented spatially in Figure 5-6. The search identified 34 threatened fauna species (26 of which are EPBC Act listed threatened species) to occur within a 50 km buffer. Fifteen of these species were also located within a 5 km buffer, including six migratory species records.

Of the 34 fauna species and six migratory species identified from the desktop exercise, a reconnaissance survey was conducted on the 22 June 2020 to obtain information to inform knowledge gaps found during the desktop study. The results were used to assist in determining the potential for threatened species to occur in the Project area.

The survey involved collecting information on suitable habitat for threatened species and specifically characteristics of key habitat features for each species, presence of pests and weeds, anthropogenic disturbances and vegetation community species composition.

Using the survey information, a preliminary likelihood of occurrence methodology was used to determine the potential for threatened species to occur within the Project area based on the occurrence classes identified in Section 5.4.

Eleven species were identified as having the potential to possibly or likely occur in the Project area. These fauna species are highlighted in green in Table 5-2 and include reptiles, mammals and birds, two of which are listed as Endangered, and one as Critically Endangered. The preliminary likelihood of occurrence methodology is described in Section 6 of the Biodiversity Assessment Report, 2020 (Appendix C).

Of the six migratory species, four species have the potential to possibly occur on the site. However, the Project area is unlikely to contain important habitat for any of these four migratory species, and it was determined that it is unlikely the Project would significantly impact on these species. No on-site surveys were considered necessary to ascertain their presence or absence (Connect Environmental, 2020).

Table 5-2 Threatened Fauna Recorded within a 50 km and 5 km radius of the Project Area including a Preliminary Likelihood of Occurrence Assessment

Data Sources [1]	Scientific name	Common name	TPWC Act	EPBC Act	No. Records	Most Recent	Preliminary Likelihood of Occurrence[2]
Reptiles							
EPBC Act PMST, NT Fauna Atlas, 50 km radius	*Acanthophis hawkei*	Plains Death Adder	Vulnerable	Vulnerable	1	1983	Unlikely
EPBC Act PMST	*Bellatorias obiri*	Arnhem Land Egernia	Endangered	Endangered	-	-	
NT Fauna Atlas 5 km, 50 km radius	*Morelia oenpelliensis*	Oenpelli Python	Vulnerable	Not Listed			
NT Fauna Atlas 5 km, 50km radius	*Varanus mitchelli*	Mitchell's Water Monitor	Vulnerable	Not Listed			
NT Fauna Atlas 5 km, 50 km radius	*Varanus mertensi*	Mertens' Water Monitor	Vulnerable	Not Listed			Possible
NT Fauna Atlas 5 km, 50 km radius	*Varanus panoptes*	Yellow-spotted Monitor	Vulnerable	Not Listed			
Mammals							
NT Fauna Atlas 5 km, 50 km radius EPBC Act PMST	*Conilurus penicillatus*	Brush-tailed Rabbit-rat	Endangered	Vulnerable	1	1983	Unlikely
EPBC Act PMST	*Hipposideros inornatus*	Arnhem Leaf-nosed Bat	Vulnerable	Endangered	-	-	
NT Fauna Atlas 50 km radius only	*Hipposideros stenotis*	Northern Leaf-nosed Bat	Vulnerable	Not Listed			
NT Fauna Atlas 5 km, 50 km radius EPBC Act PMST	*Macroderma gigs*	Ghost bat	Near Threatened	Vulnerable	2	2011	
EPBC Act PMST	*Petrogale concinna canescens*	Nabarlek	Vulnerable	Endangered	-	-	
EPBC Act PMST	*Saccolaimus*	Bare-rumped Sheath-tailed Bat	Data Deficient	Vulnerable	-	-	
NT Fauna Atlas 5 km, 50 km radius	*Xeromys myoides*	Water Mouse, False Water Rat	Not listed	Vulnerable	-	-	
NT Fauna Atlas 5 km, 50 km radius	*Zyzomys maini*	Arnhem Rock-rat	Vulnerable	Vulnerable	-	-	
NT Fauna Atlas 5 km, 50 km radius EPBC Act PMST	*Antechinus bellus*	Fawn Antechinus	Endangered	Vulnerable	19	2013	Possible

Data Sources [1]	Scientific name	Common name	TPWC Act	EPBC Act	No. Records	Most Recent	Preliminary Likelihood of Occurrence[2]
NT Fauna Atlas 5 km, 50 km radius EPBC Act PMST	*Dasyurus hallucatus*	Northern Quoll	Critically Endangered	Endangered	23	2002	
NT Fauna Atlas 5 km, 50 km radius EPBC Act PMST	*Phascogale pirata*	Northern Brush-tailed Phascogale	Endangered	Vulnerable	7	2002	
NT Fauna Atlas 5 km, 50 km radius	*Rattus tunneyi*	Pale Field-rat	Vulnerable	Not Listed			
NT Fauna Atlas 5 km, 50 km radius EPBC Act PMST	*Mesembriomys gouldii*	Black-footed Tree-rat (Kimberley and mainland Northern Territory)	Vulnerable	Endangered	7	2012	Likely
Birds							
NT Fauna Atlas 5km, 50km radius EPBC Act PMST	*Erythrura gouldiae*	Gouldian Finch	Vulnerable	Endangered	4	2019	Possible
EPBC Act PMST	*Falcunculus frontatus whitei*	Crested Shrike-tit	Not listed	Vulnerable	-	-	
NT Fauna Atlas 5km, 50 km radius	*Geophaps smithii*	Partridge Pigeon	Vulnerable	Vulnerable	107	2013	
EPBC Act PMST	*Tyto novaehollandiae kimberli*	Masked Owl	Vulnerable	Vulnerable	-	-	
NT Fauna Atlas 50 km radius only EPBC Act PMST	*Amytornis woodwardi*	White-throated Grasswren	Vulnerable	Vulnerable	-	-	Unlikely
EPBC Act PMST	*Calidris ferruginea*	Curlew Sandpiper	Vulnerable	Critically Endangered	-	-	
NT Fauna Atlas 50 km radius only EPBC Act PMST	*Calidris tenuirostris*	Great Knot	Vulnerable	Critically Endangered	-	-	
NT Fauna Atlas 50 km radius only EPBC Act PMST	*Charadrius leschenaultii*	Greater Sand Plover	Vulnerable	Vulnerable	-	-	
NT Fauna Atlas 5 km, 50 km radius	*Charadrius mongolus*	Lesser Sand Plover	Vulnerable	Critically Endangered	1	2000	

Data Sources [1]	Scientific name	Common name	TPWC Act	EPBC Act	No. Records	Most Recent	Preliminary Likelihood of Occurrence[2]
EPBC Act PMST							
NT Fauna **Atlas 50 km radius only** **EPBC Act PMST**	*Epthianura crocea tunneyi*	Yellow Chat	Endangered	Endangered	-	-	
NT Fauna Atlas **50 km radius** **EPBC Act PMST**	*Erythrotriorchis radiatus*	Red Goshawk	Vulnerable	Vulnerable	1	2019	
NT Fauna Atlas 50 km radius	*Falco hypoleucus*	Grey Falcon	Vulnerable	Not Listed	-	-	Unlikely
NT Fauna Atlas 50 km radius	*Limosa lapponica*	Bar-tailed Godwit	Vulnerable	Not Listed	-	-	
EPBC Act PMST	*Numenius madagascariensis*	Far Eastern Curlew	Vulnerable	Critically Endangered	-	-	
EPBC Act PMST	*Rostralata australis*	Australian Painted Snipe	Vulnerable	Endangered	-	-	
EPBC Act PMST	*Motacilla cinerea*	Grey Wagtail	Not Listed	Marine, Migratory	-	-	
EPBC Act PMST	*Rhipidura rufifrons*	Rufous Fantail	Not Listed	Marine, Migratory	-	-	
EPBC Act PMST	*Cecropis daurica*	Red-rumped Swallow	Not Listed	Marine, Migratory	-	-	Possible
EPBC Act PMST	*Cuculus optatus*	Oriental Cuckoo	Not Listed	Marine, Migratory	-	-	
EPBC Act PMST	*Hirundo rustica*	Barn Swallow	Not Listed	Marine, Migratory	-	-	
EPBC Act PMST	*Motacilla flava*	Yellow Wagtail	Not Listed	Marine, Migratory	-	-	

[1]Data Sources: NT Fauna Atlas, (EPBC Act PMST) Environmental Protection, Biodiversity, Conservation Act Protected, Matters Search Tool.

[2] Preliminary Likelihood of Occurrence Assessment Ratings – unlikely, possible, unlikely.

5.4.2 Threatened Species Risk Assessments

5.4.2.1 Preliminary Threatened Species Risk Assessment

A preliminary assessment of the level of potential inherent threat to potentially occurring species was conducted to determine the level of unmitigated risk and whether further surveys and assessments were required. It is specifically related to species determined to potentially occur in the vicinity of the Project area, as per the likelihood of occurrence assessment in Section 5.4.1, considering unmitigated risks only. Definitions for the consequence of impacts are in Table 5-3 and are taken from the Species Expert Assessment Plan (SEAP) Manual (Threatened Species Scientific Committee, 2015b). The results of the preliminary assessment of inherent risks are in Table 5-4.

Table 5-3 Impact Consequence Definitions for Threatened Species

Consequence	Insignificant	Minor	Moderate	Major	Critical
Impact on population (the proportional changes to the numbers of individuals; change in the size of the population).	Minimal impact on local population numbers; area affected negligible compared to total population; minimal or acceptable impact on population size	Minor impact on local population numbers. Population in other locations not impacted	Moderate impact on local population numbers. Some impacts on populations in other locations; moderate and/or short-term effects	Major population reduction or loss of local population; recovery measure in years to decades; serious and significant impact on species	Population reduction which may results in species extinction; recovery period is greater than decades; very significant and serious impact on high value species
Fragmentation of habitat / loss of habitat connectivity / reduce the areas of occupancy (the physical destruction of the species habitat and/or chemical or physical barriers).	Minimal losses of local habitat only, recovery likely in a relatively short period of time; threats are covered by current management or legislation	Minor losses of local habitat requiring recovery over short term	Moderate loss of local habitat requiring recovery over a short to medium term and resulting in loss of connectivity between habitats at a local scale	Loss of local habitat with no potential for recovery, or partial loss of habitat across large areas and/or with limited potential for recovery in the medium to long term. Results in a net reduction in connectivity over a large area	Complete loss of local habitat with no potential for recovery and loss of habitat in other locations with limited potential for recovery in the long term resulting in a significant impact on habitat connectivity over a large area

Consequence	Insignificant	Minor	Moderate	Major	Critical
Impact on the habitat critical to the survival of the species (species habitat resource includes modify, destroy, isolate or decrease the availability or quality of habitat).	Minimal modification, destruction, removal or decrease of local habitat only, recovery likely in a relatively short period of time; insignificant impact to habitat or threat activity only occurs in a very small area of habitat; limited damage to minimal area of low significance; minor effects on physical environment	Minor modification, destruction, removal or decrease of local habitat requiring recovery over short term	Moderate modification, destruction, removal or decrease of local habitat requiring recovery over a short to medium term and resulting in loss of connectivity between habitats at a local scale	Modification, destruction, removal or loss of local habitat with no potential for recovery, or partial loss of habitat across large areas and/or with limited potential for recovery in the medium to long term. Results in a net reduction in connectivity over a large area; habitat is affected which may endanger the species and habitat long term survival – 70-90% habitat affected or removed; 30% fragile habitat affected or removed; 10-20% critical habitat affected or removed	Significant impact resulting in the removal, destruction, fragmentation and degradation of habitat; the entire habitat is in danger of being affected or removed, that >90% habitat, >50% fragile habitat, and >30% critical habitat
Disruption to breeding cycle (Breeding cycle including activities associated with breeding (mating, gestation, nesting). Assessment assumes that the species is present in the affected area during the breeding cycle).	Minimal impact on any aspect of the breeding cycle	Minor disruption to the breeding cycle	Moderate disruption to breeding cycle resulting in modification of behaviour both within the direct impact zone and at nearby locations; long term recruitment and/or population dynamics are not adversely impacted	Direct impacts on breeding cycle resulting in a net decline in size of the population; there is limited information to judge the impact	Complete disruption of breeding cycles over several seasons with significant population decline and possible extinction

Consequence	Insignificant	Minor	Moderate	Major	Critical
Impact of invasive species and/or disease (the invasive species that is harmful to the species becoming established in the species habitat and introduced disease that may cause the species to decline)	Minimal impact on local population numbers or habitat quality	Minor impact on local population numbers or habitat quality. Population in other locations not impacted	Moderate impact on local population numbers or habitat quality. Some impacts on populations in other locations	Major population reduction or loss of local population or loss of habitat quality	Population reduction which may results in species extinction loss of critical habitat extent or quality
Interaction with species migration	Minimal impact on species migratory patterns	Results in minor behavioural modification on a local scale or impacts to physical conditions of animal interfering with migration for the short term only. Unlikely to negatively impact on the overall success of migration	Results in modification of behaviour or animal conditions such that there is potential for medium term impacts, with some possibility of individuals failing to complete migration	Results in modification of behaviour or animal condition such that there is potential for medium to long term impacts, both locally and in nearby locations, with some individuals failing to complete migration	Significant impact resulting in either complete failure, or failure of majority of individuals, to complete migration in that cycle

Of the 11 species which were identified as having the potential to occur in the Project area (listed as possible or likely), the Gouldian Finch (*Erythrura gouldiae)* and Mertens' Water Monitor (*Varanus mertensi*) were preliminary assessed for the level of potential inherent impact and likelihood of their presence onsite. Both species received a rating of insignificant (and no greater) which would be unlikely to require on-ground surveys to determine their presence and/ or distribution. The remaining nine fauna species (seven of which are EPBC Act listed species) were assessed as minor or greater and further consideration in the site surveys was considered necessary.

Table 5-4 Preliminary Assessment of Unmitigated Risk Levels

	Population	Habitat Connectivity	Critical Habitat	Breeding Cycles	Invasive Species
Determined to be focus of field survey					
Partridge Pigeon	Insignificant	Insignificant	Minor	Insignificant	Insignificant
Crested Shrike-tit	Insignificant	Insignificant	Minor	Insignificant	Insignificant
Masked Owl	Minor	Insignificant	Minor	Minor	Minor
Fawn Antechinus	Minor	Insignificant	Minor	Minor	Minor
Northern Quoll	Minor	Insignificant	Minor	Minor	Minor
Black-footed Tree-rat	Moderate	Minor	Minor	Minor	Minor

	Population	Habitat Connectivity	Critical Habitat	Breeding Cycles	Invasive Species
Determined to be focus of field survey					
Northern Brush-tailed Phascogale	Minor	Insignificant	Minor	Minor	Minor
Pale Field-rat	Minor	Insignificant	Insignificant	Insignificant	Insignificant
Yellow- spotted Monitor	Insignificant	Insignificant	Minor	Insignificant	Insignificant
No further assessment of threatened species required					
Gouldian Finch	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Mertens' Water Monitor	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

Two site (camera-trap) surveys were conducted in August-September 2020 and then in November 2020 by Connect Environmental. A third survey (trap-release) focused on obtaining population data for the Black-footed Tree-rat was conducted in March 2021 by Low Ecological Services. Full details of the survey methodology and results are included in the Biodiversity Assessment Report, Appendix C and the Black-footed Tree-rat Population and Management Assessment Report, Appendix D).

The first survey objectives included:

- To determine and map vegetation communities across the Project are and Lot 2303;
- To determine the presence and quality of habitats for threatened species; and
- To determine the presence of threatened species, using the methods described.

The second survey objective was to determine the presence of the Black-footed Tree-rat (*Mesembriomys gouldii gouldii)* outside of the Project area and the aim of the third survey was to determine the population size and spatial use of Black-footed Tree-rats within and adjacent to the Project area.

5.4.2.2 First Site Survey Results

The first site survey, undertaken in August-September 2020, recorded several fauna species, some of which are threatened and pest species. Survey methods included targeted bird surveys, camera traps and general observations. A targeted bird survey was undertaken to determine the presence of threatened bird species which included the Partridge Pigeon, Crested Shrike-tit (*Falcunculus frontatus whitei*) and Masked Owl (*Tyto novaehollandiae kimberli*). A total of seven bird surveys were conducted over five days in which all birds were observed and calls recorded. Depending on target species, bird surveys consisted of:

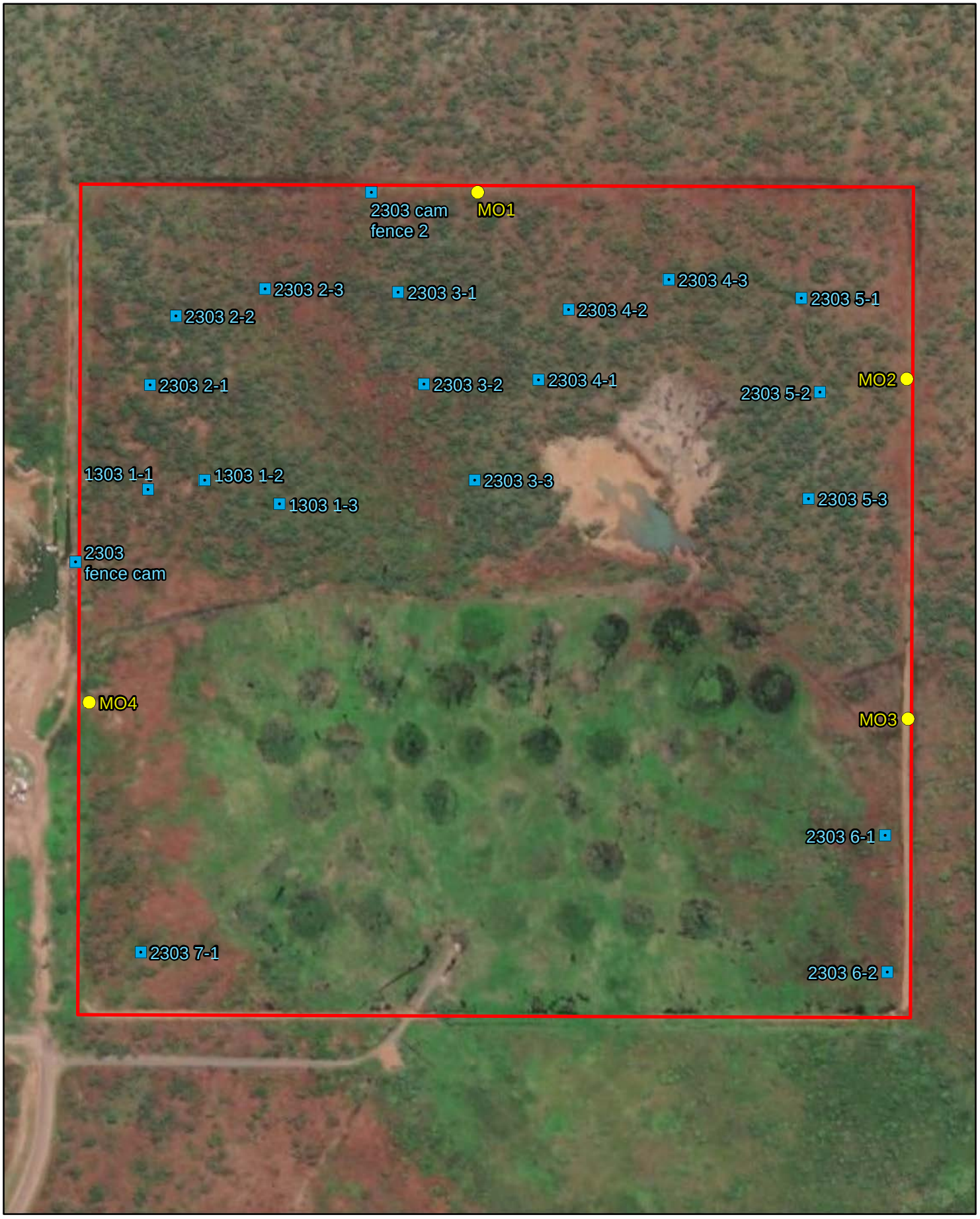
- Broadcast calls;
- Area searches;
- Call playback;
- Spotlight searches; and
- Observations and responses.

The bird survey identified a total 22 bird species being either observed or heard during survey period. This included non-threatened and threatened bird species.

Camera traps were set up at varying locations across the Project area and Lot 2303 in potential habitats for threatened mammal species. A total of 20 cameras were deployed exclusively within the lot, with the majority positioned in Eucalyptus dominated woodland in the northern portion of the site (Figure 5-7). Each camera faced bait stations that consisted of a mixture of oats, peanut butter and honey. Cameras were stationed for 29 nights from 31 August to 29 September 2020 and checked on a weekly basis.

Results from the camera traps recorded seven mammals, one amphibian and nine bird species over the period. The greatest number of recordings on cameras were the northern brown bandicoot with 18 sightings followed by the Black-footed Tree-rat with 14 sightings (listed Vulnerable under TPWC Act and Endangered under EPBC Act). Of the twenty cameras, camera 5-3 which was located at the north eastern portion of the site recorded the greatest diversity with nine different species recorded. Given that cameras were typically set up in groups of three approximately 50 m to 100 m apart, it is likely that any one individual was captured on more than one camera and therefore total number of sightings does not represent individual counts.

All Black-footed Tree-rat detections were in the *Eucalyptus miniata / E. tetrodonta* woodland in the northern half of Lot 2303. This correlates with their preferred habitat (i.e. the southern half of Lot 2303 does not contain habitat attributes typically utilised by the species). The surveys were also conducted during this species peak breeding season which is from August to September (Friend, 1987; Rankmore, 2006), suggesting that the species may be more active across a larger range at this time. Because no traps were placed outside of Lot 2303 a second survey was conducted in November using baited camera traps and spotlighting situated around Jabiru township preferably in *Eucalyptus miniata / E. tetrodonta* woodland habitat. Details of this survey are included in the second site survey results.

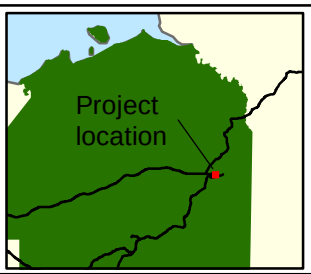


DATA SOURCES
Connect Environmental 2020
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 45 90
Metres

Scale @ A4 1:3,500
Date: 25/02/21
Author: D. Bayliss



Lot 2303
Camera
Masked Owl Survey Site
Road
Kakadu National Park

Figure 5-7
Preliminary Survey Camera Trap Locations on Lot 2303

CDM Smith

EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_5_7_CameraTrapLocations.mxd 25/02/2021

5.4.2.3 Second Site Survey Results

The second site survey was conducted in November 2020. Survey methods included spotlighting and deployment of 12 camera traps outside of Lot 2303 positioned around Jabiru township, near the adjacent landfill and to the northern end of Lot 2303 in *Eucalyptus miniata / E. tetrodonta* woodland (Figure 5-8). Finding suitable undisturbed habitat around the Jabiru area was difficult due to the impacted nature of the area from regular fires, pests, fragmented habitat and anthropogenic activities. Each camera faced bait stations that consisted of a mixture of oats, peanut butter and honey. Cameras were stationed for 17 nights in November 2020 and checked on a weekly basis.

Results from the second survey camera traps observed only one Black-footed Tree-rat. The siting was immediately north-west of the Project area at camera site J-N-23 (Figure 5-8). No observations were detected on cameras within Jabiru or the adjacent landfill during spotlighting sessions.

Fourteen Partridge Pigeons which were incidentally detected when ecologists were walking in and around the Project area and numerous other locations in the surrounding area.

5.4.2.4 Third Site Survey Results

A trapping grid was designed to overlay the vegetated portion within Lot 2303 and a 200 m buffer in the adjacent woodland, with traps positioned 50 m apart (Figure 5-9). However, difficulties laying traps in inundated areas on the western side, and hazards associated with the active landfill, resulted in a decision to remove the 25 traps from the landfill area after the first night (see Figure 5-9). The remaining 191 traps were set for five nights to ensure the recapture rates would be sufficient for population estimates (totalling 955 trap nights).

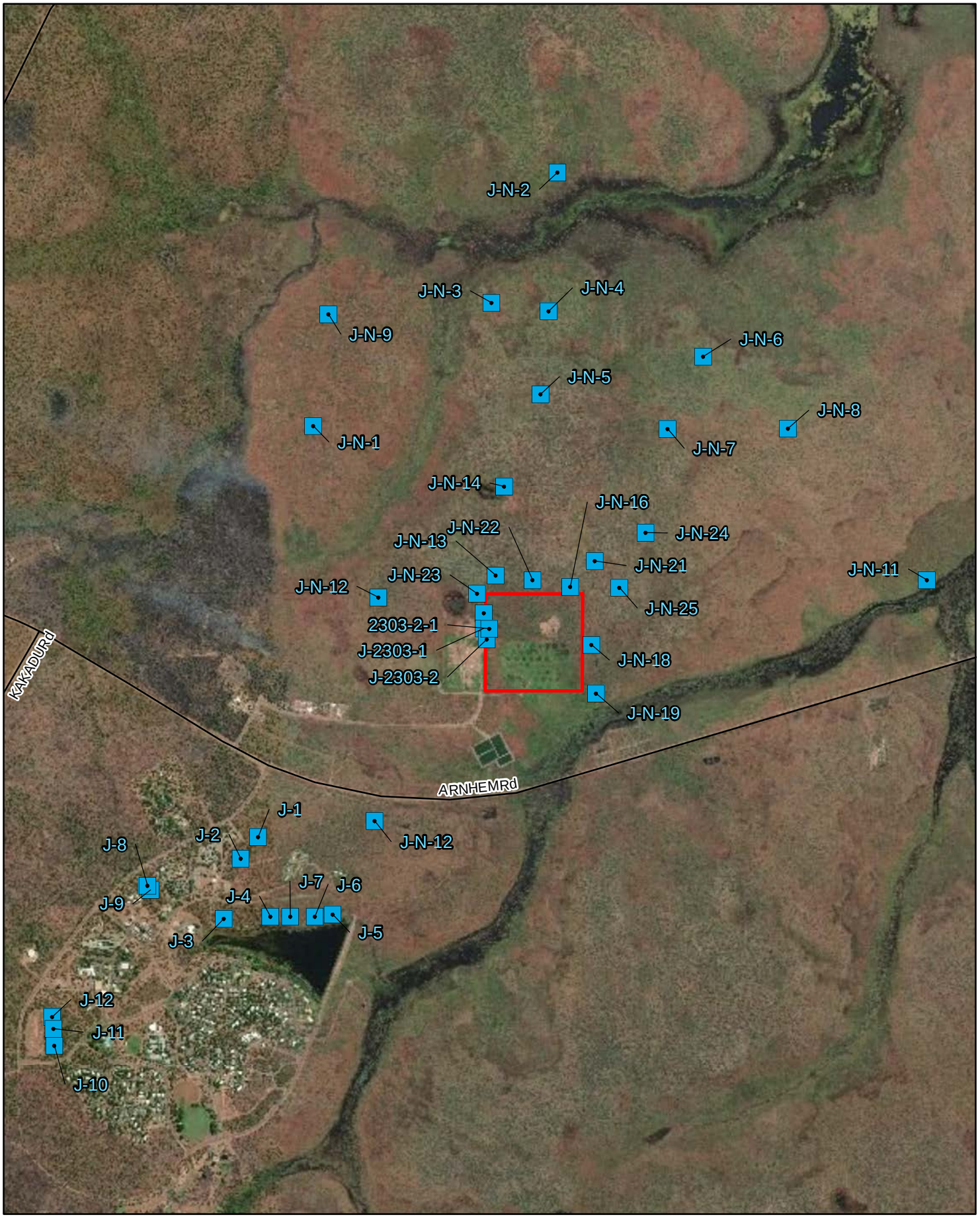
Small cage traps were baited with a mixture of peanut butter, oats and honey. Traps were baited and set in the late afternoon and cleared at first light each morning. All traps were cleared by 8:30 am each day to reduce heat stress on animals and were closed during the day to avoid animals entering the traps. Traps were uniquely coded so that movement of uniquely identified individual animals could be tracked.

Upon capture of a trapped Black-footed Tree-rat, ecological staff were instructed in the Flora and Fauna Division protocol, which would involve specimens being immediately processed at each trap location, and each animal weighed, sexed and a unique Passive Implant Transponder (PIT tag) inserted with a sterile applicator beneath the skin on the back of the neck, and the details recorded with date, time and trap location. Once processed, each animal would be released at the point of capture. Where trapped animals are recaptures, the PIT tag ID and trap location would be recorded with a handheld reader and the animal released at the site of capture. Data would be recorded to a suitable proforma and subsequently analysed. Where species other than Black-footed Tree-rat were captured, the date, identity and location were recorded.

Experienced members of the Flora and Fauna Division planned to use a closed capture-mark-recapture population model to estimate population size. Capture data would have been summarised to create a capture history of each individual over the five trap nights. Data would have been analysed in Program MARK v9.0 to estimate capture probability and the recapture probability to estimate population size.

No Black-footed Tree-rats were trapped over the 955 trap nights. Northern Brown Bandicoot (*Isoodon macrourus*) were trapped in eight instances; seven within Lot 2303 and one outside (trap 5A, see Figure 5-9). Given the substantial trapping effort, and the highly trap-able nature of Black-footed Tree-rats, there is a high degree of confidence that the zero-capture result is a true absence of the species from the Project area and surrounds (T. Griffiths pers. comm. March 2021).

The Black-footed Tree-rats detected in Lot 2303 in August-September 2020 (late dry season) appear to be absent from the site. It is anticipated the individuals have dispersed to surrounding areas that have now become more suitable during the above average wet season conditions, for example with fruiting trees, ground vegetation and hollow-bearing logs (Low Ecological Services, 2021). Based on the findings, Black-footed Tree-rat individuals are expected to infrequently utilise the Project area for foraging in the late dry season when vegetation condition in the surrounding area is diminished. The full report on the third survey effort is provided in Appendix D.

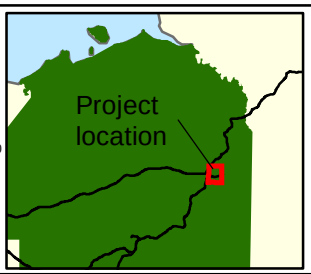


DATA SOURCES
Connect Environmental 2020
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 410 820
Metres

Scale @ A4 1:30,000
Date: 25/02/21
Author: D.Bayliss

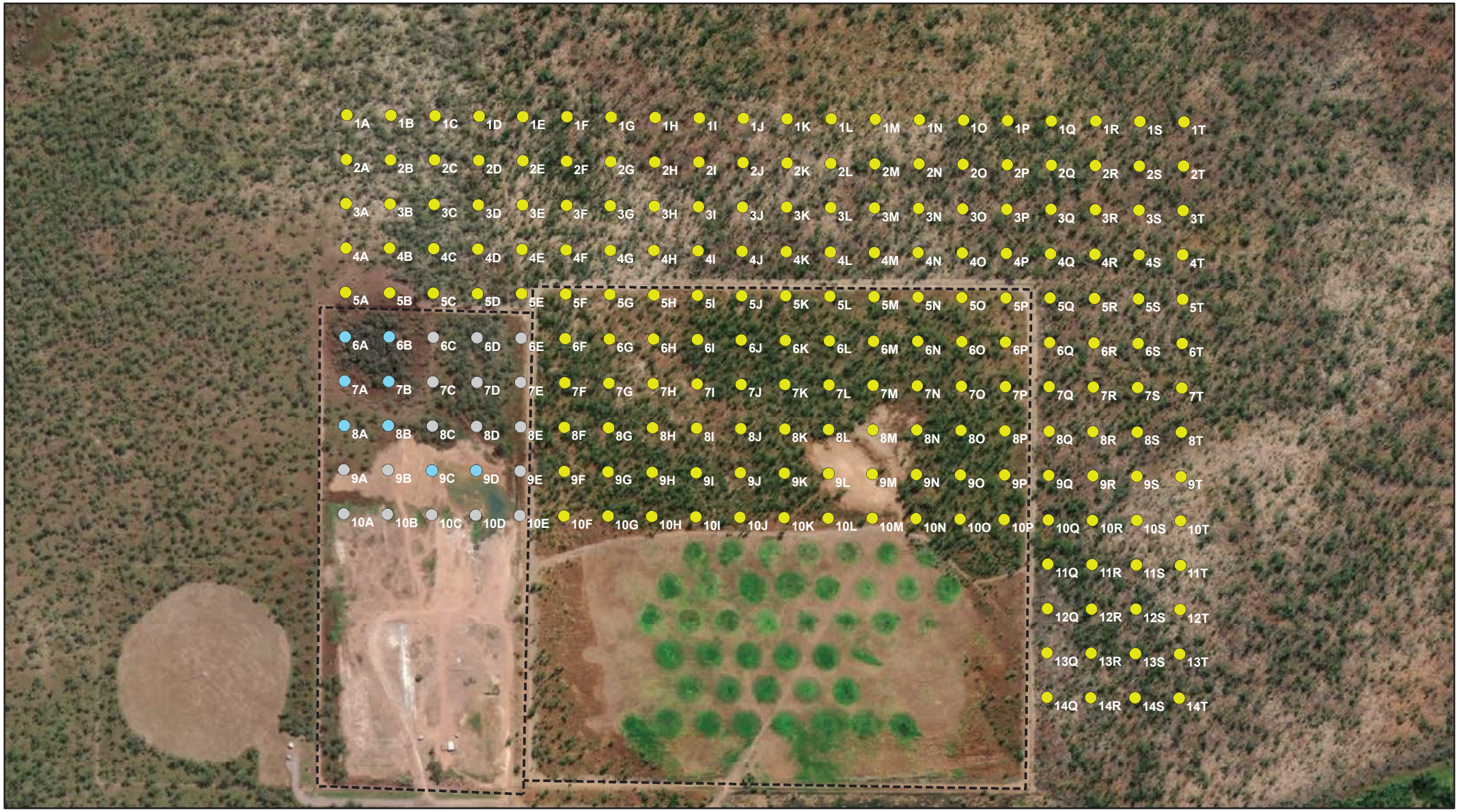


Lot 2303
Camera
Road
Kakadu National Park

Figure 5-8
Second Survey Camera Trap Locations

CDM Smith

EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_5_8_CameraTrapLocations_Secondary.mxd 25/02/2021

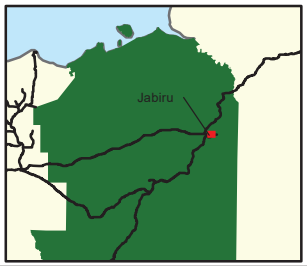


DATA SOURCES
© Northern Territory Fauna Atlas
Source: Low Ecological Services, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, Esri, Maxar, USGS, AeroGRID, IGN, and the GIS User Community
* Locations of markers slightly dispersed for illustration

N

0 80 160
Metres

Scale @ A4 1:6,000
Date: 25/03/21
Author: D. Bayliss



Road
Fenceline
Kakadu National Park

Trap Grid Design
- Traps not set in inundated areas
- Traps set for one night then removed
- Traps set for five nights

Figure 5-9
Black-footed Tree-rat Trap Locations

CDM Smith

EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_X_X_BFTR_TrapLocations.mxd 25/03/2021

5.4.2.5 Final Threatened Species Risk Assessment

The final risk assessment was based on all findings in the preliminary desktop review, reconnaissance and field surveys. The six species identified below were assessed to potentially occur within the Project area and thus could be impacted by proposed activities.

The Partridge Pigeon and Black-footed Tree-rat were the only threatened species confirmed to occur during site surveys in the Project area. Management and mitigation measures to address the risk of impacts to threatened species are provided in Section 7 of this Referral.

Despite the Project area not containing a population of the species, it is recognised that the infrequent use of the Project area for late dry season foraging provides a benefit to the local population of Black-footed Tree-rat. As such, a voluntary compensatory action measure has been proposed by CM&C to improve the suitability of surrounding habitat for Black-footed Tree-rats (refer to Section 6.1.4).

Table 5-5 Final Risk Assessment of Threatened Species

Species	TPWC Act	EPBC Act	Detection on Field Survey	Mitigation Measure	Residual Risk
Partridge pigeon	Vulnerable	Vulnerable	Yes	Fire and weed management Erosion and sediment control	Low
Northern crested shrike- tit	Not listed	Vulnerable	No		
Masked owl	Vulnerable	Vulnerable	No		
Northern Quoll	Critically Endangered	Endangered	No		
Yellow spotted monitor	Vulnerable	Not listed	No		
Black- footed Tree-rat	Vulnerable	Endangered	Yes	As above and see sections below for further details	Low

Partridge Pigeons have experienced several threats in recent decades with the most apparent being altered and more frequent fire regimes, weeds, and cats (Connect Environment, 2020). The woodland area appears to burn every one to two years, based on fire scar records and weeds were recorded from site surveys. No feral cats were detected during the site surveys however anecdotal evidence from Jabiru residents and Kakadu Park staff report feral cats are known to occur in the area and are a problem. Given the species' known ecology, distribution, and number of local records, it is logical to expect that the species would occur in the Project area and surrounds. However, several key factors including Wild Dogs, fire, weeds, and the drier than average year may contribute to its abundance and distribution in and around the Project area. Nevertheless, there is approximately 14 ha of suitable habitat (i.e. *E. miniata / E. tetrodonta* dominated vegetation) in the Project area (Connect Environmental, 2020).

The first ecological camera-trap survey undertaken exclusively within the Lot resulted in 14 detections of Black-footed Tree-rats of the 20 cameras within Lot 2303. The NT Fauna Atlas recorded seven species sightings within a 5 km buffer of the Project area since 2006, with the nearest being approximately 2 km to the south west. ERA's Ranger Mine Closure Plan[4] confirms that the Black-footed Tree-rat is one of only two EPBC Act listed species still known to be present in the Mine area, suggesting there is a regional population in the Jabiru area. In mid- January 2021, the Djurrubu Rangers

[4] https://www.energyres.com.au/uploads/general/S05_Knowledge_base_and_supporting_studies_2020a.pdf

informed Connect Environmental that they had recorded a Black-footed Tree-rat on a camera located approximately 300-400 m west of the Jabiru Kart Track (approximately 2 km west of the Project area).

While this survey data may not provide conclusive evidence of population size, (noting that cameras were typically grouped, and multiple cameras may have recorded the same individuals) within and at one site outside of the Project area during the second camera-trap event conducted exclusively outside the Lot. The results do however provide information of the presence of this species in the area.

The threats to the Black-footed Tree-rat include habitat fragmentation, fire frequency, wild dogs and cats and possibly large herbivores which destroy the habitats (Connect environmental, 2020). Habitat fragmentation is thought to disadvantage this species (Rankmore, 2006) and this may account for the greater observations made in the Project area and surrounding portions of Lot 2303 compared to camera traps within the Jabiru township area where there is less suitable vegetation. It is also unclear whether the adjacent landfill supports wildlife and pest food options and whether this may alter the numbers of individuals observed in the Project area.

The third survey involving high-intensity trap-release methods within the site and immediate surrounds provides a high degree of confidence that a population of the Black-footed Tree-rat is not maintained in the Project area. Sightings in the first camera trapping survey undertaken exclusively within the project area are anticipated to be the result of individuals moving out of the surrounding habitat to forage when vegetation condition in the surrounding area is diminished.

The Project is the first of many for the Northern Territory Government under its Future for Jabiru and Kakadu accredited programme and is essential to establish critical infrastructure for the township of Jabiru. It will become a guiding project for other developments.

In conclusion, both the Black-footed Tree-rat and Partridge Pigeon are not expected to be significantly impacted because of the Project's activities. Section 7 of this referral document and Appendix A comprise the preliminary risk assessment including the adopted mitigation and management measures to address the risk of impact to both listed species. With the appropriate mitigation measures put in place during construction and operations the overall residual impact to threatened species is considered low.

5.4.3 Flora

During the reconnaissance survey, no threatened or endemic flora species were recorded within the Project area. A desktop study undertaken using NVIS mapping (National Vegetation Information Systems, 2007), describes vegetation in the Project area as a *Eucalyptus miniata*, *E. tetrodonta*, *Erythrophleum chlorostachys* mid open forest over *Livistona humilis*, *Cycas armstrongii*, *Acacia oncinocarpa* low sparse shrubland over *Heteropogon triticeus*, *Sorghum plumosum*, *Chrysopogon fallax* tall tussock grassland (Figure 5-10). Keys for vegetation communities are provided in Table 5-6.

Table 5-6 Vegetation Community Key

Vegetation community	Description
315	*Melaleuca viridiflora, M. leucadendra, M. cajuputi*
316	*Melaleuca viridiflora, M. leucadendra +/- M. argentea*
330	*Melaleuca cajuputi, M. viridiflora +/- M. leucadendra*
360	*Melaleuca leucadendra, M. argentea +/- M. cajuputi*
383	*Melaleuca viridiflora, M. leucadendra +/- Corymbia polycarpa*
441	*Eucalyptus miniate, E. tetrodonta, Erythrophleum chlorostachys*
572	*Eucalyptus tectifica, Erythrophleum chlorostachys, Corymbia latifolia*

Vegetation community	Description
1064	Pastoral, horticultural, roads

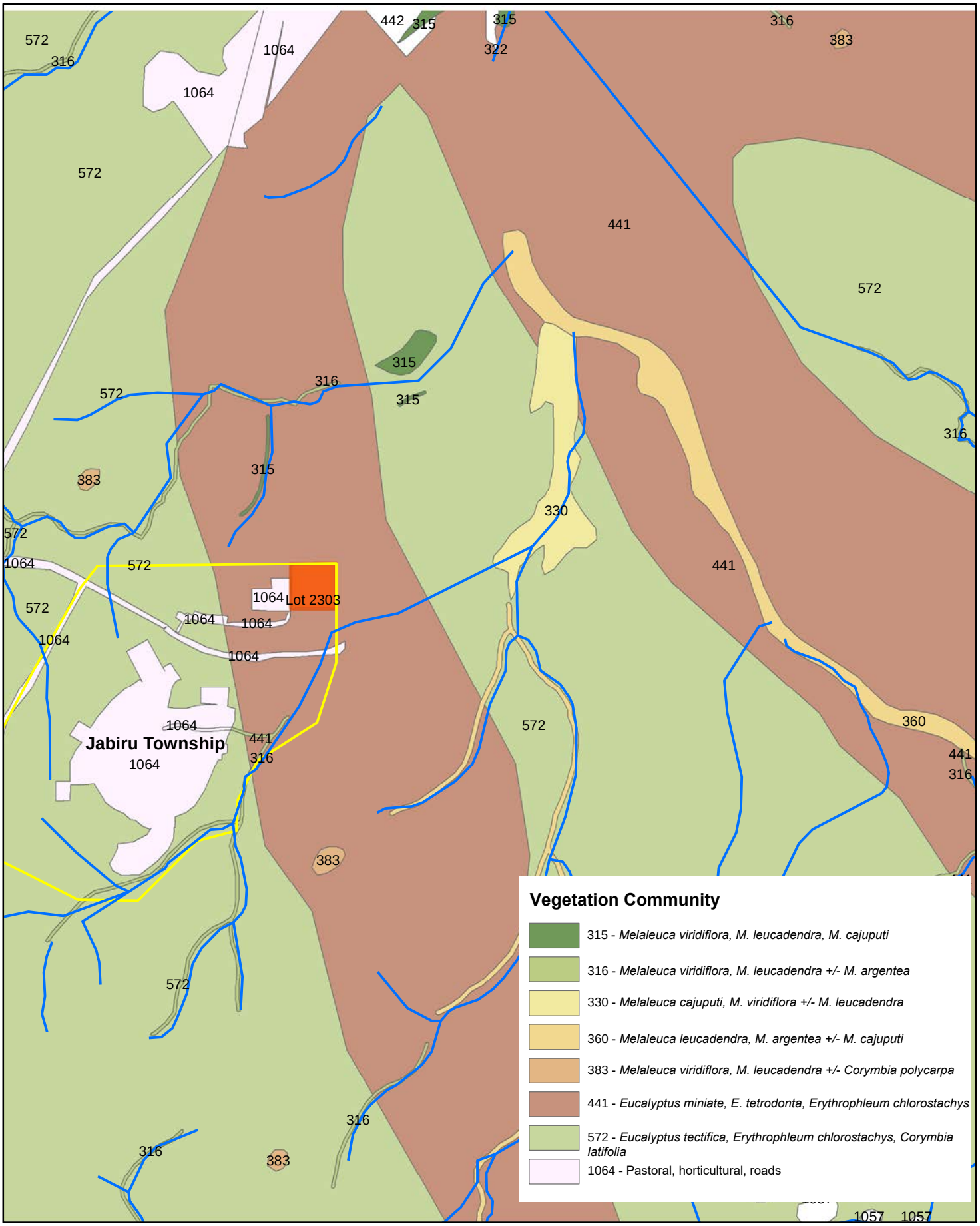
During the reconnaissance survey, field observations confirmed vegetation in the Project area consisted almost entirely of *Eucalyptus miniata, E. tetrodonta, Erythrophleum chlorostachys* mid open forest over *Livistona humilis, Terminalia ferdinandiana, Acacia platycarpa* (not sighted) low sparse shrubland over mixed tall tussock grassland (Plate 5-1). *Pandanus spiralis* was observed very occasionally in the eastern half of the Project area and the south eastern portion of Lot 2303. A moderate shrubby layer existed across much of the Project area.

The survey identified the Project area was in relatively good ecological condition with a good diversity of upper, mid and ground storey vegetation. Hollow bearing trees were scattered throughout the Project area, to a maximum of approximately 20 m in height and diameter at breast heights of up to approximately 50 cm. Occasional logs were observed with very few exceeding 15 cm diameter, though very occasionally, logs with a diameter of approximately 30 cm were noted. There were previous disturbances noted during the survey in the western half of the Project area. This section was observed to contain younger *E. tetrodonta* trees (to 8 m) (Plate 5-2). Disturbance was also recorded in the southern portion of the site which was a cleared area of about 60 m x 20 m and devoid of trees or shrubs.

Plate 5-1 Typical Vegetation Across the Project Area[5]

[5] (Connect Environmental, 2020)

Plate 5-2 Apparent Regeneration along a 50 m strip of the Western Boundary[10]

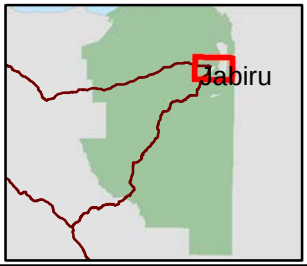


N

0 0.5 1

Kilometres

Scale @ A4 1:63,360
Date: 11/11/20
Author: MARRJL



Legend

- Streams
- Jabiru Town Boundary
- Lot 2303

Figure 5-10
Vegetation Communities

CDM Smith

MARRJL G:\Jaime\Projects\1000765- Jabiru Environmental Approval\02 MXD\1000765_BFTR.mxd 11/11/2020

5.4.4 Threatened Flora Species

Kakadu is known for its rich biodiversity, populations of threatened, endemic and culturally significant species. Kakadu supports more than 75 threatened flora and fauna species. In accordance with the International Union for Conservation of Nature (IUCN) red list criteria and categories, Northern Territory's threatened species protected under the TPWC Act also include listings 'Near Threatened' and 'Data Deficient'. Internationally, the IUCN maintains a global list of threatened species though has no legislative support in Australia (Woinarski & Winderlich, 2014).

A preliminary desktop study was undertaken to identify NT listed threatened species potentially occurring within the Project aea. The assessment identified ten threatened flora species to occur within a 50 km buffer and found none within a reduced 5 km buffer (Table 5-7). The number of records and most recent records were also included in this table. This expansive buffer was considered appropriate as it was expected to satisfactorily characterise local and regional abundance and distributions of threatened species and adequately capture the potential for these species to exist in the Project area (Connect Environmental, 2020).

The reconnaissance survey assessed the likelihood for all threatened flora species to occur within the Project area. Based on habitat preference and number of local records, all species within the 50 km buffer were considered unlikely to occur within the Project area (refer to Table 5-7) (Connect Environmental, 2020).

Table 5-7 Likelihood of Occurrence in the Project Area of NT Threatened Flora Recorded Within 50 km of Buffer[6]

Scientific name	Common name	TPWC Act	No. records	Most recent	Likelihood of occurrence
Abrodictyum obscurum	Cephalomanes	Endangered	2	1984	Unlikely
Boronia quadrilata	Boronia	Vulnerable	130	2014	
Hibbertia brennanii	Hibbertia	Vulnerable	13	2016	
Hibbertia pancerea	Hibbertia	Vulnerable	8	2016	
Hibbertia sp. South Magela	Hibbertia	Vulnerable	9	2016	
Hibbertia tricornis	Hibbertia	Vulnerable	4	2016	
Hibiscus brennanii	Hibiscus	Vulnerable	96	2016	
Lithomyrtus linariifolia	Lithomyrtus	Vulnerable	13	2017	
Utricularia dunstaniae	Bladderwort	Vulnerable	1	1981	
Utricularia singeriana	Bladderwort	Vulnerable	2	2010	

The full Biodiversity Assessment Report is provided in Appendix C.

5.4.5 Sensitive and Significant Habitats

The NT *Land Clearing Guidelines* (Department of Environment and Natural Resources, 2019) describe sensitive or significant vegetation as rainforest, vine thicket, closed forest, riparian vegetation, mangroves, monsoon vine forest, sand sheet heath and vegetation containing large trees with hollows suitable for fauna. In addition, the NT EPA, in its Terms of Reference for several projects, have referred to sensitive or significant vegetation as also including important habitat corridors, wetlands and groundwater dependent ecosystems. In accordance with the NT Land Clearing Guidelines the site does not contain significant vegetation and is not considered sensitive.

[6] (Connect Environmental, 2020)

As part of the ecological survey conducted by Connect Environmental in 2020 (Appendix C), the survey included a preliminary desktop study followed up by a reconnaissance survey. A preliminary desktop study concluded there were no significant or sensitive habitats within the Project area. The reconnaissance survey indicated habitat suitable for threatened species to potentially occur. Individual characteristics of key habitat features for each species was observed for, such as logs, the diversity and density of vegetation in each strata, dominant flora species, the presence of hollow-bearing trees and respective approximate sizes (including hollows), soils, and disturbance. The survey found:

- The Project area to be in relatively good ecological condition with a good diversity of upper, mid and ground storey vegetation;
- Hollow bearing trees were scattered throughout the Project area, to a maximum of approximately 20 m in diameter at breast heights of up to approximately 50 cm;
- Occasional logs were observed with very few exceeding 15 cm diameter, though very occasionally, logs with a diameter of approximately 30 cm were noted;
- The condition, diversity and density of vegetation within the Project area could support threatened species such as Black-footed Tree-rat, Partridge Pigeon, Crested Shrike- tit, Masked Owl, Northern Quoll and Floodplain Monitor; and
- Potential habitat suitable to support sheltering, foraging and breeding occurs in the Project area.

5.4.5.1 Sites of Conservation Significance, Parks and Reserves

The closest Site of Conservation Significance (SOCS) to the Project is the Alligator River Floodplains (Figure 6-1) situated 5 km downstream and north-east of the Project. Further details of SOCs are included in Section 6.1.3 'Wetlands of International importance', of this referral document.

5.5 Weeds and Pests

5.5.1 Weed Species

Declared weeds are plants that have been identified for control, eradication or prevention of entry into the NT under the NT's Weeds Management Act 2001(WM Act). They are classed according to how difficult they are to control and how much harm they can cause. If a weed is declared under the WM Act, all land holders, land managers and land users must comply with the classification. The WM Act are categorised into three management classes as follows:

- Class A Noxious weeds – to be eradicated;
- Class B Noxious weeds – prevent growth and spread; and
- Class C Noxious weeds – prevent introduction into the NT.

All Class A and Class B weeds are also Class C weeds.

Weeds of National Significance (WoNS) are those listed by the Australian Government as plants that potentially cause detrimental impacts worth billions of dollars to the sustainability of Australia's productive capacity and natural ecosystems and as such a National Weeds Strategy exists for them.

A search of the NT Flora Atlas (Department of Environment and Natural Resources, 2020b) indicated there are 64 weeds to occur within 5 km of the Project area. Of the recorded weeds, one is recognised as a Class A and declared WoNS and

nine are Class B weeds. A summary of declared weed species has been provided in Table 5-8 and full list of weed occurrence is presented in Section 4.8 of the Biodiversity Assessment Report (Appendix C).

Table 5-8 NT Flora Atlas Search - Weeds Recorded Within 5 km of the Project Area[7]

Scientific name	Common name	WoNS
Class A		
Andropogon gayanus	Gamba grass	Yes
Class B		
Cenchrus echinatus	Mossman river grass	No
Cenchrus polystachios	Perennial mission grass	No
Mesosphaerum suaveolens	Hyptis	No
Senna occidentalis	Coffee senna	No
Sida acuta	Spiny-head Sida	No
Sida cordifolia	Flannel weed	No
Sida rhombifolia	Paddy lucerne	No
Stachytarpheta cayennensis	Snakeweed	No
Themeda quadrivalvis	Grader grass	No

Presence of weeds were assessed during a site survey, though due to timing some species, particularly grasses, were difficult to identify due to lack of seeding/flowering. Ten species were identified during the survey, one was declared Class B (*Hyptis suaveolens).* The identified species are listed in Table 5-9.

Table 5-9 Recorded Weed Species within Lot 2303

Scientific name / Common name	Declared status (WM Act)
Cenchrus pedicellatus (Annual Mission Grass)	Not declared
Chloris barbata (Purple Top Chloris)	Not declared
Euphorbia hirta (Asthma Plant)	Not declared
Hibiscus sabdariffa (Rosella)	Not declared
Hyptis suaveolens (Hyptis)	Class B
Macroptilium atropurpureum (Siratro)	Not declared
Megathyrsus maximus (Guinea Grass)	Not declared
Melinis repens (Red Natal Grass)	Not declared
Phyllanthes amarus	Not declared
Tridax procumbens (Tridax Daisy)	Not declared

[7] (Connect Environmental, 2020)

5.5.2 Pest Species

A search of the NT Fauna Atlas revealed six feral animals that have been recorded within 5 km of the Project area (Table 5-10). One notable absence is the Cat (*Felis catus*), which are expected to also occur in the local area. During a site survey, Wild Dogs, cane toads and pigs were detected at numerous locations by motion censored camera traps (Connect Environmental, 2020).

Table 5-10 Feral Animals Recorded Within the Project Area

Scientific name	Common name	No. records	Most recent record
Hemidactylus frenatus	Asian House Gecko	12	2018
Rhinella marina	Cane Toad	2	2018
Bos taurus	Cattle	2	1981
Indotyphlops braminus	Flower-pot Blind Snake	3	2018
Sus scrofa	Pig	16	2003
Bubalus bubalis	Swamp Buffalo	5	2003

5.6 Biting Insects

Biting insects in Kakadu consist of biting mosquitoes and midges. Mosquitoes are potential transmitters of disease to humans. Distribution and abundance of the biting insects vary according to seasonal and other changes in habitat and food availability. The risk of being bitten and/or transmission of disease to humans varies in relation to breeding cycles and abundance. Different species of biting insects have differing patterns of distribution and seasonal changes in abundance.

There is currently no routine mosquito monitoring program for Jabiru. An exotic mosquito survey was completed for Jabiru in March 2017 (Control Medical Entomology Centre for Disease, 2017). Prior to March 2017, previous adult mosquito monitoring was undertaken between 1984 until 2010, gathering a large amount of baseline data.

The most recorded mosquitoes in Jabiru town are *Aedes* and *Culex* species: *Aedes notoscriptus* (receptacle Mosquito), *Aedes normanensis* (flood water mosquito), *Culex annulirostris* (common banded mosquito) *and Culex palpalis* (Control Medical Entomology Centre for Disease, 2017). The three first species are known carriers of Ross River virus, the most commonly recorded arboviral disease in the NT and the Barmah Forest virus, the second most common mosquito-borne infection. These species can also be vectors of Murray Valley encephalitis and dog heartworm.

The Salt Marsh Mosquito - *Ochlerotatus vigilax* (*Aedes vigilax*), considered to have the greatest potential as a pest and disease vector in the area is expected to be present with minor numbers. Mosquitoes show considerable variation in their preference for hosts, *Culex annulirostris* will generally feed on whatever source of blood is available, although it prefers mammals.

5.7 Air, Noise and Lighting

5.7.1 Air

In the NT ambient air quality monitoring is undertaken in accordance with the National Environmental Protection (Ambient Air Quality), including the measurement of particular matter (PM_{10}), carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), nitrogen oxide (NO) and ozone.

The NT EPA has established an air quality monitoring network in Darwin and its surrounds (Palmerston and Winnellie). This is the closest publicly available datapoint for air quality monitoring in reference to the Project area located in Jabiru. Annual reports to the National Environment Protection Council indicate that Darwin has good air quality (Northern Territory Environmental Protection Authority, 2018). The most significant source of atmospheric particulate matter (PM_{10}) are bushfires that occur predominantly during the dry season.

As a small regional town with a population of less than 2,000 residents, air quality in the Jabiru area is expected to be of a generally good quality. Air quality in the Jabiru area would be impacted by a limited number of sources including bushfires, vehicle movements, and mining operations at the nearby Mine. The 42-years of wind records accumulated from Jabiru airport weather station (Figure 5-11) identify that winds are predominantly easterly to south-easterly (Bureau of Meteorology, 2021). This suggests any air emissions will be drawn away from the Jabiru area.

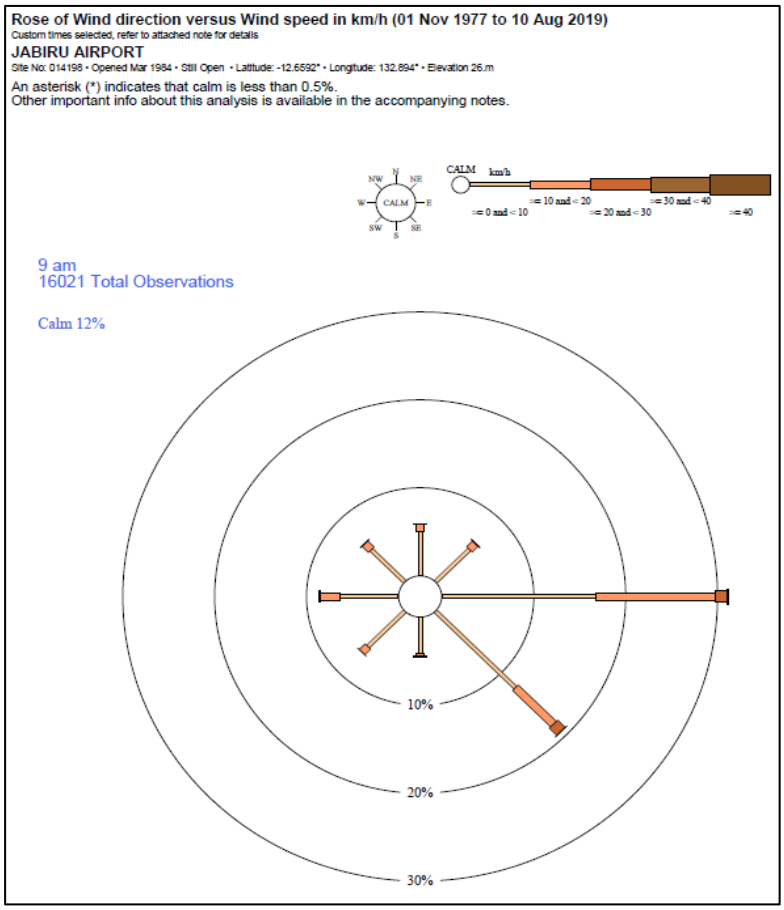


Figure 5-11 Jabiru Airport Wind Rose

5.7.2 Noise

Noise sources in the vicinity of the Project area are primarily natural sources such as wind, wildlife, flora, insects and water and occasionally urban and industrial activities. Jabiru town has a population less than 2,000 with little development and limited road traffic. The Project area is situated in the Jabiru industrial area approximately 1.6 km to the nearest residential receptor (Department of Housing and Community Development, 2017).

5.7.3 Lighting

Light pollution is mainly generated by the infrastructure associated with the existing power station, road lights and human habitation. No work at night will be scheduled and the Project will focus minor light emissions at specific work areas for safety construction and operation.

5.8 Cultural Heritage (Indigenous and European)

Wallis Heritage Consulting were engaged by CM&C to undertake an archaeological and cultural heritage survey of the Project area. No archaeological or cultural heritage sites were identified in the Project area during the survey.

An Aboriginal Areas Protection Authority (AAPA) certificate was attained and cleared Lot 2303 and El Sherana Road parcel of any cultural sites of significance. Reference number RA2020/117 (Appendix G).

5.9 Fire History

According to the North Australia and Rangelands Fire Information service (North Australia & Rangelands Fire Information, 2020), the Project area has been burnt between 11 and 15 times between 2000 and 2018 (i.e. every 1-2 years). The regular fire patterns are likely attributed to hazard reduction burns to manage for human safety and asset protection given that the site is next to a landfill site and wastewater treatment plant and irrigation area. However, high frequency and intensity fires have been shown to reduce vegetation diversity and complexity in all strata. For many obligate seeders, one fire can kill an adult plant and the survival of that species in an area is dependent on regeneration from seed (Woinarski, et al., 2009).

5.10 Community and Economy

5.10.1 Economy

Kakadu, as a dual World Heritage-listed national park, is a valuable economic, social, environmental and cultural asset. Jabiru as the only town within Kakadu is a logistical hub and service centre for the park and investing in the town will help to maintain and grow Kakadu's contribution to both the NT and broader Australian economies through tourism. With around 200,000 visitors to Kakadu annually, Kakadu creates hundreds of employment opportunities, it supports local businesses and informs the overall brand of tourism in the NT (Department of the Chief Minister, 2019).

To oversee the future of Jabiru township, a Masterplan was established by the GAC on behalf of the Mirarr people to transition the town from a mining town to an Aboriginal-led tourism and regional services hub. Strategic planning is in progress to ensure continuation of government and community services for the West Arnhem region, improved tourism visitation to Kakadu and to promote Jabiru as an internationally renowned sustainable tourism and services hub. GAC has set out eight goals in the Masterplan and include:

1. Mirarr people ownership of the town;

2. Replicate the design and theme of Kakadu through building design, landscaping and civil works;

3. Continue Jabiru as an ecofriendly, outdoor and indigenous cultural tourism town;
4. Sustainable and resource efficient town;
5. Continue to be an iconic cultural heritage destination for national and international visitors;
6. Continue to showcase excellence and best practice in indigenous land management knowledge and employment;
7. Sustain the long-term population for the town; and
8. Education and research hub for North Australian biodiversity, ecology, education, Indigenous language, cultural heritage and archaeology (Department of the Chief Minister, 2019).

This Masterplan is being supported by the NT and Commonwealth governments through the MoU agreement. Both governments have pledged a combined $351.7 million in support of essential services and tourism infrastructure projects, including the hybrid power station for the future of the town. The hybrid power station has been designed to incorporate several goals listed above in that it is a sustainable asset and an essential resource to support the community now and into the future.

5.10.2 Community

The existing land tenure arrangements and the planned tenure transition under the MoU mean that the authorising environment in Jabiru is unique, and the stakeholder engagement processes used for urban development are not appropriate for the Jabiru context. Active negotiations on the transition of tenure through a grant of Aboriginal land under the *Aboriginal Land Rights (Northern Territory) Act 1976* and the probity requirements for CM&C's procurement process have also created some limitations around broader stakeholder engagement.

CM&C's stakeholder engagement for this Project has been targeted to key stakeholders only, and has been supported by broader engagement on the future of Jabiru in both key stakeholder and community forums over several years. The closure of the Mine and therefore the loss of the current source of electricity supply to the town has been a known issue for some time, hence its prominence in commitments under the MoU. There is a general air of concern from Jabiru residents regarding the security of future electricity supply, which is reflected in recent media coverage on the future of Jabiru. There has been broad support from MoU parties, other key stakeholders and community members for a new power station to be constructed to supply electricity to Jabiru and ensure its continued functioning as a regional service centre for the Kakadu and West Arnhem region.

Targeted stakeholder engagement for this Project has occurred on the following issues:

- Referral processes;
- Site selection (see further detail in Section 3.7);
- Current and future tenure arrangements;
- Development consent;
- Project delivery and program coordination;
- Identification of sacred sites and cultural heritage areas of significance;
- Threatened species identification; and
- Black-footed Tree-rat impacts and risk mitigations.

Further detail on targeted stakeholder engagement by issue is provided in Table 5-11.

Table 5-11 Stakeholder Engagement

Stakeholder	Issues	Discussion
MoU parties and key stakeholders	Referral processes Site selection (see further detail in Section 3.7) Current and future tenure arrangements Project delivery and program coordination	The four MoU parties and other key stakeholders for the Future of Jabiru and Kakadu program have been consistently briefed and engaged on the power station project and various issues around site selection, tenure arrangements, delivery timeframes etc. over the past 18 months through forums such as the Jabiru-Kakadu Taskforce (formerly Jabiru Steering Committee), subordinate forums and working groups reporting to the Taskforce and bilateral meetings with all MoU parties. The MoU parties have all expressed support for the site selection process and the power station project in general as a critical part of ongoing essential service delivery for Jabiru.
Department of Environment, Parks and Water Security (DEPWS [formally Department of Environment and Natural Resources]) and Northern Territory Environmental Protection Authority (NT EPA)	Referral processes Various risk identification and mitigation issues Black-footed Tree-rat impacts and risk mitigations	Discussion with DEPWS and NT EPA to seek expert guidance from the earliest conceptual stage of the project with regards to: ▪ Environmental referral, process, documentation and submission; ▪ Natural resource management; ▪ Land clearing and management; ▪ Environmental management; ▪ Pre referral environmental check list meeting; ▪ Provision of data regarding previous flora and fauna studies; ▪ Determine what processes should be taken to fill knowledge gaps for the Black-footed Tree-rat; ▪ Interpreting results from Black-footed Tree-rat field survey and applying appropriate risk mitigation measures; ▪ Advice regarding appropriate methods for assessing air quality and emissions impacts; and ▪ Suitability and robustness of selected risk mitigation measures.
Parks Australia (Australian Government)	Referral processes Black-Footed Tree-rat impacts and risk mitigations	CM&C wrote to the Director of National Parks to confirm consent to construct a power station on Lot 2303 in March 2020. CM&C received a letter in response confirming that provided the power station is constructed on Lot 2303, no consent from the Director is required as the Lot is zoned appropriately for utilities. Discussions with Parks Australia to seek advice regarding: ▪ EPBC Act referral; ▪ Peer review of studies undertaken and referral reports; ▪ Coordination with the Kakadu National Park Strategy and Redevelopment; ▪ Available data, surveys and studies that have been undertaken for threatened species within Jabiru; and ▪ Determine what processes should be taken to fill knowledge gaps for the Black-footed Tree-rat and whether there were proposed management strategies for the species.

Stakeholder	Issues	Discussion
Jabiru Town Development Authority (JTDA) (Lease terminates 30th June 2021: New Town Lease Entity Commences 1st July 2021)	Development consent	CM&C wrote to the JTDA: ▪ In March 2020 to request its consent to lodge plans to construct a power station on Lot 2303; and ▪ In June 2020 and to request permission to seek a construction licence from West Arnhem Regional Council as the current sub-lease holder of Lot 2303. The JTDA responded to confirm its consent on both of these requests.
West Arnhem Regional Council (WARC) councillors and staff	Site selection Current and future tenure arrangements Project delivery	West Arnhem Regional Council are the lease holders for Lot 2303, Project area and Lot 1428 road reserve and service easement and were consulted with throughout the Project. CM&C verbally briefed WARC Council Members at Council meetings and written to WARC on multiple occasions to seek its approval to use Lot 2303 as the site for the new hybrid power station and engage on Project delivery issues including the reconfiguration of the liquid effluent irrigation area on Lot 2303. CM&C has also worked closely with key staff members from WARC to coordinate on project delivery issues. WARC has signed a Deed of Licence granting CM&C permission to access and develop the relevant portion of Lot 2303 for the permitted use of the construction, testing, commissioning and operating of a power station and associated electronic transmission facilities to supply electricity to the Town of Jabiru. Council members and staff have been supportive of the project since its commencement.
Gundjeihmi Aboriginal Corporation (GAC)	Site selection Current and future tenure arrangements Project delivery and program coordination Identification of sacred sites and cultural heritage areas of significance	The Mirarr established GAC in 1995 to assist them in managing a balance between sustainable development, traditional practice and living culture on their land. Beyond engagement through MoU party forums, GAC has been engaged directly on a range of issues, including: ▪ Site selection and future tenure arrangements for the power station; ▪ Permission to access the site for arrange of project delivery purposes including survey and geotechnical testing, and access to Jabiru during periods of COVID19 remote travel restrictions; and ▪ Engaging GAC to undertake an archaeological cultural heritage survey of the entire township of Jabiru (including Lot 2303) to identify any sites of significance under the *Northern Territory Aboriginal Sacred Sites Act 1989 (NT)* and *Heritage Act 2011 (NT).*

Stakeholder	Issues	Discussion
Jabiru Kabolkmakmen Limited	Site selection Current and future tenure arrangements Development consent Project delivery and program coordination	Jabiru Kabolkmakmen has been established as a company limited by guarantee with the Northern Territory Government and GAC as its two founding members. Discussion with Jabiru Kabolkmakmen included matters concerning services that progress the repurposing of Jabiru with the following three priorities: ▪ Support the transition of ownership, leasing and maintenance of housing, business premises and other infrastructure from the current town Headlease to new township leasing arrangements; ▪ Provide services to the founding members and other major stakeholders, which support and progress the detailed implementation of the Jabiru Masterplan; and ▪ Facilitate social and economic development for Jabiru, West Arnhem Land and Kakadu.
Power and Water Corporation (PWC)	Project delivery and program coordination	CM&C has engaged heavily with PWC throughout its major procurement process to select EDL as the successful proponent. As part of this process, PWC has had input on power station design and appropriate standards, operational logistics, connection to the Jabiru network and coordination of electricity network upgrades. CM&C has committed $10 million in funding to PWC to undertake major repairs and upgrades to the electricity network to maintain reliability and ensure readiness for connection to a new generation source.
Djurrubu Rangers	Identification of sacred sites and cultural heritage areas of significance Threatened species identification Black-footed Tree-rat field survey work Employment opportunities in construction stage of Project	The Djurrubu Rangers is a group of young Bininj (Aboriginal people) providing professional land management services across the Kakadu region. The group is a social enterprise established by GAC engaging local culture, identity and practice to provide employment and training for local youth. The Djurrubu Rangers were engaged to in the following tasks to support the Project assessments: ▪ Archaeological cultural heritage; and ▪ Partook in training re the fauna / flora surveys for the township of Jabiru.
Broader community	Planning - Proposed developments associated with the MoU	Public communications and on-the-ground engagement with local community stakeholders undertaken by CM&C and its MoU partners has consistently referenced the Project and secured positive feedback from the community.
Department of Infrastructure, Planning and Logistics	Site selection Current and future tenure arrangements Development consent	Planning, design, construction and delivery of essential services projects and new infrastructure / built environment developments. Peer review of environmental pre referral checklist, NT EPA referral document and EPBC referral.
Department of Health	Project delivery and program coordination	CM&C consulted with the Department of Health on best-practice liquid effluent irrigation to inform its planning to reconfigure the irrigation system on Lot 2303 as part of the Project delivery. Department of Health provided guidelines and policies regarding wastewater management and developed a Project plan to allow for continued operation and the minimisation of public nuisance.

Section 6 Environmental Protection and Biodiversity Act

6.1 Matters of National Environmental Significance (MNES)

This section has been prepared to support referral of the Project under the EPBC Act, for those elements that may have a significant impact to MNES. A referral under the EPBC Act is required where there is the potential for a 'significant impact' to MNES. The threshold test of a 'significant impact' is held to mean an impact that is important, notable or of consequence having regard to its context or intensity[8].

The following section considers the potential impact of the proposal on each of the nine MNES listed under the EPBC Act. Each of the MNES has been considered against the significant impact criteria referenced in '*Matters of National Environmental Significance, Significant impact guideline 1.1* (Significant Impact Guidelines 1.1)' (Department of the Environment, 2013). The action proposed by the CM&C is the construction of a new power generation system and connection to the existing power distribution infrastructure for the Jabiru township.

As discussed in Section 3, the Project is required to continue power supply once ERA's existing diesel power station is decommissioned. Therefore, the Project is considered essential for the region and will be the only source of energy for the Jabiru Township. Table 6-1 summarises the potential impacts on the nine MNES, where applicable.

Table 6-1 Summary of the potential impacts of MNES

Matters of National Environmental Significance	Relevant	Description
World heritage properties	✓	In 2011, the entire Kakadu was listed as a world heritage area by UNESCO meeting five criteria for its outstanding natural and cultural universal values. The entirety of the Jabiru Township and the Project area is within the World Heritage Property boundary.
National heritage places	✓	In 2007, Kakadu was included on the National Heritage List in recognition of its national heritage significance under the EPBC Act. The entirety of the Jabiru Township and the Project area is within the National Heritage Place boundary.
Wetlands of international importance/ Ramsar wetlands	✓	In 2010, the entire Kakadu (inclusive of the Project area) was included in the Ramsar Convention, meeting all nine criteria as a wetland of international importance.
Nationally threatened species and ecological communities	✓	During a preliminary desktop study, 26 EPBC Act listed threatened fauna species and two threatened flora species were identified as likely to occur within 50 km of the Project area. Following a reconnaissance and field survey, five species were determined to have the potential to occur in the Project area (Lot 2303). Of these

[8] Booth v Bosworth (2001) 114 FCR 39 "the Flying Fox Case" considering the operation of s43A and s43B of the EPBC Act.

Matters of National Environmental Significance	Relevant	Description
		species, two species are listed as Endangered and three as Vulnerable under the EPBC Act. No threatened ecological communities were identified in the Project area. Refer to Section 5 of this referral for detail of the ecological survey conducted at site. Refer to Section 7 of this referral for details of the mitigation and management measures.
Migratory species	✓	A desktop study indicated 22 EPBC Act listed migratory species were likely to occur within 5 km of the Project area. No migratory species were detected during the field assessment/site surveys or are expected to either occur within the Project area or be significantly impacted by the Project.
Commonwealth marine areas	X	There are no commonwealth marine areas close to the Project area. The Project area is located approximately 117 km to the closest Commonwealth marine area (northern coast of Arnhem Land).
The Great Barrier Reef Marine Park	X	Not applicable. The Project area is located approximately 1,155 km to the closest point of the Great Barrier Reef Marine Park (north-eastern coast of Cape York in proximity to Lockhart River).
Nuclear actions (including uranium mining)	X	Not applicable
A water resource, in relation to coal seam gas development and large coal mining development	X	Not applicable

For each MNES identified as being relevant to the Project in Table 6-1, the corresponding sub-section provides a table of assessment against the significant impact criteria for that matter based on the Significant Impact Guidelines 1.1.

6.1.1 World Heritage Properties

World heritage areas are protected under both the EBPC Act and World Heritage International Convention agreement of world heritage (1972). This agreement aims to protect cultural and natural heritage areas throughout the world. Sections of Kakadu were first included into the World Heritage list in 1981 and the area was expanded in 1987 and again in 1992. Koongarra was also added in 2011, making the entire Kakadu National Park heritage listed by UNESCO. Of the ten criteria available for listing a site as a World Heritage area, Kakadu meets five for its natural and cultural outstanding universal values (UNESCO, no date). The following five criteria have been recognised:

- Criterion (i): Art sites within the park represent unique artistic achievement – There are no known art sites within the Project area. A cultural heritage survey of the entire Jabiru township determined that the absence of sandstone escarpments in the area precludes the possibility of rock shelters with archaeological deposit and/or rock art. The risk to this value from the Project is low;

- Criterion (vi): Rock art and archaeological record is source of evidence for social and ritual activities. No cultural and heritage sites are present in the Project area as confirmed by the cultural and heritage survey and AAPA certificate. The risk to this value from the Project is low;

- Criterion (vii): Kakadu's natural beauty and authentic importance is formed from contrast between the extensive internationally recognised Ramsar–listed wetlands and the rocky escarpment and plateau - The Project area is on the northern boundary of the Jabiru township and over 1 km from the nearest sensitive residential receptor. The neighbouring wastewater treatment plant and landfill are in closer proximity to publicly accessible areas than the Project. No significant landforms or views from tourist lookout points are impacted by the Project. The risk of the Project impacting Kakadu's natural beauty and aesthetic importance is low;

- Criterion (ix): The property incorporates significant elements of four major river systems of tropical Australia. Kakadu's ancient escarpment and stone country span more than 2 billion years of geological history, whereas the floodplains are recent, dynamic environments, shaped by changing sea levels and big floods every wet season - The Project area landform comprises a sandy erosional surface dissected by lowland streams and part of the Alluvial plains of Kakadu National Park. With inclusion of appropriate control (refer to Section 7) the risk of impacts to significant landform and geological features is low; and

- Criterion (x): Kakadu is unique in protecting almost the entire catchment of a large tropical river and has one of the widest ranges of habitats and greatest number of species documented of any comparable area in tropical northern Australia – The Project is outside the Baralil floodplain and the Project area constitutes 20.08 ha. Surveys have confirmed the presence of two listed threatened species onsite; however, the habitat value of the site is considered average and significant suitable habitat for these species exists in the surrounding area. Therefore, the risk of impacts Kakadu National Park's unique habitats is considered low.

Table 6-2 provides an assessment of the Project against the significant impact criteria for World Heritage properties in accordance with the Significant Impact Guidelines 1.1. Kakadu has both natural and cultural heritage values and has thus been considered against the criteria for both.

Table 6-2 Assessment against Significant Impact Criteria: World Heritage Properties

Criterion	Assessment against Significant Criteria
Overarching Significant Impact Criteria	
One or more of the World Heritage values to be lost.	**Highly Unlikely** – While the Project is located within the boundaries of Kakadu, the Project area constitutes 20.08 ha within the 1,981,600 ha park area (0.001%). The Project area has been disturbed by anthropogenic activities (e.g. gravel quarry and tracks), weed flora infestations, pest fauna activity and directly adjoins waste disposal areas associated with the Jabiru township. The area is listed as a Ramsar wetland; however, no migratory species were detected during the field assessment/site surveys or are expected to either occur within the Project area or be significantly impacted by the Project. The Project will involve a range of control to limit risk to the environment, particularly downstream environmental receptors. The nature, position and scale of the Project would not result in the loss of one or more World Heritage values.
One or more of the World Heritage values to be degraded or damaged.	**Highly Unlikely** – Multiple components and controls of the Project would need to fail simultaneously to cause an impact that would degrade or damage a World Heritage value. Given the nature, position and scale of the Project, it is considered highly unlikely that it would result in degradation or damage to a World Heritage value of Kakadu.

Criterion	Assessment against Significant Criteria
One or more of the World Heritage values to be notably altered, modified, obscured or diminished.	**Highly Unlikely** – Multiple components and controls of the Project would need to fail simultaneously to cause an impact that would notably alter, modify, obscure, or diminish one or more of the World Heritage values. Given the nature, position and scale of the Project, it is considered highly unlikely that it would result in a change to a World Heritage values of this nature.
World Heritage Properties with Natural Heritage Values	
Damage, modify, alter or obscure important geological formations in a World Heritage property.	**Unlikely** – The Project area is on the Koolpinyah Surface. This landform is a Tertiary peneplain, comprising a sandy erosional surface dissected by lowland streams and part of the Alluvial plains of Kakadu. The Project involves minimal earthworks, and while it will result in localised modification to the landform, it would not result in impacts to the geological formation outside the Project area.
Damage, modify, alter or obscure landforms or landscape features, for example, by excavation or infilling of the land surface in a World Heritage property.	**Highly Unlikely** – The Project area is on the Koolpinyah Surface. This landform is a Tertiary peneplain, comprising a sandy erosional surface dissected by lowland streams and part of the Alluvial plains of Kakadu. The Project involves minimal earthworks, and while it will result in localised modification to the landform, it would not result in impacts to the landscape outside the Project area with the implementation of standard controls. Appendix A of Significant Impact Guidelines 1.2 provides environmental context to landscape and landforms. Considering this context, the siting and scale of the Project, it is highly unlikely to damage, modify, alter or obscure the relevant landform and landscape feature to any degree that would be considered significant (refer to controls presented in Section 7).
Modify, alter or inhibit landscape processes, for example, by accelerating or increasing susceptibility to erosion, or stabilising mobile landforms, such as sand dunes, in a World Heritage property.	**Unlikely** – The Project area landform comprises a sandy erosional surface dissected by lowland streams and part of the Alluvial plains of Kakadu. The Project is located on the left bank of Baralil Creek sub-catchment at a level of 30 m AHD (Surface Water Erosion Solutions, 2020). Conservative estimates using regional flood frequency estimation methods indicated a probable maximum flood level of ≈17.5m AHD in Baralil Creek at the Project area. This is ≈9.5m below the average site level of ≈27 m AHD and based on these estimations, it is unlikely flood will affect the Project area (Surface Water Erosion Solutions, 2020). The Project involves minimal earthworks, and while it will result in localised modification to the landscape within the Project area, standard clean water diversion and erosion control measures (e.g. an ESCP) will be employed to prevent any modification, alteration and inhibition of landscape processes beyond the Project area (refer to controls presented in Section 7 and Appendix A, and the draft ESCP in Appendix I).
Divert, impound or channelise a river, wetland or other water body in a World Heritage property.	**No** – Overland flows across the Project area drain either to the north-east or south, and there are no defined watercourses or distinct drainage lines. The Project will not involve the diversion, impoundment or channelisation of a river, wetland or other water body.
Substantially increase concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a World Heritage property.	**Highly Unlikely** – The soils in the Project area are mostly sandy. Sandy soils generally have low erosion rates; however, skeletal soils can be eroded and mobilised once disturbed. Standard clean water diversion, erosion control measures (e.g. an ESCP) and stormwater runoff controls will be employed to prevent or limit offsite movement of sediment and other potential pollutants (refer to controls presented in Section 7 and Appendix A, and the draft ESCP in Appendix I).

Criterion	Assessment against Significant Criteria
Reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property.	**Highly Unlikely** – The Project will reduce to a minor degree the area of Eucalypt woodland as habitat to native species. There are significant intact stands of this woodland adjacent to the Project area. The Project area contains a range of weed species, including introduced grasses, and exhibits anthropogenic disturbances (e.g. quarrying, effluent irrigation, cleared tracks). The Project area may be intermittently utilised by Partridge Pigeon and Black-footed Tree-rats; however, loss of the area is not considered a significant impact to either species (refer to Section 6.1.4). The Project will be contained to a 20.08 ha area and is considered highly unlikely to impact the diversity or composition of plant and animal species outside the Project area.
Fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property.	**No** – The Project will reduce to a minor degree the area of Eucalypt woodland habitat. The Project area is surrounded by intact portions of Eucalypt woodland within the National Park on two sides, a landfill on one side and treated effluent irrigation on the fourth side. The Project area may be intermittently utilised by Partridge Pigeon and Black-footed Tree-rats; however, loss of the habitat is not considered a significant impact to either species (refer to Section 6.1.4). Vegetation clearing for the Project footprint will not fragment, isolate or substantially damage habitat important for conservation or biological diversity.
Cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property.	**Unlikely** – Five EPBC Act listed fauna species were considered to have the potential to occur in the Project area. Following three separate survey events, the Partridge Pigeon and Black-footed Tree-rat were the only threatened species confirmed to occur in the Project area during site surveys. An assessment against the relevant significant impact criteria for each species is provided in Table 6-5. A significant trapping effort was completed for the third survey event and no Black-footed Tree-rats caught over the 955 trap nights. Given the substantial trapping effort, and the highly trap-able nature of Black-footed Tree-rats, there is a high degree of confidence that the zero-capture result is a true absence of the species from the Project area and surrounds (T. Griffiths pers. comm. March 2021). Based on the findings, Black-footed Tree-rat individuals are expected to infrequently utilise the Project area for foraging in the late dry season when vegetation condition in the surrounding area is diminished. Therefore, while Project area may be intermittently utilised by Partridge Pigeon and Black-footed Tree-rats; the loss of the area is not considered a significant impact to either species (refer to Section 6.1.4). Given significant suitable habitat in surrounding areas, and the outcomes of the third species-specific trapping survey, it is considered unlikely to fragment, isolate or substantially damage habitat for rare, unique or endemic animal populations.
Fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property.	**Unlikely** – Five EPBC Act listed fauna species were considered to have the potential to occur in the Project area. Following three separate survey events, the Partridge Pigeon and Black-footed Tree-rat were the only threatened species confirmed to occur in the Project area during site surveys. An assessment against the relevant significant impact criteria for each species is provided in Table 6-5. Given significant suitable habitat in surrounding areas, and the outcomes of the third species-specific trapping survey, it is considered unlikely to fragment, isolate or substantially damage habitat for rare, unique or endemic animal populations.

Criterion	Assessment against Significant Criteria
Involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values.	**Unlikely** – While the Project involves land clearance and construction of a hybrid power station, the area of disturbance is limited and a range of controls are proposed to protect relevant values external to the Project area (refer to controls presented in Section 7 and Appendix A). Furthermore, the Project is considered essential infrastructure for the ongoing functioning of Kakadu and the Jabiru township. The Project will also replace an ageing existing diesel power station with a hybrid diesel-solar operation, improving sustainability and reducing local air emissions.
Introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values.	**Unlikely** – While the Project will produce noise and air emissions, it will be replacing an existing diesel power station with a hybrid diesel-solar solution. The Project will result in a net reduction of noise and air emissions to the local airshed. Given the scale and hybrid design of the power station, it is considered highly unlikely to result in substantial, long-term or permanent negative impacts to relevant values.
World Heritage Properties with Cultural Heritage Values	
Permanently remove, destroy, damage or substantially alter the fabric[9] of a World Heritage property.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. The Project will support the ongoing maintenance of the fabric through provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
Extend, renovate, refurbish or substantially alter a World Heritage property in a manner which is inconsistent with relevant values.	**No** – While the Project involves introduction of a new, more efficient and reliable power solution for Jabiru it will not substantially alter Kakadu in a manner which is inconsistent with relevant values.
Permanently remove, destroy, damage or substantially disturb archaeological deposits or artefacts in a World Heritage property.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works; however, this site will not be impacted by the Project.
Involve activities in a World Heritage property with substantial and/or long-term impacts on its values.	**No** – The provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism, provides enormous positive benefits to the World Heritage property. The Project related activities are not anticipated to have an adverse substantial or long-term impact.
Involve construction of buildings or other structures within, adjacent to, or within important sight lines of, a World Heritage property which are inconsistent with relevant values.	**No** – While the Project may result in temporary visual impacts to the Jabiru community (e.g. increase traffic movements), the Project area is on the northern boundary of the Jabiru township and over 1 km from the nearest sensitive residential receptor. The neighbouring wastewater treatment plant and landfill are in closer proximity to publicly accessible areas than the Project.
Make notable changes to the layout, spaces, form or species composition in a garden, landscape or setting of a World Heritage property which are inconsistent with relevant values.	**No** – The Project is the northern boundary of the Jabiru township and over 1 km from the nearest sensitive residential receptor. The Project will not result in noticeable changes.
Assessment of potential for significant residual impacts	**The assessment against the significant impact criteria for World Heritage properties indicates the Project does not meet any of the criteria for significant impact.**

[9] Fabric' means physical material including structural elements and other components, fixtures, fittings, contents and items with historic value (Department of the Environment, 2013)

6.1.2 National Heritage Places

National Parks and Wildlife Conservation Act 1975 was a federal act to establish national parks and reserves for protection and conservation. The entire Kakadu was protected under this act in three stages between 1979 and 1991, which was later replaced by the EPBC Act. Kakadu was declared for the preservation in its natural condition and for the encouragement and regulation for appropriate use, appreciation and enjoyment of the area by the public. In 2007, Kakadu was included on the National Heritage List in recognition of its national heritage significance under the EPBC Act. Kakadu is listed for the following national heritage values:

a. Outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history;

b. Outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history;

c. Outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history;

d. Outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:

    i. A class of Australia's natural or cultural places; or

    ii. A class of Australia's natural or cultural environments;

e. Outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;

f. Outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period;

g. Outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; and

i. Outstanding heritage value to the nation because of the place's importance as part of indigenous tradition (Department of Environment and Water Resources, 2007).

The Indigenous art sites of Kakadu are considered a unique artistic achievement that provides an outstanding record of human interaction with the environment over tens of thousands of years (Department of Agriculture, Water and the Environment, 2021). The region's Indigenous sites also illustrate globally significant examples of the hunter-gatherer way of life, including its spiritual aspects and sites of great antiquity ((Department of Agriculture, Water and the Environment, 2021). There are no known art sites within the Project area. A cultural heritage survey of the entire Jabiru township determined that the absence of sandstone escarpments in the area precludes the possibility of rock shelters with archaeological deposit and/or rock art. The risk to this value from the Project is low

Table 6-3 provides an assessment of the Project against the significant impact criteria for National Heritage properties in accordance with the Significant Impact Guidelines 1.1. Kakadu has both natural and cultural heritage values and has thus been considered against the criteria for both.

Table 6-3 Assessment against Significant Impact Criteria: National Heritage Places

Criterion	Assessment against Significant Criteria
Overarching Significant Impact Criteria	
One or more of the National Heritage values to be lost.	**Highly Unlikely** – While the Project is located within the boundaries of Kakadu National Park, the Project area constitutes 20.08 ha within an area of 1,981,600 ha park area (0.001%). The Project area has been disturbed by anthropogenic activities (e.g. gravel quarry and tracks), weed flora infestations, pest fauna activity and directly adjoins waste disposal areas associated with the Jabiru township. No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works. The Project will involve a range of control to limit risk to the environment, particularly downstream environmental receptors. The nature, position and scale of the Project would not result in the loss of one or more National Heritage values.
One or more of the National Heritage values to be degraded or damaged.	**Highly Unlikely** – Multiple components and controls of the Project would need to fail simultaneously to cause an impact that would degrade or damage a National Heritage value. Given the nature, position and scale of the Project, it is considered highly unlikely that it would result in degradation or damage to a National Heritage value of Kakadu.
One or more of the National Heritage values to be notably altered, modified, obscured or diminished.	**Highly Unlikely** – Multiple components and controls of the Project would need to fail simultaneously to cause an impact that would notably alter, modify, obscure, or diminish one or more of the National Heritage values. Given the nature, position and scale of the Project, it is considered highly unlikely that it would result in a change to a National Heritage values of this nature.
National Heritage Places with Natural Heritage Values	
Damage, modify, alter or obscure important geological formations in a National Heritage place.	**Unlikely** – The Project area is on the Koolpinyah Surface. This landform is a Tertiary peneplain, comprising a sandy erosional surface dissected by lowland streams and part of the Alluvial plains of Kakadu. The Project involves minimal earthworks, and while it will result in localised modification to the landform, it would not result in impacts to the geological formation outside the Project area.
Damage, modify, alter or obscure landforms or landscape features, for example, by excavation or infilling of the land surface in a National Heritage place.	**Highly Unlikely** – As per the response provided in Table 6-2, Appendix A of Significant Impact Guidelines 1.2 provides environmental context to landscape and landforms. Considering this context, the siting and scale of the Project, it is highly unlikely to damage, modify, alter or obscure the relevant landform and landscape feature to any degree that would be considered significant (refer to controls presented in Section 7).

Criterion	Assessment against Significant Criteria
Modify, alter or inhibit landscape processes, for example, by accelerating or increasing susceptibility to erosion, or stabilising mobile landforms, such as sand dunes in a National Heritage place	**Unlikely** – The Project area landform comprises a sandy erosional surface dissected by lowland streams and part of the Alluvial plains of Kakadu. The Project is located on the left bank of Baralil Creek sub-catchment at a level of 30 m AHD (Surface Water Erosion Solutions, 2020). Conservative estimates using regional flood frequency estimation methods indicated a probable maximum flood level of ≈17.5m AHD in Baralil Creek at the Project area. This is ≈9.5m below the average site level of ≈27 m AHD and based on these estimations, it is unlikely flooding will affect the Project area (Surface Water Erosion Solutions, 2020). The Project involves minimal earthworks, and while it will result in localised modification to the landscape within the Project area, standard clean water diversion and erosion control measures (e.g. an ESCP) will be employed to prevent any modification, alteration and inhibition of landscape processes beyond the Project area (refer to controls presented in Section 7 and Appendix A, and the draft ESCP in Appendix I).
Divert, impound or channelise a river, wetland or other water body in a National Heritage place.	**No** – Overland flows across the Project area drain either to the north-east or south, and there are no defined watercourses or distinct drainage lines. The Project will not involve the diversion, impoundment or channelisation of a river, wetland or other water body.
Substantially increase concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a National Heritage place; permanently damage or obscure rock art or other cultural or ceremonial features with World Heritage values.	**Highly Unlikely** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works; however, this site is not within the downstream flow path for the Project area. The soils in the Project area are mostly sandy. Sandy soils generally have low erosion rates; however, skeletal soils can be eroded and mobilised once disturbed. Standard clean water diversion, erosion control measures (e.g. an ESCP) and stormwater runoff controls will be employed to prevent or limit offsite movement of sediment and other potential pollutants (refer to controls presented in Section 7 and Appendix A, and the draft ESCP in Appendix I).
Modify or inhibit ecological processes in a National Heritage place.	**Unlikely** – The Project will reduce to a minor degree the area of Eucalypt woodland as habitat to native species. There are significant intact stands of this woodland adjacent to the Project area. The Project area contains a range of weed species, including introduced grasses, and exhibits anthropogenic disturbances (e.g. quarrying, effluent irrigation, cleared tracks). The Project will be contained to a 20.08 ha area and is considered highly unlikely to modify or inhibit ecological process such as the natural fire regime, the water cycle and nutrient cycle etc.
Reduce the diversity or modify the composition of plant and animal species in a National Heritage place.	**Highly Unlikely** – The Project will reduce to a minor degree the area of Eucalypt woodland as habitat to native species. There are significant intact stands of this woodland adjacent to the Project area. The Project area contains a range of weed species, including introduced grasses, and exhibits anthropogenic disturbances (e.g. quarrying, effluent irrigation, cleared tracks). The Project will be contained to a 20.08 ha area and is considered highly unlikely to impact the diversity or composition of plant and animal species outside the Project area
Fragment or damage habitat important for the conservation of biological diversity in a National Heritage place.	**No** – The Project will reduce to a minor degree the area of Eucalypt woodland habitat. The Project area is surrounded by intact portions of Eucalypt woodland within the National Park on two sides, a landfill on one side and treated effluent irrigation on the fourth side. The Project area may be intermittently utilised by Partridge Pigeon and Black-footed Tree-rats; however, loss of the habitat is not considered a significant impact to either species (refer to Section 6.1.4). Vegetation clearing within the Project footprint will not fragment, isolate or substantially damage habitat important for conservation or biological diversity.

Criterion	Assessment against Significant Criteria
Cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a National Heritage place.	**Unlikely** – Five EPBC Act listed fauna species were considered to have the potential to occur in the Project area. Following three separate survey events, the Partridge Pigeon and Black-footed Tree-rat were the only threatened species confirmed to occur in the Project area during site surveys. An assessment against the relevant significant impact criteria for each species is provided in Table 6-5. A significant trapping effort was completed for the third survey event and no Black-footed Tree-rats caught over the 955 trap nights. Given the substantial trapping effort, and the highly trap-able nature of Black-footed Tree-rats, there is a high degree of confidence that the zero-capture result is a true absence of the species from the Project area and surrounds (T. Griffiths pers. comm. March 2021). Based on the findings, Black-footed Tree-rat individuals are expected to infrequently utilise the Project area for foraging in the late dry season when vegetation condition in the surrounding area is diminished. Therefore, while Project area may be intermittently utilised by Partridge Pigeon and Black-footed Tree-rats; the loss of the area is not considered a significant impact to either species (refer to Section 6.1.4).
Fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a National Heritage place.	**Unlikely** – Five EPBC Act listed fauna species were considered to have the potential to occur in the Project area. Following three separate survey events, the Partridge Pigeon and Black-footed Tree-rat were the only threatened species confirmed to occur in the Project area during site surveys. An assessment against the relevant significant impact criteria for each species is provided in Table 6-5. As per the response above, a significant impact to the Partridge Pigeon and Black-footed Tree-rats is considered unlikely. Given significant suitable habitat in surrounding areas, and the outcomes of the third species-specific trapping survey, it is considered unlikely to fragment, isolate or substantially damage habitat rare, unique or endemic animal populations.
Involve construction of buildings, roads or other structures, vegetation clearance, or other actions with substantial and/or long-term impacts on relevant values.	**Unlikely** – While the Project involves land clearance and construction of a hybrid power station, the area of disturbance is limited and a range of controls are proposed to protect relevant values external to the Project area (refer to controls presented in Section 7 and Appendix A). Furthermore, the Project is considered essential infrastructure for the ongoing functioning of Kakadu and the Jabiru township. The Project will also replace an ageing existing diesel power station with a hybrid diesel-solar operation, improving sustainability and reducing local air emissions.
Introduce noise, odours, pollutants or other intrusive elements with substantial and/or long-term impacts on relevant values.	**Unlikely** – While the Project will produce noise and air emissions, it will be replacing an existing diesel power station with a hybrid diesel-solar solution. The Project will result in a net reduction of noise and air emissions to the local airshed. Given the scale and hybrid design of the power station, it is considered highly unlikely to result in substantial, long-term or permanent negative impacts to relevant values.
National Heritage Places with Cultural Heritage Values	
Permanently remove, destroy, damage or substantially alter the fabric of a National Heritage place in a manner which is inconsistent with relevant values.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. The Project will support the ongoing maintenance of the fabric through provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
Extend, renovate, refurbish or substantially alter a National Heritage place in a manner which is inconsistent with relevant values.	**No** – While the Project involves introduction of a new, more efficient, and reliable power solution for Jabiru it will not substantially alter Kakadu in a manner which is inconsistent with relevant values.

Criterion	Assessment against Significant Criteria
Permanently remove, destroy, damage or substantially disturb archaeological deposits or artefacts in a National Heritage place.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works; however, this site will not be impacted by the Project.
Involve activities in a National Heritage place with substantial and/or long-term impacts on its values.	**No** – The provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism, provides enormous positive benefits to the National Heritage place. The Project related activities are not anticipated to have an adverse substantial or long-term impact.
Involve the construction of buildings or other structures within, adjacent to, or within important sight lines of, a National Heritage place which are inconsistent with relevant values.	**No** – While the Project may result in temporary visual impacts to the Jabiru community (e.g. increase traffic movements), the Project area is on the northern boundary of the Jabiru township and over 1 km from the nearest sensitive residential receptor. The neighbouring wastewater treatment plant and landfill are in closer proximity to publicly accessible areas than the Project.
Make notable changes to the layout, spaces, form or species composition of a garden, landscape or setting of a National Heritage place in a manner which is inconsistent with relevant values.	**No** – The Project is the northern boundary of the Jabiru township and over 1 km from the nearest sensitive residential receptor. The Project will not result in noticeable changes.
Restrict or inhibit the continuing use of a National Heritage place as a cultural or ceremonial site causing its values to notably diminish over time.	**No** – The provision of a reliable and sustainable long-term power solution provides for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
Permanently diminish the cultural value of a National Heritage place for a community or group to which its National Heritage values relate.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. The Project will support the ongoing management of cultural heritage site through provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
Destroy or damage cultural or ceremonial, artefacts, features, or objects in a National Heritage place.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works; however, this site will not be impacted by the Project.
Notably diminish the value of a National Heritage place in demonstrating creative or technical achievement.	**No** – The provision of a reliable and sustainable long-term power solution provides for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
National Heritage Places with Indigenous Heritage Values	
Restrict or inhibit the continuing use of a National Heritage place as a cultural or ceremonial site causing its values to notably diminish over time.	**No** – The provision of a reliable and sustainable long-term power solution provides for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
Permanently diminish the cultural value of a National Heritage place for an Indigenous group to which its National Heritage values relate.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. The Project will support the ongoing management of cultural heritage site through provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.

Criterion	Assessment against Significant Criteria
Alter the setting of a National Heritage place in a manner which is inconsistent with relevant values.	**No** – The Project is the northern boundary of the Jabiru township and over 1 km from the nearest sensitive residential receptor. The Project will not alter the setting of Kakadu in a manner which is inconsistent with relevant values.
Remove, destroy, damage or substantially disturb archaeological deposits or cultural artefacts in a National Heritage place.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works; however, this site will not be impacted by the Project.
Destroy, damage or permanently obscure rock art or other cultural or ceremonial, artefacts, features, or objects in a National Heritage place.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works; however, this site will not be impacted by the Project.
Notably diminish the value of a National Heritage place in demonstrating creative or technical achievement.	**No** – The provision of a reliable and sustainable long-term power solution provides for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
Permanently remove, destroy, damage or substantially alter Indigenous built structures in a National Heritage place.	**No** – No cultural and heritage sites are present on the Project area as confirmed by the cultural and heritage survey and AAPA certificate. One known heritage site is located 200 m from proposed works; however, this site will not be impacted by the Project.
Involve activities in a National Heritage place with substantial and/or long-term impacts on the values of the place.	**No** – The provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu National Park, including Indigenous land management and cultural tourism, provides enormous positive benefits to the National Heritage place. The Project related activities are not anticipated to have an adverse substantial or long-term impact on the National Heritage values of Kakadu National Park.
Assessment of potential for significant residual impacts	**The assessment against the significant impact criteria for National Heritage places indicates the Project does not meet any of the criteria for significant impact.**

6.1.3 Wetlands of International Importance/Ramsar Wetlands

The Kakadu Ramsar site is listed as a Wetland of International Importance under the 'Convention on Wetlands of International Importance' or also known as the Ramsar Convention. Kakadu meets all nine criteria for identifying wetlands of international importance and listed through varying stages over 30 years. The first Ramsar site was listed in 1980 under Stage 1 and included all lands and waters in the eastern portion of the Kakadu, following the eastern boundary of along the East Alligator River and including the Nourlangie, Jim and Barramundi Creeks (Figure 6-2). This was later expanded in 1995 to include wetland components within the eastern and southern areas of Kakadu in two subsequent stages.

The Project area was included in the Stage 2 listing in 1989. Stage 2 also included all lands and waters situated in the northern and western part of Kakadu, including the Wildman, West Alligator and South Alligator River systems and their floodplains, following the western boundary.

In April 2010, the Stage 1 and Stage 2 areas sites were merged to form a single Ramsar site, called Kakadu National Park. In addition, the site was extended by approximately 600,000 ha to include all remaining areas of Stage 3. This merge and expansion brought the Ramsar boundary in line with the existing boundary of the Kakadu (BMT WBM, 2010).

Regionally, Kakadu wetland habitats are relatively undisturbed and support a broad range of natural values including threatened and endemic species and an abundance of waterbirds. These habitats expand to coastal and inland aquatic ecosystems which include terrestrial wetlands and woodlands, floodplain ecosystems, swamp forest, rivers, springs, and

billabongs, as well as coastal/marine ecosystems with intertidal mudflats, saltmarsh, mangroves and seagrass. (BMT WBM, 2010).

The closest SOCS to the Project is the Alligator River Floodplains (Figure 6-1) situated 5 km downstream and north-east of the Project. The Project area is within the Baralil Creek catchment which drains into the Magela Creek, which contains wetlands of international significance (Surface Water Erosion Solutions, 2020). A Project-specific surface hydrological and erosion analysis determined that Project activities are unlikely to adversely affect flow regimes entering Magela Creek and the site is above the probable maximum flood level for Baralil Creek (Appendix B). Mitigation and management recommendations including an ESCP and Surface Water Management Plan are included in the Project commitments (refer to Section 7 and Appendix A). A draft version of the ESCP for the Project is provided in Appendix I.

Locally, Baralil Creek located to the south of the Project area is a perennial watercourse that creates a floodplain during high flow events. This floodplain contributes to the broader Kakadu wetland and is of national significance under the Directory of Importance Wetlands in Australia and international significance under the Ramsar Convention (Department of Agriculture, Water and the Environment, 2020a). As per the directory, Baralil Creek meets all six of the criteria for determining nationally important wetlands in Australia as follows:

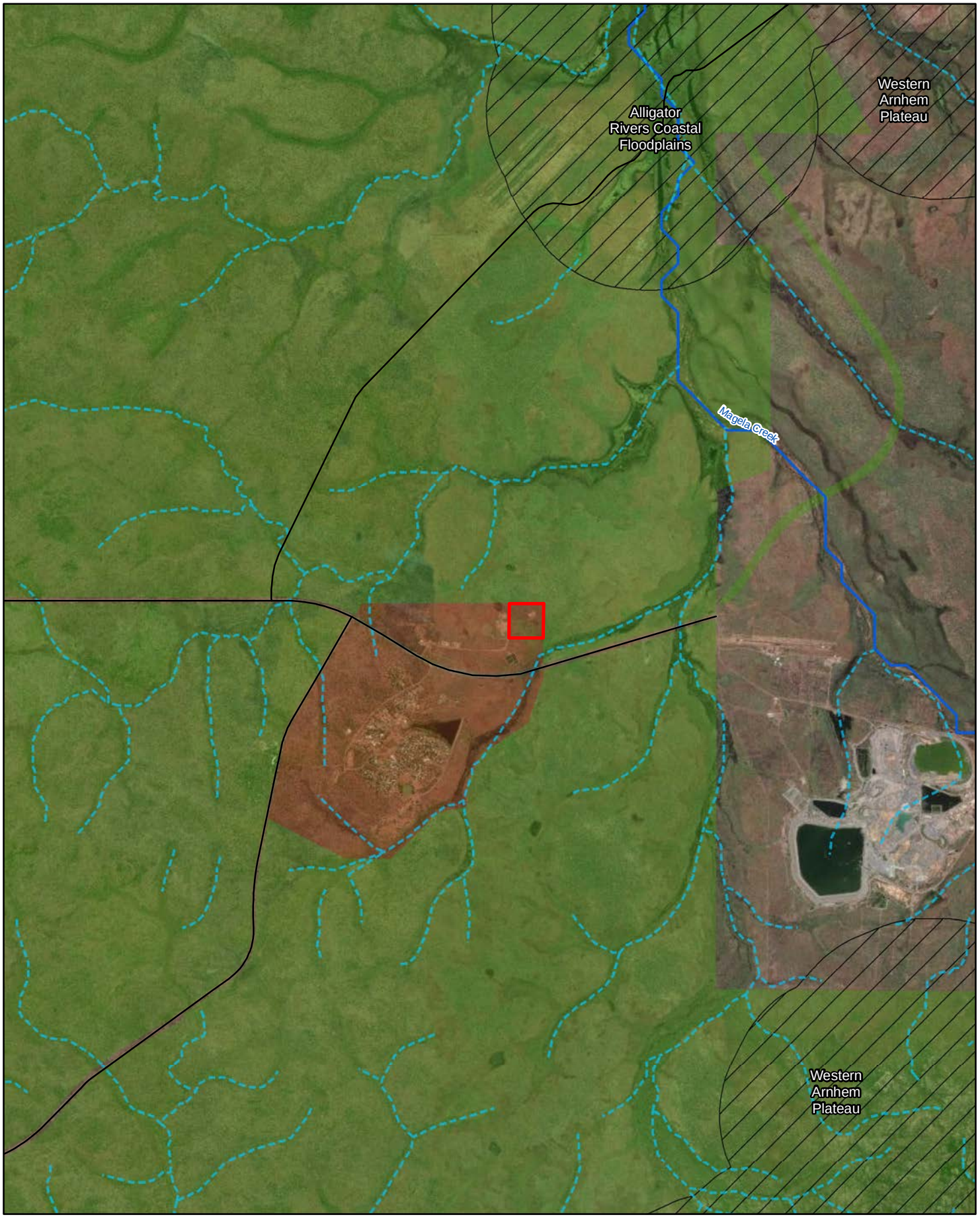
1. It is a good example of a wetland type occurring within a biogeographic region in Australia;
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles or provides a refuge when adverse conditions such as drought prevail;
4. The wetland supports 1% or more of the national populations of any native plant or animal taxa;
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level; and
6. The wetland is of outstanding historical or cultural significance.

Table 6-4 provides an assessment of the Project against the significant impact criteria for wetlands of international importance and declared Ramsar wetlands in accordance with the Significant Impact Guidelines 1.1 (Department of the Environment, 2013).

Table 6-4 Assessment against Significant Impact Criteria: Wetlands of International Importance/Ramsar Wetlands

Criterion	Assessment against Significant Criteria
Areas of the wetland being destroyed or substantially modified.	**No** – Overland flows across the Project area drain either to the north-east or south, and there are no defined watercourses or distinct drainage lines. At the closest point, the Project area is approximately 370 m from Baralil Creek and there are no areas of wetland within the Project footprint. The Project will not involve the diversion, impoundment or channelisation of a river, wetland or other water body. Standard clean water diversion and erosion control measures (e.g. an ESCP) will be employed to prevent offsite impacts to wetlands (refer to controls presented in Section 7 and Appendix A).

Criterion	Assessment against Significant Criteria
A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland.	**Highly Unlikely** – The Project involves disturbance of roughly 16 ha within the Baralil Creek catchment (within the 20.08 ha Project area). Standard clean water diversion and erosion control measures (e.g. an ESCP) will be employed to minimise hydrological changes. Given the spatial extent and positioning of the Project (i.e. no defined watercourses or drainage lines onsite) it is considered highly unlikely that the Project would result in a substantial or measurable change in ground or surface water flows entering Baralil Creek or the downstream Magela Creek.
The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected.	**Highly Unlikely** – The Project involves disturbance of roughly 16 ha within the Baralil Creek catchment (within the 20.08 ha Project area). Standard clean water diversion and erosion control measures (e.g. an ESCP), and hazardous chemical management measures will be employed to minimise the risk of contaminant releases and discharges from the site and hydrological changes. Given the spatial extent and positioning of the Project (i.e. no defined watercourses or drainage lines onsite) it is considered highly unlikely that the Project would result in impacts to the lifecycle of native wetland species (refer to controls presented in Section 7 and Appendix A).
A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**Highly Unlikely** – Overland flows across the Project area drain either to the north-east or south, and there are no defined watercourses or distinct drainage lines. At the closest point, the Project area is approximately 370 m from Baralil Creek and there are no areas of wetland within the Project footprint. Furthermore, the Project is above the probable maximum flood level and therefore the risk of mobilising sediment and contaminants from the site are reduced. Given the spatial extent and positioning of the Project it is considered highly unlikely that the Project would result in substantial and measurable changes to water quality to downstream wetlands (refer to controls presented in Section 7 and Appendix A).
An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.	**No** – Overland flows across the Project area drain either to the north-east or south, and there are no defined watercourses or distinct drainage lines. At the closest point, the Project area is approximately 370 m from Baralil Creek and there are no areas of wetland within the Project footprint. The Project controls include various measures to prevent the introduction or spread of invasive flora and fauna (refer to controls presented in Section 7 and Appendix A).
Assessment of potential for significant residual impacts	**With consideration of the spatial position, disturbance extent and proposed controls, the Project does not meet any of the criteria for significant impact to wetlands of international importance/Ramsar wetlands.**

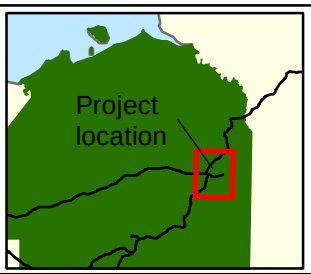


DATA SOURCES
Connect Environmental 2020
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 1,125 2,250
Metres

Scale @ A4 1:85,000
Date: 25/02/21
Author: D. Bayliss



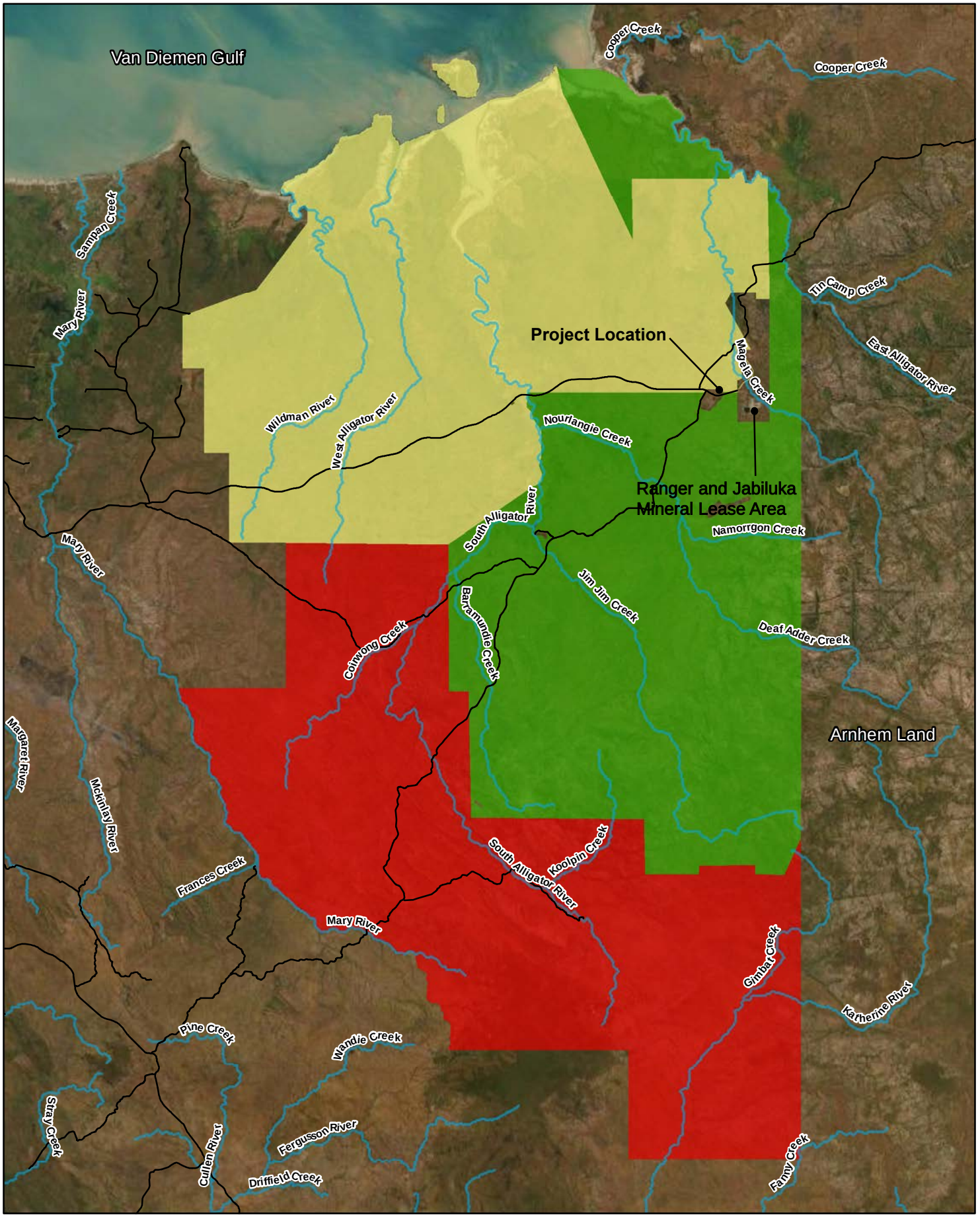
- Lot 2303
- Road
- Major Waterway
- Streams
- Sites of Conservation Significance

Parks and Reserves

- Kakadu National Park
- Town of Jabiru within Kakadu

Figure 6-1
Sites of Conservation Significance, Parks and Reserves

CDM Smith

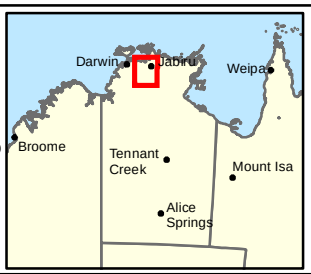


DATA SOURCES
BMT WBM 2010
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 13,000 26,000
Metres

Scale @ A4 1:1,000,000
Date: 25/02/21
Author: D. Bayliss



Major Waterway
Road
Stage I
Stage II
Stage III

Figure 6-2
Stages of Listing for Ramsar Sites

CDM Smith

EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_6_2_Ramsar_Stages.mxd 25/02/2021

6.1.4 Nationally Threatened Species and Ecological Communities

Kakadu is known for its rich biodiversity, populations of threatened, endemic and culturally significant species. Kakadu supports more than 75 threatened flora and fauna species and one threatened ecological community.

As per Section 5, five EPBC Act listed fauna species were considered to have the potential to occur in the Project area. Following three separate survey events, the Partridge Pigeon and Black-footed Tree-rat were the only threatened species confirmed to occur in the Project area during site surveys. No ecological communities protected under the EPBC Act were identified on the Project area.

Table 6-5 provides an assessment of the Project against the significant impact criteria for the two threatened fauna species known to occur onsite, in accordance with the Significant Impact Guidelines 1.1 (Department of the Environment, 2013).

Table 6-5 Assessment against Significant Impact Criteria: Threatened Species

Criterion	Assessment against Significant Criteria	
	Partridge Pigeon (V)	**Black-footed Tree-rat (E)**
Lead to a long-term decrease in the size of a population for endangered species or important population for vulnerable species.	**Unlikely** – The species was detected onsite and may occasionally utilise the eucalypt woodland in the northern half of the Lot 2303 (the Project area portion). However, there are numerous recent records of the species in proximity of the Project area (i.e. 128 records within 5 km and over 1000 within 50 km) and removal of this 14 ha is unlikely to lead to a decrease of an important population of Partridge Pigeon.	**Unlikely** – Based on the first camera trap survey, the species is known to utilise the Project area. However, the third comprehensive population survey, failed to locate any Black-footed Tree-rat within or immediately surrounding the main portion of the Project area. The third survey results indicate that the Project area does not maintain a population of the species. Based on the findings, Black-footed Tree-rat individuals are expected to infrequently utilise the Project area for foraging in the late dry season when vegetation condition in the surrounding area is diminished. Therefore, it is unlikely the Project would lead to the long-term decrease in size of a Black-footed Tree-rat population.

Criterion	Assessment against Significant Criteria	
	Partridge Pigeon (V)	**Black-footed Tree-rat (E)**
Reduce the area of occupancy of the species for endangered or important population for vulnerable.	**Unlikely** – They may occasionally utilise the eucalypt woodland in the northern half of the Lot 2303 (the Project area portion). Vegetation clearing within the 14 ha Project footprint is unlikely to impact the ability of the species locally to forage, breed, roost or disperse and is therefore unlikely to reduce the area of occupancy of the local population or species.	**Unlikely** – Using available data (i.e., results of the surveys and existing NT Fauna Atlas data), it is unlikely that the loss of habitat in Lot 2303 will reduce the area of occupancy of the species. The species occurs in the Jabiru region, with the NT Fauna Atlas containing seven records within 5 km of Lot 2303 since 2000[10], with the nearest being approximately 2 km to the south-west. The species has also been recorded from the Mine site to the southwest (Eidnoder *et al*., 2019). In mid-January, the Djurrubu Rangers informed Connect Environmental that they had recorded a Black-footed Tree-rat on a camera located approximately 300-400 m west of the Jabiru Kart Track (approximately 2 km west of Lot 2303). Furthermore, the results of the third population survey confirm the Project area does not maintain a population of the species and the Black-footed Tree-rat recorded during the first survey are likely to reside in surrounding habitat.
Fragment an existing population into two or more populations.	**Unlikely** – The Project area is surrounded by intact portions of eucalypt within National Park on two sides, a landfill on one side and treated effluent irrigation on the fourth side. Vegetation clearing within the 14 ha Project footprint is unlikely to fragment an existing population.	**Unlikely** – The third comprehensive population survey, failed to locate any Black-footed Tree-rat within or immediately surrounding the main portion of the Project area. The third survey results indicate that the Project area does not maintain a population of the species and it is unlikely to fragment an existing population.
Adversely affect habitat critical to the survival of a species.	**Unlikely** – The species was detected onsite and may occasionally utilise the eucalypt woodland in the northern half of the Lot 2303. However, Partridge Pigeons were also detected at numerous other locations around the Project area and in Jabiru. There is abundant similar habitat in the neighboring Kakadu and Jabiru township.	**Unlikely** – Habitat within Lot 2303 appears suitable; however, the Project area does not maintain a population of the species. Based survey findings, Black-footed Tree-rat individuals are expected to infrequently utilise the Project area for foraging in the late dry season when vegetation condition in the surrounding area is diminished. Therefore, habitat in the Project area is not considered critical to the survival of the species.
Disrupt the breeding cycle of a population.	**Unlikely** – The Project area contains a range of weed species including introduced grasses that are sub-optimal for Partridge Pigeon ground nesting. While the fencing surrounding the Project area may provide a measure of protection against predation by feral animals during the breeding season, the minor extent of the Project area in the local and regional context means the Project is unlikely to disrupt the breeding cycle of a population.	**Possible** – Breeding may occur throughout the year, though could peak in August to September (TSSC, 2015). However, the Project area does not maintain a population of the species and it is considered unlikely to disrupt the breeding cycle of the Black-footed Tree-rats residing in the surrounding area.

[10] Post-2000 was selected as the timeframe for which records may still be relevant (i.e., current).

Criterion	Assessment against Significant Criteria	
	Partridge Pigeon (V)	**Black-footed Tree-rat (E)**
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely** – The Project will reduce to a minor degree the area of habitat available to the species in the wider landscape. The removal of a relatively small proportion of habitat is unlikely to impact the species ability to forage, breed, roost or disperse given the availability of proximal suitable habitat. The removal of this habitat is unlikely to have a deleterious effect on the long-term maintenance of the species or the ability for the species to maintain genetic diversity and long-term evolutionary development. As such, it is considered unlikely the Project will adversely affect habitat to the extent the species is likely to decline.	**Unlikely** – The Project will reduce to a minor degree the area of habitat available to the species in the wider landscape. Given the high number of regional records, it is unlikely that the removal of the habitat will cause a species decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	**Unlikely** – Many weeds already occur in the local area.	**Unlikely** – Many weeds already occur in the local area.
Introduce disease that may cause the species to decline.	**Unlikely** – No diseases that may cause the species to decline are known.	**Unlikely** – No diseases that may cause the species to decline are known.
Interfere with the recovery of the species.	**Unlikely** - Given the high number of regional records, the expected intermittent use of the Project area by the Partridge Pigeon, and it generally poor condition for the species, it is unlikely that the removal of the habitat will interfere with the recovery of the species.	**Unlikely** - Given the high number of regional records, and the apparent small size of this 'population', it is unlikely that the removal of the habitat will interfere with the recovery of the species.
Assessment of potential for significant residual impacts	**Partridge Pigeons were also detected at numerous other locations around the Project area and in Jabiru. Their presence in the Project area is not considered unique, the habitat is not ideal, and the species is unlikely to be significantly impacted by the Project. No significant impact assessment criteria are met for the Partridge Pigeon.**	**The presence of Black-footed Tree-rats in in the Project area appears to be an infrequent occurrence likely associated with diminished vegetation condition in the surrounding areas of Kakadu during the late dry season. No significant impact assessment criteria are met for the Black-footed Tree-rat.**

Note: V = Vulnerable, E = Endangered

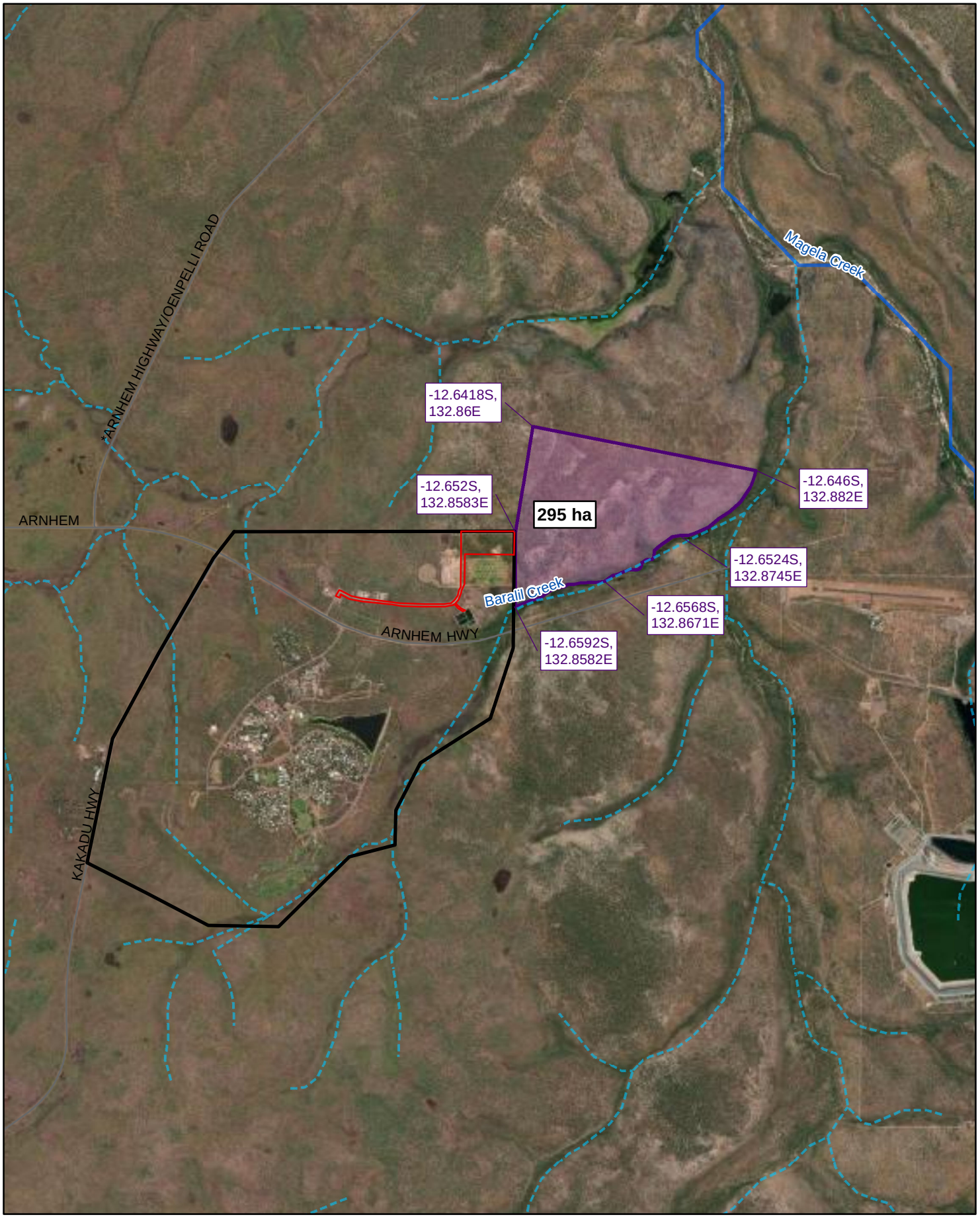
As discussed in 5.4, CM&C liaised with the Department of Environment, Parks and Water Security's Flora and Fauna Division and species subject matter experts, follow the initial field survey (August-September 2020) which detected Black-footed Tree-rats at 14 of 20 camera locations within Lot 2303 (Connect Environmental, 2020). A follow-up survey (November-December 2020) was then completed in the area surrounding Lot 2303 and throughout Jabiru, resulting in a single detection from 35 camera traps. This finding, combined with the low detection of Black-footed Tree-rats in the broader Jabiru area, suggested that Lot 2303 may provide important habitat for a local subpopulation of this species.

However, the internal and external camera trapping surveys were completed two months apart and data from the initial September 2020 sample could not be used to determine the number of individuals using the habitat within Lot 2303. This could feasibly range from a single active and broad-ranging individual to a number of animals. As such, a third

trapping survey was completed to accurately determine the number of individual Black-footed Tree-rats within Lot 2303 as well as adjacent, similar, habitat, and test the extent of movement of individuals into and out of the Project area.

The third field survey found no Black-footed Tree-rats, indicating that the Project area does not maintain a population of the species. Based on the findings, Black-footed Tree-rat individuals are expected to infrequently utilise the Project area for foraging in the late dry season when vegetation condition in the surrounding area is diminished.

Despite the findings, it is recognised that the infrequent use of the Project area for late dry season foraging provides a benefit to the local population of Black-footed Tree-rat. As such, CM&C will be forming a works program as part of the overall Project development, that involves compensatory action to improve the condition of surrounding similar habitat. CM&C have liaised with Djurrubu Rangers and obtained an in-principle agreement to actively work together on a range of actions that may improve the surrounding habitat, with a particular focus on late dry season vegetation condition. These actions may involve the provision of expert advice to update management plans and the resourcing of activities (e.g. revised controlled burn arrangements, weed management actions etc.). The proposed area for this voluntary compensatory action is provided in Figure 6-3.

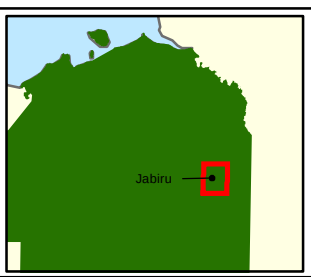


DATA SOURCES
© Northern Territory Fauna Atlas
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
* Locations of markers slightly dispersed for illustration

N

0 700 1,400
Metres

Scale @ A4 1:55,000
Date: 25/03/21
Author: D. Bayliss



- Project Area
- Jabiru Town Boundary
- Voluntary Compensatory Action Area
- Kakadu National Park
- Road
- Major Waterway
- Streams

Figure **6-3**
Black-Footed Tree-rat Voluntary Compensatory Action Area

CDM Smith

EcoGI C:\Users\EcoGI\Documents\EcoGIS\02_Projects\CDM_Smith\086_Jabiru_Hybrid_Power_Station\05_Data_GIS\02_Maps\FIGURE_X_X_BlackFTreeRat_ActionArea.mxd 25/03/2021

6.1.5 Migratory Species

Kakadu is listed on the Ramsar Convention, in which Australia has entered into international agreements with China, Japan and Republic of North Korea to protect the breeding and summer grounds of migratory birds. In March 1996, the parties to the Ramsar Convention agreed to establish an East Asian–Australasian Flyway to protect areas used by migratory waterbirds. The flyway provides an East Asian–Australasian shorebird reserve network of sites that are critically important to migratory shorebirds. The wetlands of Kakadu are part of this reserve network. Numerous migratory species that occur in the park are protected under international agreements. These agreements include:

- The Bonn Convention for conserving migratory species;
- Ramsar; and
- Australia's migratory bird protection bilateral agreements with China (CAMBA), Japan (JAMBA) and the Republic of Korea (ROKAMBA).

Species listed in these agreements and in the Bonn Convention are placed on the Commonwealth migratory species list under the EPBC Act (Department of Agriculture, Water and the Environment, 2020b).

Kakadu's wetlands are seasonally visited by 28 species of migratory birds each year. Some species include the little curlew, the snipe and the godwit (BMT WBM, 2010). Each year intercontinental migratory bird species leaves breeding grounds in the northern hemisphere (China, Japan and Russia) at the end of the summer to fly south to warmer climates. Most migratory shorebirds visit Kakadu between July and September. Migratory waterbird abundance in Kakadu are rainfall dependant. During high rainfall events (October to April), species are dispersed throughout floodplain habitats and in the dry season are restricted to remaining water bodies (BMT WBM, 2010).

A preliminary desktop study was undertaken to identify migratory species potentially occurring within the Project area. Using the Protected Matters Search Tool, 22 migratory species were recorded within a 5 km radius of the Project area (Department of Agriculture, Water and Environment, 2020). Of the species listed, all shorebirds were removed from further assessment as they are unlikely to occur at the Project area due to the inland location. Analysis of vegetation mapping and aerial imagery indicates that no suitable habitat exists for shorebird species. Marine species like the Saltwater Crocodile (*Crocodylus porosus*) and Freshwater Sawfish (*Pristis microdon*) were also excluded, although records show presence within 50 km of the Project area (Connect Environmental, 2020).

The likelihood of species and important habitat occurring within the Project area were assessed during the reconnaissance survey. Four migratory bird species identified during the desktop study were classified as having the potential to occur (Table 6-6).

Using criteria from the Significant Impact Guidelines 1.1, important habitat for each of the potentially occurring migratory bird species was assessed. The assessment found no important habitat within the Project area (Table 6-8). Based on the Significant Impact Guidelines 1.1, impacts to the species were also addressed and included in the Biodiversity Assessment Report in Appendix C (refer to Table 6-8 for assessment against the Significant Impact Guidelines 1.1). Connect Environmental (2020) did not record any migratory species during the reconnaissance survey and concluded there is unlikely impact to each of the potentially occurring species and were thus excluded from further assessment.

Table 6-6 Migratory Species Recorded Within the Project Area[11]

Scientific name	Common name	EPBC Act	Likelihood of occurrence
Motacilla cinerea	Grey wagtail	Marine, Migratory	Unlikely
Rhipidura rufifrons	Rufous fantail	Marine, Migratory	
Cecropis daurica	Red- rumped swallow	Marine, Migratory	Possible
Cuculus optatus	Oriental cuckoo	Migratory	
Hirundo rustica	Barn swallow	Marine, Migratory	
Motacilla flava	Yellow wagtail	Marine, Migratory	

[11] (Connect Environmental, 2020)

Table 6-7 Migratory Species Important Habitat Assessment [12]

Common name	Habitat utilised by migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/ or	Habitat that is of critical importance to the species at particular life- cycle stages and/ or	Habitat utilised by a migratory species which is at the limit of the species range and/ or	Habitat within an area where the species is declining	Likelihood of occurrence
Red-stumped Swallow	Most records in Australia are around Cairns, the Gulf of Carpentaria, Darwin and Broome (Department of the Environment, 2015), with no records within 50 km of The Project area (according to the NT Fauna Atlas). The species only sporadically migrates to Australia, and, subsequently in some years it is not recorded in Australia.	The suitable habitat within Lot 2303 (irrigated grassland) is outside the Project area and unlikely to be of critical importance to the species given there are no records within 50 km and the species only sporadically migrates to Australia (Department of the Environment, 2015).	The species migrates to areas across northern Australia, particularly around Cairns, Gulf of Carpentaria, Darwin and Broome.	The IUCN classifies the species as 'least concern' and the Action Plan for Australian Birds 2010 classifies it as a vagrant (Department of the Environment, 2015).	Unlikely
Oriental Cuckoo	The Oriental Cuckoo is relatively wide-ranging in the NT (Department of the Environment, 2015) and the NT Fauna Atlas contains only 390 records of the species across the whole NT, dating back to 1948. Sixty of these records are within 50 km of the Project area. Given the global population is estimated at over 20 million, it is unlikely that the region supports an ecologically significant proportion of this species.	The habitat within the wider Lot 2303 is unlikely to be critical to a particular life-cycle stage for the species, given its location (i.e. adjacent to a landfill, condition and size).	The Project area is not at the limit of the range of species. It occurs across northern Australia and southwards on the east coast as far as Newcastle (Department of the Environment, 2015).	While the global population has not been formally quantified, the IUCN has classified the species as 'least concern' and the Action Plan for Australian Birds 2010 classifies it as 'non-threatened' (Department of the Environment, 2015).	

[12] (Connect Environmental, 2020)

Common name	Habitat utilised by migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/ or	Habitat that is of critical importance to the species at particular life- cycle stages and/ or	Habitat utilised by a migratory species which is at the limit of the species range and/ or	Habitat within an area where the species is declining	Likelihood of occurrence
Barn swallow	Only a small number of Barn Swallows regularly migrate to northern Australia, with the global population estimated to be greater than 190 million (Department of the Environment, 2015). Most records in the NT are around Darwin, with no records within 50 km of the Project area (according to the NT Fauna Atlas).	The suitable habitat within Lot 2303 (irrigated grassland) is outside the Project area and unlikely to be of critical importance to the species given that there are no records within 50 km and only a small number migrate to Australia (Department of the Environment, 2015).	Of the small number of Barn Swallows that migrate to Australia, some are vagrants to southern Australia.	Both the IUCN and the Australian Birds 2010 classify the species as 'least concern' (Department of the Environment, 2015).	Unlikely
Yellow wagtail	No records of the species are shown in the NT Fauna as being within 50 km of the Project area (Department of the Environment, 2015).	The suitable habitat within Lot 2303 (irrigated grassland) is outside the Project area and unlikely to be of critical importance to the species given that there are no records within 50 km.	The species is a regular visitor to northern Australia, with vagrants in the south (Department of the Environment, 2015).	The IUCN classifies the species as 'least concern' and the Action Plan for Australian Birds 2010 classifies it as 'non-threatened' (Department of the Environment, 2015).	

Table 6-8 provides an assessment of the Project against the significant impact criteria migratory species in accordance with the Significant Impact Guidelines 1.1 (Department of the Environment, 2013).

Table 6-8 Assessment against Significant Impact Criteria: Migratory Species

Criterion	Assessment against Significant Criteria
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	**Unlikely** – The Project area is not considered to constitute important habitat for any of the species (as discussed in Table 6-7). In addition, it is unlikely development in the Project area will destroy or isolate any nearby important habitat, should it occur.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	**Unlikely** – The Project area is not considered to constitute important habitat for any of the species (as discussed in Table 6-7) and it is unlikely that the Project will introduce invasive flora or fauna that is harmful to the species becoming established in any nearby important habitat, should it occur. There are already numerous exotic flora species in and around the Project area.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**Unlikely** – The proposed vegetation clearing is not likely to seriously disrupt an ecological significant proportion of the population of any of the four species listed in Table 6-7, as it is not plausible that an ecologically significant proportion of the species would be found within or near the Project area.
Assessment of potential for significant residual impacts	**The Project does not meet any of the criteria that would constitute a significant impact to migratory species. As such, it is concluded that the proposed development is unlikely to significantly impact any of the four potentially occurring migratory species.**

6.1.6 Commonwealth Marine Areas

There are no commonwealth marine areas within or close to the Project area.

6.1.7 The Great Barrier Reef Marine Park

Not applicable.

6.1.8 Nuclear Actions (Including Uranium Mining)

Not applicable

6.1.9 A Water Resource - Coal Seam Gas Development and Large Coal Mining Development

Not applicable

6.2 Commonwealth Land

The Project area is located within the Jabiru Township of Kakadu and on Commonwealth leased land. As identified in Section 2.2.2, despite the changes in ownership, the site remains in Kakadu, and will remain a Commonwealth reserve under the EPBC Act. Section 388 of the EPBC Act provides for land use in Kakadu including Jabiru and states the town must be used and developed in accordance with Kakadu management plans and the approved town plans. Current approved documents under section 389 of the EPBC Act includes the Jabiru Town Plan 2019, which identifies the Project area within the "Infrastructure Zone" and is designated 'UJ – Utilities'. According to the Clause 11.4 of the Jabiru Town Plan 2019, the Project may be carried out without consent under the *Planning Act 1999* (NT) (Section 2.2.2).

Proposed actions to be undertaken on Commonwealth land or which may have the potential to impact a Commonwealth land, must be assessed against '*Actions on, or impacting upon Commonwealth land, and actions by Commonwealth agencies, Significant impact guideline 1.2* (Significant Impact Guidelines 1.2)' (Department of Sustainability, Environment, Water, Population and Communities, 2013. Under the EPBC Act approval is required for:

- An action taken by any person on Commonwealth land that is likely to have a significant impact on the environment (subsection 26(1) of the EPBC Act); or
- An action taken by any person outside of Commonwealth land that is likely to have a significant impact on the environment on Commonwealth land (subsection 26(2) of the EPBC Act).

In accordance with the EPBC Act, the term environment is defined as:

a. Ecosystems and their constituent parts including people and communities ('ecosystem' is defined in the EPBC Act as 'a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functioning unit')

b. Natural and physical resources;

c. Qualities and characteristics of locations, places and areas;

d. Heritage values of places ('heritage value' is defined in the EPBC Act as including 'the place's natural and cultural environment having aesthetic, historic, scientific or social significance, or other significance, for current and future generations of Australians.' 'Indigenous heritage value' is defined as meaning 'a heritage value of the place that is of significance to Indigenous persons in accordance with their practices, observances, customs, traditions, beliefs or history'); and

e. The social, economic and cultural aspects of a thing mentioned in paragraphs a, b or c.

In accordance with the Significant Impact Guidelines 1.2, in deciding whether or not the action is likely to have a significant impact the following must be considered:

- The environmental context;
- Potential impacts likely to be generated by the action, including indirect consequences of the action;
- Whether mitigation measures will avoid or reduce these impacts; and
- Taking into consideration the above, whether the impacts are likely to be significant.

The preliminary environmental impact assessment summarised in Section 7, and detailed more comprehensively in Appendix A, follows the general methodology set out in the Significant Impact Guidelines 1.2. The risk assessment identified potential environmental impacts from the Project and categorised these as per NT EPA themes and factors. The assessment also identified the specific Project stage, site activity associated with the potential impact, potential impact pathway (e.g. land or waterway), assumptions (uncertainty) associated with the potential impact and risk of the impact accounting for likelihood and consequence. Each potential environmental impact was then reviewed and mitigation and management measures assigned. The residual risk of the potential environmental impact was then reassessed to ensure the residual risk was appropriate (refer to Appendix A). As per the Significant Impact Guidelines 1.2, the ratings used accounted for intensity, scale, duration and frequency of the potential environmental impact to identify an inherent and residual risk severity.

In determining whether an impact is significant the Significant Impact Guidelines 1.2 provides 40 guiding questions. These questions are provided in Table 6-9 and are based on the consideration – 'is there a real chance or possibility that the action will'.

Table 6-9 Assessment against Significant Impact Criteria 1.2: Significant Impact Guiding Questions

Question	Response
Impacts on Landscapes and Soils	
Substantially alter natural landscape features?	**No** – The roughly 16 ha Project disturbance area (within the Project area of 20.08 ha) is not considered a substantial alteration of the landscape.
Cause subsidence, instability or substantial erosion?	**No** – While erosion is an identified risk, control measures will be implemented to appropriately manage.
Involve medium or large-scale excavation of soil or minerals?	**No** – Minimal soil excavation is required for the Project.
Impacts on Coastal Landscapes and Processes	
Alter coastal processes, including wave action, sediment movement or accretion, or water circulation patterns?	**No –** The Project is located approximately 60 km from the coast.
Permanently alter tidal patterns, water flows or water quality in estuaries?	**No –** The Project is located approximately 60 km from the coast.
Reduce biological diversity or change species composition in estuaries?	**No –** The Project is located approximately 60 km from the coast. Standard controls are proposed to manage the risk of spills and offsite release of contaminants.
Extract large volumes of sand or substantially destabilise sand dunes?	**No** – No sand extraction proposed.
Impacts on Ocean Forms, Ocean Processes and Ocean Life	
Reduce biological diversity or change species composition on reefs, seamounts or in other sensitive marine environments?	**No –** The Project is located approximately 60 km from the coast.
Alter water circulation patterns by modification of existing landforms or the addition of artificial reefs or other large structures?	**No –** The Project is located approximately 60 km from the coast.
Substantially damage or modify large areas of the seafloor or ocean habitat, such as sea grass?	**No –** The Project is located approximately 60 km from the coast.
Release oil, fuel or other toxic substances into the marine environment in sufficient quantity to kill larger marine animals or alter ecosystem processes?	**No –** The Project is located approximately 60 km from the coast. Standard controls are proposed to manage the risk of spills and offsite release of contaminants.
Release large quantities of sewage or other waste into the marine environment?	**No –** With exception of connecting into the existing sewer system, the Project does not involve sewage conveyance or treatment.
Impacts on Water Resources	
Measurably reduce the quantity, quality or availability of surface or ground water?	**No –** While the Project may capture some stormwater onsite and treat prior to discharge this would not result in a measurable reduction. Furthermore, standard controls are proposed to manage stormwater runoff quality. Furthermore, CM&C have confirmed sufficient water to supply both the construction and operational phases of the Project. The operational water demand will be equivalent to a single-family residential house.
Channelise, divert or impound rivers or creeks or substantially alter drainage patterns?	**No** – There are no watercourses in the Project area.
Measurably alter water table levels?	**No** – The Project is not anticipated to intersect the water table nor extract underground water.
Pollutants, Chemicals and Toxic Substances	

Question	Response
Generate smoke, fumes, chemicals, nutrients, or other pollutants which will substantially reduce local air quality or water quality?	**Unlikely** – While the Project will involve the burning of diesel to produce power, the location (on the northern boundary of Jabiru township), the predominant wind directions and the inclusion of solar to offset diesel mean the Project unlikely to not substantially reduce the local air quality.
Result in the release, leakage, spillage, or explosion of flammable, explosive, toxic, radioactive, carcinogenic, or mutagenic substances, through use, storage, transport, or disposal?	**Unlikely** – While the Project will involve the storage of up to 300,000L of diesel onsite standard controls are proposed to manage the risk of spills and offsite release of contaminants.
Increase atmospheric concentrations of gases which will contribute to the greenhouse effect or ozone damage?	**Unlikely** – While the Project include the use of four 0.908 MW diesel generators, it also includes solar panels and a battery storage unit. The Project will result in a reduction to the release of greenhouse gases produced to power Jabiru through the replacement of a solely diesel power station.
Substantially disturb contaminated or acid-sulphate soils?	**No** – A soil sampling analysis identified potential contaminants of concern in surface soils were below adopted guidelines. A site-specific geotechnical study found that the Project area is not impacted by acid sulfate soils
Impacts on Plants	
Involve medium or large-scale native vegetation clearance?	**No –** Clearing for the Project is considered relatively small-scale.
Involve any clearance of any vegetation containing a listed threatened species which is likely to result in a long-term decline in a population or which threatens the viability of the species?	**No** – No listed threatened flora species were identified in the Project area. All species identified in the PMST within the 50 km buffer were classified as unlikely to occur within the Project area. Nevertheless, should such a species occur it would not likely result in long-term decline of a population.
Introduce potentially invasive species?	**Unlikely** – It is unlikely that the Project will introduce invasive flora or fauna. There are already numerous exotic flora species in and around the Project area and a range of standard controls are proposed.
Involve the use of chemicals which substantially stunt the growth of native vegetation?	**No** – The Project will not involve the application of chemicals to native vegetation.
Involve large-scale controlled burning or any controlled burning in sensitive areas, including areas which contain listed threatened species?	**No** – The Project does not require large-scale controlled burning.
Impacts on Animals	
Cause a long-term decrease in, or threaten the viability of, a native animal population or populations, through death, injury or other harm to individuals?	**Unlikely** – As per the assessment in Section 6.1.4, while listed threatened fauna have been observed onsite, the Project is unlikely to significantly impact the species.
Displace or substantially limit the movement or dispersal of native animal populations?	**Unlikely** – As per the assessment in Section 6.1.4, while listed threatened fauna have been observed onsite, the Project is unlikely to significantly impact the species.
Substantially reduce or fragment available habitat for native species?	**No** – The Project area is surrounded by intact portions of Eucalypt woodland within the National Park on two sides, a landfill on one side and treated effluent irrigation on the fourth side. Vegetation clearing for the Project footprint will not fragment available habitat for native species.

Question	Response
Reduce or fragment available habitat for listed threatened species which is likely to displace a population, result in a long-term decline in a population, or threaten the viability of the species?	**Unlikely –** Five EPBC Act listed fauna species were considered to have the potential to occur in the Project area. Following three separate survey events, the Partridge Pigeon and Black-footed Tree-rat were the only threatened species confirmed to occur in the Project area during site surveys. An assessment against the relevant significant impact criteria for each species is provided in Table 6-5. Given significant suitable habitat in surrounding areas, and the outcomes of the third species-specific trapping survey, it is considered unlikely to fragment, available habitat and result in a long-term decline of the respective populations.
Introduce exotic species which will substantially reduce habitat or resources for native species?	**Unlikely** – It is unlikely that the Project will introduce invasive flora or fauna. There are already numerous exotic flora species in and around the Project area and a range of standard controls are proposed.
Undertake large-scale controlled burning or any controlled burning in areas containing listed threatened species?	**No** – The Project does not require controlled burning.
Impacts on People and Communities	
Substantially increase demand for, or reduce the availability of, community services or infrastructure which have direct or indirect impacts on the environment, including water supply, power supply, roads, waste disposal, and housing?	**No** – While the Project is an essential service to supply power to Jabiru, it will not substantially increase demand or reduce availability of power or other utility services.
Affect the health, safety, welfare or quality of life of the members of a community, through factors such as noise, odours, fumes, smoke, or other pollutants?	**Unlikely** – While the Project will involve the burning of diesel to produce power, the location (on the northern boundary of Jabiru township), the predominant wind directions and the inclusion of solar to offset diesel mean the Project unlikely to not substantially reduce the local air quality.
Cause physical dislocation of individuals or communities?	**No** – No Jabiru residents will be dislocated for the Project.
Substantially change or diminish cultural identity, social organisation or community resources?	**No** – The Project will not substantially change or diminish cultural identify, social organisation or community resources.
Impacts on Heritage	
Permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures, contents, and objects) of a heritage place?	**No –** The Project will support the ongoing maintenance of the fabric through provision of a reliable and sustainable long-term power solution for the ongoing operation of Jabiru and the essential function it provides to local residents and management of Kakadu, including Indigenous land management and cultural tourism.
Involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place?	**No** – The Project does not involve extension, renovation or substantial alteration of a heritage place (refer to the assessment in Table 6-3).
Involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place?	**No** – While the Project may result in temporary visual impacts to the Jabiru community (e.g. increase traffic movements), the Project area is on the northern boundary of the Jabiru township and over 1 km from the nearest sensitive residential receptor. The neighbouring wastewater treatment plant and landfill are in closer proximity to publicly accessible areas than the Project (refer to the assessment in Table 6-3).
Substantially diminish the heritage value of a heritage place for a community or group for which it is significant?	**No** – The Project will not substantially diminish the listed Kakadu as a heritage place for a community or group (refer to the assessment in Table 6-3).
Substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place?	**No** – The Project will not substantially alter the setting of Kakadu a heritage (refer to the assessment in Table 6-3).

Question	Response
Substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site?	**No** – The Project will not substantially restrict or inhibit the use of Kakadu for cultural or ceremonial uses (refer to the assessment in Table 6-3).

Section 7 Preliminary Environmental Impact Assessment

This section identifies all potential impacts to the NT EPA's environmental factors during site preparation, construction and operation of the project and provides proposed mitigation measures to avoid, reduce or offset the potential impacts. A description of receiving environments that are subject to potential impact is provided in Section 5. A summary of the environmental factors potentially impacted followed by the inherent and residual risk is provided in Table 7-1. The preliminary risk assessment is attached in Appendix A.

The management controls that arise from the assessment of the inherent risks have been included in a draft CEMP provided in Appendix H. This draft CEMP is under development and any management and mitigation measures included in Section 7, but not currently represented in the draft version, will be included in the final CEMP.

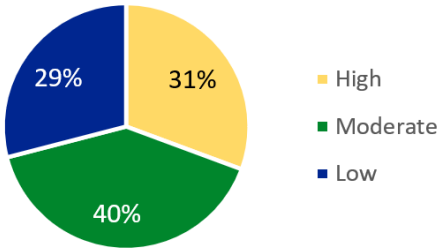
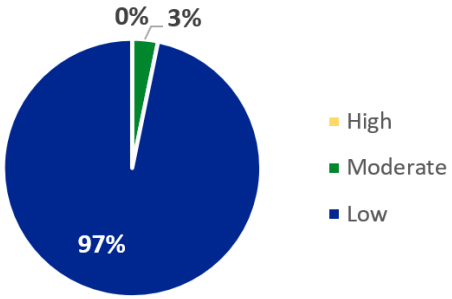
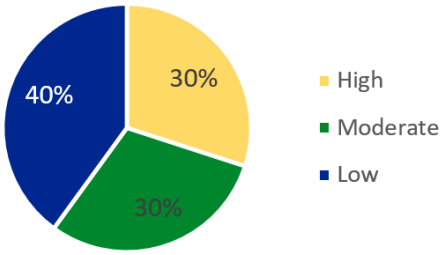
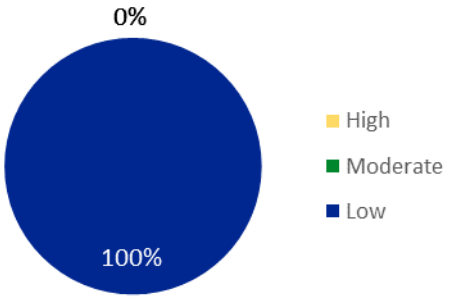
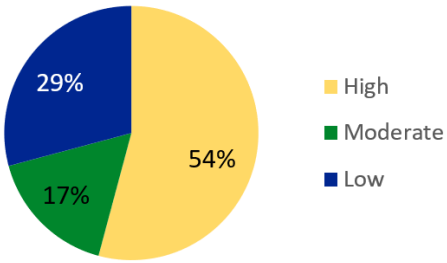
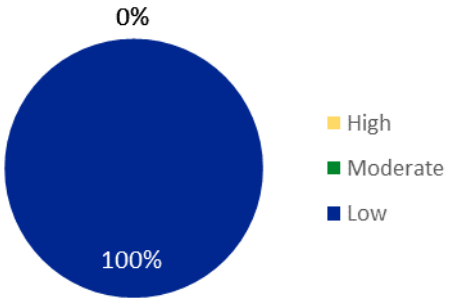
The inherent and residual risks from the environmental risk assessment based on the NT EPA's environmental themes and factors and are summarised in Table 7-2. The pie graphs illustrate the inherent and residual risk levels (once controls are put in place) at each phase of the project during site preparation, construction and operation.

Table 7-1 Environmental Factors Potential Impact Summary

Theme	Factor	Potential Impacts	Inherent Risk*	Residual Risk*
Land	Landforms	Yes	Low	Low
	Terrestrial Environmental Quality	Yes	Moderate	Low
	Terrestrial Ecosystems	Yes	High	Low
Water	Hydrological Processes	Yes	Moderate	Low
	Inland Water Quality	Yes	Moderate	Low
	Aquatic Ecosystems	Yes	Low	Low
Sea	Coastal Processes	Not applicable	-	-
	Marine Environmental Quality	Not applicable	-	-
	Marine Ecosystems	Not applicable	-	-
Air	Air Quality	Yes	Moderate	Low
	Atmospheric Processes	Yes	Low	Low
People	Communities and Economy	Yes	High	Low
	Culture and Heritage	Yes	Low	Low
	Human Health	Yes	Low	Low

* Inherent and residual risk ratings include (very low, low, medium, high, catastrophic)

Table 7-2 Summary of Inherent and Residual Risks

Phase of project	Inherent Risk	Residual risk
Site preparation		
Construction		
Operations and maintenance		

7.1 Land

The potential impacts on the NT EPA Environment Factor "Land" and the proposed mitigation measures are provided in Table 7-3. Matters relating to threatened species are also addressed in this section.

Table 7-3 NT EPA Environment Factor - Land

Objectives			
▪ **Landforms**: Conserve the variety and integrity of distinctive physical landforms so that environmental values are protected; ▪ **Terrestrial Environmental Quality**: Protect the quality and integrity of land and soils so that environmental values are supported and maintained; and ▪ **Terrestrial Ecosystems**: Protect the NT's flora and fauna so that environmental values including biological diversity and ecological integrity are maintained.			
References			
Legislation	Guidelines	Standards / Codes	Other
Aboriginal Land Rights Act 1976 *Building Act 1993* *Electricity Reform Act 2000* *EPBC Act 1999* *Heritage Act 1977* *Jabiru Town Development Act 1978 (NT)* *Litter Act 1972* *Northern Territory Aboriginal Sacred Sites Act 1989* *Planning Act 2016*	Northern Territory Land Suitability Guidelines (Department of Lands, Planning and the Environment, 2013) Land Clearing Guideline (Department of Environment and Natural Resources, 2019) Noise Management Framework (Northern Territory Environment Protection Authority, 2018)	AS 1289:2017 Compaction standards	Kakadu National Park Management Plan 2016- 2026 (Director of National Parks, 2016) A strategy for the conservation of threatened species and threatened ecological communities in Kakadu 2014-2024 (Woinarski & Winderlich, 2014) International agreements
Performance Criteria			
- Avoid potential environmental impacts where possible, including cumulative; - No unapproved loss in biodiversity values over and above those impacts necessary to deliver the Project and permitted through project approvals; - No direct fauna mortality of protected species; - No increase in level of weed and pest infestation as a result of construction and operational activities for the Project; - Surrounding and downstream gradient habitat is not degraded by sediment deposition, scouring or water quality degradation; and - Minimise the severity and duration of all potential impacts to flora and fauna.			

Landform Impacts					
No.	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**
L1	Disturbance to culturally important significant features. Note: Cultural Heritage survey and AAPA certificate: No culturally important features identified. No impact.	Site establishment	Moderate	- Flagging and boundary markers to be implemented to retain clearing within marked disturbance footprint; - GAC provide cultural heritage education to all employees and contractors, including detail of how to identify features and protect these for inspection; - If a heritage site or artefact is discovered during clearing activities, all works will cease immediately, and notification provided to GAC and the Heritage Branch under the *Heritage Act 2011 (NT)* provisions; and - A Construction Environmental Management Plan (CEMP) is to be implemented detailing any further management measures and the process for reporting and actioning potential culturally significant features.	Low
Terrestrial Environmental Quality Impacts					
No.	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**
L2	Exposure/ disturbance of contaminated land from offsite irrigation of treated effluent water. Note: Power station site is completely separated from irrigation area and a Greencap (2020) report concluded contaminants in soil are within acceptable levels.	Site establishment	Low	- Any soils identified as potentially contaminated during construction will not be scraped up and used elsewhere; - There will be no Project activities area to disturb soils within the effluent irrigation area; and - Sediment and erosion controls will be implemented at all times during construction as per an ESCP.	Low
L3	Excavation and land clearing causing exposure to potential ASS and impacting quality of soils and waterways	Site establishment, construction and operations	Moderate	- If ASS is encountered, works will cease, and ASS management measures will be incorporated prior to works continuing; - Sediment and erosion controls will be implemented as per the Project ESCP; and - Minimise clearing and limit both the spatial extent of exposed earth and period of exposure.	Low

L4	Soil erosion causing loss of topsoil during overland flows and potential sedimentation of the downstream catchment adversely impact the aquatic environment of Baralil Creek and downstream aquatic ecosystems.	Site establishment, construction and operations	High	- All site preparation will be undertaken in accordance with Land Clearing Guidelines (Department of Environment and Natural Resources, 2019); - An Erosion and Sediment Control plan is to be included in the contractors Construction Environment Management Plan (CEMP) and include measures to prevent erosion, sedimentation and pooling during site preparation and permanently for operations. The plan must include control measures that minimise the level of surface erosion and sedimentation from exposed ground and trenching; - Drains will be installed across the site to divert clean surface water to stable land areas and away from the site where soil is exposed; - Swales with rock check dams and then outlets to the grassed paddock to the south will be used as a filter buffer; and - Part of the site preparation, construction and operation phases, all erosion and sediment control infrastructure should be regularly checked during the wet season for effectiveness and integrity and remediated where systems fail.	Moderate
L5	Compaction of soils leading to degraded soil quality, less infiltration and greater runoff velocities with potential to cause erosion and sedimentation.	Site establishment, construction and operations	Moderate	- The site will be proof rolled in order to compact loose soil. This will assist with ground stability and mitigate soil dispersal. - Sediment and erosion controls will be implemented as per the Project ESCP. - Flagging and boundary markers to be implemented to prevent vehicle access and compaction outside the project footprint.	Low
L6	Increase in land instability through the creation of wheel ruts during wet weather. Potential to lead to direct impact to soil quality and integrity and downstream waterways through erosion.	Site establishment, construction and operations	Low	- The site will be proof rolled in order to compact loose soil; - Sediment and erosion controls will be implemented as per the Project ESCP; - Clean fill will be selected for foundations or footings, voids created by the removal vegetation, wheel ruts created in wet weather or if existing soils are below subgrade level; - All structural fill will be inspected and tested; and - All access roads will be maintained regularly to prevent deterioration.	Low
L7	Soil erosion of stockpiles during rainfall events resulting in direct impact to soil quality and integrity	Site establishment	Moderate	- An ESCP is to be included in the contractors CEMP and include measures to prevent erosion, sedimentation and pooling during site	Low

	and downstream waterways through erosion of stockpiled soil.			preparation and permanently for operations. The plan will include bunding around stockpiled soil during seasonal work. All stockpiles will be temporary and will be removed from site where required.	
L8	Substantial or small spills of hydrocarbons through refuelling and storage of fuels and oils, contaminating soils. Direct impact to soil quality and indirect impact to waterways through overland flows.	Site establishment, construction and operations	High	- Spills will be cleaned immediately; - Handling and storage of combustible and flammable liquids in accordance with Australian Standards; - All vehicles, plant and equipment will be maintained in good working order (e.g. regular servicing) and operated as intended; - Any refueling trucks will carry a spill kit capable of containing any spills; - Appropriate spill response equipment will be located at all refueling and liquid chemical storage locations including containment and recovery equipment; - In the event of a spill, work will be shut down at the spill site; - Material contaminated as a result of a spill (e.g. soil or solid absorbent) must be removed (i.e. excavated or cleaned up) and placed in an appropriate container or taken off site to prevent further contamination; - An accredited chemical waste contractor will be engaged to dispose of the material and to provide copies of Waste Transport Certificates and Certificates of Disposal for each consignment; and - All hazardous chemicals and fuels will be stored away from drainage lines, away from non- compatible chemicals and appropriately bunded.	Low
Terrestrial Ecosystems Impacts					
No	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**
L9	Dust generation impacting remaining sensitive, significant, endemic or threatened vegetation. Resulting in direct and potentially cumulative impacts to surrounding ecosystem functioning. Note: Desktop searches found no threatened or sensitive flora species records occurring within	Site establishment and construction	Low	- Speed limit restrictions will be implemented on site to reduce dust generation; - A water cart will be used to wet frequently used access tracks; - All access tracks will be maintained and the main access to the site will be compacted with gravel; and	Low

	15 km of the Project area. The field ecological reconnaissance survey assessed the likelihood of threatened flora species occurring within the Project area. Based on habitat preference and number of local records, all species within the 50 km buffer were considered unlikely to be found within the Project area.			- Sediment and erosion controls will be implemented as per the Project ESCP.	
L10	Combustion from Project ignition sources such as machinery, equipment, welding or smoking. Resulting in direct and potentially cumulative impact to surrounding ecosystem function, viability and habitat. Loss of species that use surrounding habitat. Loss of habitat. Note: Fire management is undertaken by the GAC through the Djurrubu Rangers to prevent late season wildfires and to maintain species diversity through controlled low intensity early dry season reduction burns.	Site establishment, construction and operations	High	- Fire prevention equipment such as reels and extinguishers will be provided and validated in specified areas on site; - Smoking and hot works will only be permitted in designated areas, clear of any flammable material or vegetation; - A firebreak of 5 m on the internal side of the Project area boundary fence line will be established during site preparation and maintained during operation; and - Emergency contact numbers will be given to all contractors during site induction and displayed once common areas are established.	Low
L11	Disturbance to sensitive NT and MNES fauna species and their habitat. Resulting in direct and cumulative impact to protected sensitive NT and MNES terrestrial fauna species and their habitat.	Site establishment, construction and operations	High	- Djurrubu Rangers or suitable ecologist to be used as spotters to check for wildlife during clearing process; - Voluntary compensatory actions to address the loss of potential habitat for Black-footed Tree-rats by working with the Djurrubu Rangers to reduce frequency of burning improve habitat in a 295 ha target area adjacent to the north and east of the Project area and improve habitat quality in the area (refer to Figure 6-3); - A fauna spotter-catcher will be employed for the vegetation clearing phase; - Boundaries will remain within existing fence line and surveyed markers along road parcels; - Progressive clearing will be undertaken working form the southern boundary to the north with fences lifted to allow appropriate escape points for fleeing fauna; - Overspill of lighting will be minimised during project activities;	Low

				- A fauna register will be maintained and interactions will be recorded and reported; and - Fire breaks will be maintained and speed limits implemented.	
L12	Over clearing of known habitat for threatened species beyond the approval proposal footprint. Resulting in direct and cumulative impact to protected sensitive NT and MNES terrestrial fauna species and their habitat.	Site establishment	Moderate	- All disturbances will be minimised where possible and kept within the site boundary, Lot 2303 and approved disturbance footprint; - Clearing will be kept within surveyed area, to approved construction drawings; - Boundaries will remain within existing fence line and surveyed markers along road parcels; and - Boundaries will remain within existing fence line and established markers.	Low
L13	Loss of habitat suitable foraging and sheltering. Resulting in direct and cumulative impact to protected sensitive NT and MNES terrestrial fauna species and their habitat.	Site establishment	Moderate	- All disturbances will be minimised where possible and kept within the site boundary, Lot 2303 and approved disturbance footprint; - Voluntary compensatory actions to address the loss of potential habitat for Black-footed Tree-rats by working with the Djurrubu Rangers to reduce frequency of burning improve habitat in a 295 ha target area adjacent to the north and east of the Project area and improve habitat quality in the area (refer to Figure 6-3); - Clearing will be kept within surveyed area, to approved construction drawings; - Boundaries will remain within existing fence line and surveyed markers along road parcels; - Progressive clearing will be undertaken working form the southern boundary to the north; - A 25m wide vegetation buffer within Lot 2303 will be retained to the south of the Project area; - This buffer and other areas with remaining vegetation will become a no-go area and included in site inductions; - Overspill of lighting will be minimised during Project activities; and - A weed management plan will be established.	Moderate
L14	Threatened species altered behaviours and breeding cycles. Resulting in direct and cumulative impact to	Site establishment,	Moderate	- All management measures listed for L13 above; and	Low

	protected sensitive NT and MNES terrestrial fauna species and their habitat.	construction and operations		- Clearing will be undertaken outside of the months of August-September (breeding season of the Black-footed Tree-rat).	
L15	Disturbance to migratory species and their habitat. Note: A total of four migratory species were determined to potentially occur in the Project area. A preliminary assessment of the level of inherent risk to each of these was conducted to determine whether there was a real risk of significant impact to them. As a result, no migratory species were concluded as being the focus of on ground surveys No migratory species were detected, and the Project area is unlikely to contain important habitat for any of the four potentially occurring migratory species.	Site establishment, construction and operations	Moderate	- All management measures listed for L13 above; - An ESCP is to be included in the contractors CEMP and include measures to prevent erosion, sedimentation and pooling during site preparation and permanently for operations; - Chemical storage will be located away from drainage channels, appropriate bunding and spill response kits maintained; and - A weed management plan will be established.	Low
L16	Disturbance to locally endemic species or species with restricted habitat. Note: Ecological studies determined no endemic or species with restricted habitat occur in the Project area.	Site establishment, construction and operations	Low	- Voluntary compensatory actions o address the loss of potential habitat for Black-footed Tree-rats by working with the Djurrubu Rangers to reduce frequency of burning improve habitat in a 295 ha target area adjacent to the north and east of the Project area and improve habitat quality in the area (refer to Figure 6-3); - All disturbances will be minimised where possible and kept within the site boundary, Lot 2303 and approved disturbance footprint; - Clearing will be kept within surveyed area, to approved construction drawings; - Boundaries will remain within existing fence line and surveyed markers along road parcels; and - A fauna register will be maintained and interactions will be recorded and reported.	Low
L17	Change of habitat from introduced and accidently spread weeds. Resulting in cumulative impact as a result of inappropriate weed management or hygiene and changes of vegetation characteristics, functioning and associated fire regime.	Site establishment, construction and operations	High	- All construction personnel will receive induction training in procedures for personal weed-control hygiene practices, such as removing seeds and mud from clothing and footwear; - All vehicles and construction equipment will be cleaned by the contractor prior to arrival in line with the Weed Management Branch Brochure 'How to keep your equipment and vehicles clean of weeds' to ensure equipment and people are weed free; - All vehicles arriving to site is to have a weed/ pest declaration form;	Low

				- All movement of vehicles and equipment on site will be kept to cleared areas; - Cleared vegetation will be segregated with weed infested piles taken off site for correct disposal; - Any fill required for site preparation and construction will be clean of weed seeds and other organic material; - Any newly established declared weeds will be treated by a sub contractor and monitored seasonally until eradicated; - Class A or Weeds of National Significance species found on site will be reported to the Weed Management Branch immediately; and - A weed management plan will be incorporated into the CEMP.	
L18	Disturbance to existing conservation and management activities resulting in direct impacts to existing conservation and management activities.	Site establishment, construction and operations	Low	- All disturbances will be kept within the site boundary, Lot 2303. - Clearing will be kept within surveyed area, to approved construction drawings. - Boundaries will remain within existing fence line and established markers. - Appropriate communication will be undertaken with key stakeholders for the life of the Project.	Low
L19	Fragmentation and loss of vegetation diversity resulting in direct impact to species communities and vegetation type within small range.	Site establishment	Moderate	- All management measures listed for L18 above.	Low
L21	Noise, light and vibration emissions from construction and operational activities. Artificial light emitting from the site could attract fauna and alter foraging patterns, increase predation risks, disrupt biological clocks and disrupt dispersal movements impacting breeding and roosting regimes.	Site establishment, construction and operations	Moderate	- Noise from clearing and trenching will be kept to minimum intensity and expected to be short; - Noise shall be controlled by constructing during daytime hours and equipment serviced regularly; - The NT EPA Noise Management Framework Guideline will be followed through out site preparation activities; - Lighting will be used only for required operational areas, all light sources will be aimed towards specific work areas requiring light for safe construction and/or operation, with a low vertical angle, and light shields will be placed on large equipment to minimise light spill over;	Low

				- Where possible, lighting will be the minimum wattage, whilst not compromising safety or OH&S requirements; - All vehicles, plant and equipment will be maintained in good working order (e.g. regular servicing) and operated as intended; and - Compaction of soils and land clearing will be undertaken during the day.	
L22	Threatened terrestrial fauna species interaction with vehicles resulting in direct fauna mortality and local reduction of populations.	Site establishment, construction and operations	Low	- Speed limits will be introduced on site, all fauna observations will be recorded in a fauna register; - Night time works/ driving will be avoided where possible. and - Any interactions with any fauna species will be reported to the HSE advisor and site supervisor, all interactions will become an environmental incident and will be reported and investigated.	Low
L23	Vermin introduction to site through poor waste management activities resulting in direct impacts to native species within and surrounding the Project area.	Site establishment, construction and operations	Low	- Waste will be managed through bins provided onsite and large skip bin for larger construction items. - Waste will be taken offsite to a waste facility in Darwin for correct disposal; - All waste will be managed appropriately to prevent scavengers and windblown rubbish; and - Waste Management Plan to be incorporated into the CEMP.	Low
L24	Sensitive NT and MNES terrestrial fauna species entrapment	Site establishment, construction and operations	Low	- The time a trench or footings are open should be minimised and barricaded to prevent entry; - Trenches and footings should be checked each morning for trapped wildlife; - If an animal becomes trapped, call Wildcare NT (89 886 121) for assistance or guidance; - Cleared timber shall be stockpiled away from remaining vegetation and removed as soon as possible to prevent sheltering opportunities.	Low

7.2 Water

Surface and groundwater systems have the potential to be impacted by this project through changes in hydrological processes, water quality and disturbances to aquatic ecology. The potential impacts and mitigation measures are included in Table 7-4 below.

Table 7-4 NT EPA Environment Factor - Water

Objectives					
▪ **Hydrological Processes**: Protect the hydrological regimes of groundwater and surface water so that environmental values are maintained; ▪ **Inland Water Environmental Quality**: Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained; and ▪ **Aquatic Ecosystems**: Protect aquatic habitats and flora and fauna to maintain environmental values including biological diversity of flora and fauna and the ecological functions they perform.					
References					
Legislation	**Guidelines**	**Standards / Codes**	**Other**		
Aboriginal Land Rights Act 1976 *EPBC Act 1999* *Water Act 1992* *Waste Management and Pollution Control Act 1998* Water Regulations 1992	ANZECC & ARMCANZ Guidelines 2018 Northern Territory Land Suitability Guidelines (Department of Environment and Natural Resources, 2019)		Kakadu National Park Management Plan 2016- 2026 (Director of National Parks, 2016) International agreements on migratory species		
Performance Criteria					
- Environmental values relating to hydrological processes, inland water quality, aquatic ecosystems, and cultural and spiritual values of the Baralil Creek catchment are maintained; - No contamination incidents/events; - No uncontrolled release of contaminated or sediment-laden water to surrounding drainage lines, waterways or the dedicated stormwater system; and - No complaints related to water quality.					
Hydrological Processes Impacts					
No	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**

W1	Increase of inflows to watercourses and drainage features caused by clearing. Resulting in direct impact to water levels to Baralil Creek, increasing surface runoff as a result of clearing vegetation.	Site establishment, construction and operations	High	- Minimise unnecessary disturbance and clearing, project design will locate infrastructure to minimise stormwater runoff; and - Project design to ensure water diversion to vegetated areas and are maintained as close to natural flows as practicable.	Low
W2	Site subject to seasonal flooding inundating critical infrastructure and stored chemicals. Site inundated during wet season events causing degradation of infrastructure and potential contamination from site to flooded areas. Note: The Project area is not subject to flooding. Natural surface flow is to the south east into the effluent irrigation area.	Site establishment, construction and operations	High	- Project design to ensure water diversion to vegetated areas and are maintained as close to natural flows as practicable; and - Sediment and erosion controls will be implemented as per the Project ESCP.	Low
W3	Placement of infrastructure domains obstructing/ altering natural flow paths. Resulting in a direct impact to creek alignment and natural flow paths, altering flows and increasing potential for erosion	Construction and operations	Low	- Minimise unnecessary disturbance, project design will locate infrastructure to minimise stormwater runoff; - Project design to ensure water diversion to vegetated areas and are maintained as close to natural flows as practicable; and - Sediment and erosion controls will be implemented as per the Project ESCP.	Low
Inland Water Environmental Quality Impacts					
No	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**

W4	Accidental release of pollutants causes degradation of instream habitat including water in downstream aquatic habitat. Direct impact to aquatic ecosystems, threatened species, health of biota, habitats supporting the lifecycle of aquatic biota, species of social and cultural importance, integrity of aquatic ecosystems, biological function and provision of refuge.	Site establishment, construction and operations	High	- Spills will be cleaned immediately; - All vehicles, plant and equipment will be maintained in good working order and operated as intended; - Any refueling trucks will carry a spill kit capable of containing any spills; - Appropriate spill response equipment will be located at all refueling and liquid chemical storage locations including containment and recovery equipment; - In the event of a spill, work will be shut down at the spill site; - Material contaminated as a result of a spill (e.g. soil or solid absorbent) must be removed (i.e. excavated or cleaned up) and placed in an appropriate container or taken off site to prevent further contamination; - An accredited chemical waste contractor will be engaged to dispose of the material and will provide copies of Waste Transport Certificates and Certificates of Disposal for each consignment; and - All hazardous chemicals and fuels will be stored away from drainage lines, away from non- compatible chemicals and appropriately bunded.	Low
W5	Accidental release of contaminants impacting: - Shallow groundwater quality; - Threatened aquatic fauna and flora and their habitat; and - Ramsar wetlands sites. Direct impact to aquatic ecosystems, threatened species, health of biota, habitats supporting the lifecycle of aquatic biota, species of social and cultural importance, integrity of aquatic ecosystems, biological function and provision of refuge.	Site establishment, construction and operations	Moderate	- All vehicles, plant and equipment will be maintained in good working order and operated as intended; - Any refueling trucks will carry a spill kit capable of containing any spills; - Appropriate spill response equipment will be located at all refueling and liquid chemical storage locations including containment and recovery equipment. In the event of a spill, work will be shut down at the spill site; - Material contaminated as a result of a spill (e.g. soil or solid absorbent) must be removed (i.e. excavated or cleaned up) and placed in an appropriate container to prevent further contamination; and - An accredited chemical waste contractor will be engaged to dispose of the material and to provide copies of Waste Transport Certificates and Certificates of Disposal for each consignment.	Low

W6	Change in water aesthetics from suspended solids off site. Direct impact to Baralil Creek from overland flows increasing sedimentation and influencing water quality	Site establishment, construction and operations	High	- An ESCP is to be included in the contractors CEMP and include measures to prevent erosion, sedimentation and pooling during site preparation and permanently for operations; - The ESCP will include control measures that minimise the level of surface erosion and sedimentation from exposed ground; - Drains will be installed across the site to divert clean surface water to stable land areas and away from the site where soil is exposed; and - Part of the site preparation, construction and operation phases, all erosion and sediment control infrastructure will be regularly checked during the wet season for effectiveness and integrity and remediated where systems fail.	Low
W7	Build-up of sedimentation in Baralil Creek, changing water quality, creek characteristics and function. Direct impact to Baralil Creek from overland flows increasing sedimentation and influencing water quality	Site establishment, construction and operations	High	- All management measures listed for W7 above.	Low
Aquatic Ecosystems Impacts					
No	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**
W8	Significant hydrocarbon spill impacting Ramsar Wetlands (Baralil Creek) and aquatic threatened species. Direct impact to aquatic ecosystems, threatened species, health of biota, habitats supporting the lifecycle of aquatic biota, species of social and cultural importance, integrity of aquatic ecosystems, biological function and provision of refuge.	Site establishment, construction and operations	Moderate	- All management measures listed for W5 above.	Low

W9	Mortality of aquatic fauna due to changed water regimes and water quality. Resulting in direct impact to aquatic ecosystems, threatened species, health of biota, habitats supporting the lifecycle of aquatic biota, species of social and cultural importance, integrity of aquatic ecosystems, biological function and provision of refuge.	Site establishment, construction and operations	High	- Project design to ensure water diversion to vegetated areas and are maintained as close to natural flows as practicable; - An ESCP is to be included in the contractors CEMP and include measures to prevent erosion, sedimentation and pooling during site preparation and permanently for operations; - The ESCP will include control measures that minimise the level of surface erosion and sedimentation from exposed ground; - Drains will be installed across the site to divert clean surface water to stable land areas and away from the site where soil is exposed; and - Part of the site preparation, construction and operation phases, all erosion and sediment control infrastructure will be regularly checked during the wet season for effectiveness and integrity and remediated where systems fail.	Low
W10	Disturbance to sites of conservation significance through sedimentation or hydrocarbon spills. Direct and cumulative long-term impact to sites of conservation significance and indirect impacts to species that inhabit this area of refuge. Impact has the potential to influence water quality and change flow paths. Note: The closest site of conservation significance is roughly 5 km from the Project area within the Alligator River Floodplain.	Site establishment, construction and operations	Low	- All management measures listed for W9 above.	Low

7.3 Air

The potential impacts on the NT EPA Environment Factor "Air" and the proposed mitigation measures are provided in Table 7-5.

Table 7-5 NT EPA Environment Factor - Air

Objectives			
▪ **Air Quality**: Protect air quality and minimise emissions and their impact so that environmental values are maintained; and ▪ **Atmospheric Processes**: Minimise greenhouse gas emissions so as to contribute to the NT Government's aspirational target of achieving net zero greenhouse gas emissions by 2050.			
References			
Legislation	**Guidelines**	**Standards / Codes**	**Other**
Planning Act 2016 *National Greenhouse and Energy Reporting Act 2007*	Land Clearing Guideline (Department of Environment and Natural Resources, 2019)	AS 1289:2017 Compaction standards	National Clean Air Agreement National Pollution Inventory National Greenhouse and Energy Reporting
Performance Criteria			
- Implementation of design measures for the power station to minimise carbon emissions; - No air quality complaints received from nearby sensitive receptors; - No environmental nuisance caused as a result of construction and operation; and - Actions to reduce greenhouse gas emission achieved.			
Air Quality Impacts			

No	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**
A1	Dust deposition on the surrounding environment from vehicular movement and earthworks activities. Resulting in impacts to the air quality of terrestrial ecosystem health and function.	Site establishment, construction and operations	High	- Speed limit restrictions will be implemented on site to reduce dust generation; - A water cart will be used to wet frequently used access tracks; and - Compacted fine crushed rock with minimal fines used to line frequently used on site roads;	Low

				- All disturbances will be minimised where possible and kept within the site boundary, Lot 2303 and approved disturbance footprint; - Clearing will be kept within surveyed area, to approved construction drawings; - Boundaries will remain within existing fence line and surveyed markers along road parcels; - All access tracks will be maintained and the main access to the site will be compacted with gravel; and - Progressively rehabilitate area not required for construction or operation, such as temporary access tracks.	
A2	Dust generation from stockpiled soil impacting air quality. Resulting in impacts to the air quality of terrestrial ecosystem health and function. Note: the Project construction process does not involve stockpiling onsite.	Site establishment, construction and operations	Low	- An ESCP is to be included in the contractors Construction Environment Management Plan (CEMP) and include measures to prevent erosion (including wind erosion); - Stockpiled soil will be appropriately stabilised to minimise dust generation; and - The use of a water truck will be used to suppress dust generation on site.	Low
A3	Diesel particulate and gaseous emissions (e.g. carbon monoxide and nitrogen oxides) from machinery, vehicles and generators. Impacts to the local Jabiru airshed via increased contaminate levels potentially resulting in human health and ecosystem impacts.	Site establishment, construction and operations	Moderate	- Commissioning tests to be undertaken to check particulate and gaseous emissions of diesel generators are in line with manufacturer's specifications and relevant standards; - All vehicles, plant and equipment will be maintained in good working order (e.g. regular servicing) and operated as intended with appropriate emission control equipment; - Selection of energy efficient equipment and vehicles will be preferred where practical, with a life cycle perspective; - Employee inductions to include vehicle operating instructions to reduce fuel consumption (e.g. no prolonged engine idling); and - Plant equipment to be switched off when not in operation for periods of more than 30 minutes.	Low
Atmospheric Processes Impacts					

No	Potential Impacts	Phase	Inherent Risk	Management and Mitigation Measures	Residual Risk
A5	Greenhouse gas emissions via energy production from machinery, vehicles and generators. Resulting in impacts to atmospheric contaminate levels adding to the greenhouse gas emissions and contributing to the greenhouse effect and global warming.	Site establishment, construction and operations	Moderate	- Design of a hybrid power station with use of solar PV to reduce emissions; - All Project plant and equipment is to be monitored and maintained in accordance with manufacturer recommendations; - All vehicles, plant and equipment (particularly the diesel generators) will be maintained in good working order (e.g. regular servicing) and operated as intended with appropriate emission control equipment; and - Selection of energy efficient equipment and vehicles will be preferred where practical, with a life cycle perspective; and - During operation, any opportunity to reduce use of the diesel generators in favour of solar power generation will be implemented.	Low
A6	Greenhouse gas emissions from land clearing activities. Resulting in impacts to atmospheric contaminate levels adding carbon dioxide to the greenhouse effect and global warming.	Site establishment	Moderate	- All disturbances will be minimised and kept within the site boundary, Lot 2303 and approved disturbance footprint; - The Project detailed design is to limit the clearing extent and maximise retention of vegetation within the Project area; - Boundaries will remain within existing fence line and surveyed markers along road parcels; - Onsite burning of any material will not be undertaken without appropriate permits and/or supervision by local fire authorities; and - Reuse of cleared vegetation on site to be utilised, where possible, to reduce offsite transportation, burning or decomposition (e.g. chipping for erosion control, salvaging for fauna hollows, salvage for local woodworking or cultural purposes etc.).	Low

7.4 People

The potential impacts on the NT EPA Environment Factor "People" and the proposed mitigation measures are provided in Table 7-6.

Table 7-6 NT EPA Environment Factor - People

Objectives			
▪ **Communities and Economy**: Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians; ▪ **Culture and Heritage**: Protect sacred sites, culture and heritage; and ▪ **Human Health**: Protect the health of the Northern Territory population.			
References			
Legislation	**Guidelines**	**Standards / Codes**	**Other**
Aboriginal Land Rights Act 1976 *Planning Act 2016*			Aboriginal Areas Protection Authority (AAPA) Certificate Heritage and archaeological survey
Performance Criteria			
- Implementation of measures to maximise local work force to boost local economy; - Inclusion and communication of key stakeholders during design and planning phases: - No reduction in access to services for surrounding landholders or wider community as a direct result of the Project; - Community amenity and beneficial uses of air, noise and water resources are not degraded; - No complaints related to construction activities and or workforce; and - No damage to cultural heritage items during construction activities and preservation of the heritage values of the area.			
Society and Economy Impacts			

No	**Potential Positive Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**

P1	Supports Mirarr goals as per Jabiru Masterplan	Project	N/A	- Continual consultation with the key stakeholders though all phases of the Project; - Establish routine engagement and feedback with community and key stakeholders at all phases of the Project; - Ensure adequate funding provided during and after the transition of Jabiru township to ensure power demands are met and do not compromise the growth of Jabiru community and economy; and - Establish transparency and open communication to ensure inclusion and support from stakeholders and community.	N/A
P2	Economic stimulus to small businesses in the region.	Site establishment, construction and operations	N/A	- Continual consultation with the key stakeholders though all phases of the Project; - Company to set obligations, and targets to support local businesses; and - Local industry will be prioritised over interstate resources.	N/A
P3	Critical infrastructure to help support the future of Jabiru.	Operations	N/A	- Continual consultation with the key stakeholders though all phases of the Project; and - Ensure adequate funding provided during and after the transition of Jabiru township to ensure power demands are met and do not compromise the growth of Jabiru community and economy.	N/A
P4	Increased employment opportunities to the region and Northern Territory.	Site establishment and construction	N/A	- Company to set obligations, and targets to support local businesses; and - Local and NT industry will be prioritised over interstate resources.	N/A
P5	Jabiru Township contribution to Northern Territory Government emission target	Operations	N/A	- Design of a hybrid power station with use of solar PV to reduce emissions; and - During operation, any opportunity to reduce use of the diesel generators in favor of solar power generation will be implemented.	N/A

P6	Opportunities for contractors and suppliers in the NT region to support the construction and operation of the project.	Site establishment, construction and operations	N/A	- Company to set obligations, and targets to support local businesses; and - Local industry will be prioritised over interstate resources.	N/A
No	**Potential Adverse Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**
P7	Local and regional areas do not benefit as expected from Project. Resulting in low or no economic growth due to lack of employment and business.	Site establishment, construction and operations	Low	- Continual consultation with the key stakeholders though all phases of the Project; - Company to set obligations, and targets to support local businesses; and - Local industry will be prioritised over interstate resources.	Low
P8	Pressure on resource requirements such as food, water, accommodation and fuel. Resulting in depletion of essential resources to the community and visitors.	Site establishment and construction	Low	- Continual consultation with the key stakeholders though all phases of the Project. This is to include local service providers to forward forecast demand; - Water onsite will be sourced from the main water supply; and - The main activity during site preparation for water usage is dust suppression.	Low
P9	Noise and vibration of construction activities impacting the township. Disturbance to neighbouring community, residents and businesses from construction noise and machinery	Site establishment, construction and operations	High	- Noise from clearing and trenching will be kept to minimum intensity and expected to be short; - Equipment and vehicles will be maintained in good working condition to maximise fuel efficiency; - Noise shall be controlled by constructing during daytime hours and equipment serviced regularly; - The NT EPA Noise Management Framework Guideline (2018) will be followed throughout site preparation activities; and - Commissioning tests to be undertaken to check noise outputs of diesel generators are in line with manufacturer's specifications and relevant standards.	Low

P10	Aesthetics impacted by visible dust emission from the Project. Localised visual amenity and health impacts from dust generation.	Site establishment and construction	Moderate	- Speed limit restrictions will be implemented on site to reduce dust generation; - A water cart will be used to wet frequently used access tracks where possible; and - All access tracks will be maintained and the main access to the site will be compacted with gravel.	Low
P11	Aesthetic impacts from the clearing native vegetation. Resulting in visual amenity impacts and community disappointment.	Site establishment	Low	- Continual consultation with the key stakeholders though all phases of the Project; - All disturbances will be minimised and kept within the site boundary, Lot 2303; - Clearing will be kept within surveyed area and to approved construction drawings; and - Boundaries will remain within existing fence line and established markers.	
P12	Aesthetics of permanent infrastructure not suiting surrounding environment or community expectations. Resulting in visual amenity impacts and community disappointment.	Site establishment	Low	- Continual consultation with the key stakeholders though all phases of the Project; and - All access tracks will be maintained and the main access to the site will be compacted with gravel.	Low
P13	Increased fuel deliveries impacting other road users. Note: Fuel deliveries will be reduced. Current ERA generators are diesel only. The proposed hybrid system will use less fuel.	Construction and operations	Low	- Driver awareness training of risks will be provided (e.g. via induction or toolbox talks) to all workers accessing the site during operation; and - Heavy vehicles diesel deliveries accessing the Project will be staggered during the day to minimise traffic impacts.	Low

P14	Increased traffic on local roads during construction may lead to Increased risk of traffic incidents and disruption to community amenity.	Site establishment and construction	Moderate	- Driver awareness training of risks will be provided (e.g. via induction or toolbox talks) to all workers accessing the site during construction; - Traffic management plan to be implemented to manage any disruption to road access during construction; - Heavy vehicles accessing the Project will be staggered during the day to minimise traffic impacts; and - Ensure roads accessed by the public remain in a safe and trafficable condition as a result of any construction works or traffic.	Low
P15	No communication or inclusion with key stakeholders straining social relationships. Resulting in loss of trust due to exclusion with the Project process which can put long term strain on social relationships with key stakeholders. This could impact future proposed works.	Site establishment and construction	High	- Establish routine engagement and feedback with community and key stakeholders at all phases of the Project; and - Establish transparency and open communication to ensure inclusion and support from stakeholders and community.	Low
P16	No inclusion of ranger groups or Traditional Owners during site visits and surveys straining social relationships. Resulting in loss of trust due to exclusion with the Project process which can put long term strain on social relationships with key stakeholders. This could impact future proposed works.	Site establishment	High	- Establish routine engagement and feedback with key stakeholders and community groups at all phases of the Project; and - Establish transparency and open communication to ensure inclusion and support from stakeholders and community; - Include ranger groups on research projects associated with the Project.	Low
Heritage and Culture Impacts					
No	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**

P17	Accidental disturbance to identified and unidentified cultural and archaeological heritage sites. Impact to sites of cultural significance protected for their cultural importance and loss of trust with Indigenous community. Note: No cultural and heritage sites are present on the Project Area as confirmed by the cultural and heritage survey and AAPA certificate.	Site establishment, construction and operations	Moderate	- If a heritage site or artefact is discovered during clearing activities, all works will cease immediately, and notification provided to GAC and the Heritage Branch under the Heritage Act 2011 (NT) provisions; andCultural heritage awareness training will be provided to all personnel during site inductions.	Low
P18	Unauthorised access damaging cultural and archaeological heritage sites. Impact to sites of cultural significance protected for their cultural importance and loss of trust with Indigenous community. Note: One known heritage site is located 200 m away from proposed works.	Site establishment, construction and operations	Low	- If a heritage site or artefact is discovered during clearing activities, all works will cease immediately, and notification provided to GAC and the Heritage Branch under the Heritage Act 2011 (NT) provisions; and - Cultural heritage awareness training will be provided to all personnel during site inductions.	Low
P19	Decreased air quality because of dust generating activities. Dust deposition impacts to sites of cultural significance protected for their cultural importance. Note: One known heritage site is located 200 m away from proposed works.	Site establishment and construction	Low	- Speed limit restrictions will be implemented on site to reduce dust generation; - A water cart will be used to wet frequently used access tracks where possible; and - All access tracks will be maintained and the main access to the site will be compacted with gravel.	Low
Human Health Impacts					
No	**Potential Impacts**	**Phase**	**Inherent Risk**	**Management and Mitigation Measures**	**Residual Risk**
P20	Decreased air quality because of dust generating activities. Localised impacts the health of public and employees from airborne particulate matter (dust).	Site establishment, construction and operations	Low	- Speed limit restrictions on site, use water cart to wet frequently used access tracks; - The main access to the site will be compacted with gravel; and - The NT EPA Noise Management Framework Guideline will be followed throughout site preparation activities.	Low

P21	Lightning strike of personnel working on the Project. Resulting in direct physical harm to Project staff member(s).	Site establishment, construction and operations	High	- Lightning management such as the protection of machinery and equipment and safety of personnel is to be addressed in the contractors Safety Management Plan; - Measures are to include earthing to buildings and equipment and stop work response for an encroaching storm; and - Climatic conditions will be monitored to allow for sufficient warning and preparedness before major meteorological events.	Low
P22	Unauthorised access causing injury or death to trespassers.	Site establishment, construction and operations	High	- Construction and no unauthorised access signs will be installed at the entry of the site; - A permanent fence will replace the existing boundary fence in sections that are damaged; - Regular interval warning signage along the fence line will prevent access; and - The site will have workers present during the day and secured with locks when works are complete each day.	Low
P23	Poor waste management and waste generation. Resulting in impact to the visual amenity of the area caused by windblown, mishandled, illegally disposed rubbish to land and water.	Site establishment, construction and operations	Moderate	- Solid waste will be transported to an accredited waste management facility; - General and construction waste will be disposed of in skip bins on site and taken to Darwin; - All waste storage areas will be secure as to not allow rubbish to become windblown; - Regular inspection, maintenance and cleaning of waste storage areas; - All empty drums and oily rags will be taken to Darwin for correct disposal; - All construction and operation waste storages must be designed to minimise exposure to waste and any health impacts from the waste; and - All drums with oily residue will be segregated from general waste, appropriately stored and bunded until taken off site.	Low

Section 8 Consideration of Ecologically Sustainable Development

The EP Act is clear in its purpose of promoting the ecologically sustainable development of the NT. The EP Act defines ecologically sustainable development as:

> *development that improves the total quality of human life, both now and in the future, in a way that:*
>
> *a) maintains the ecological processes on which all life depends; and*
>
> *b) recognises the need for development to be equitable between current and future generations.*

The principles of ecologically sustainable development, as set out in Part 2 Division 1 of the EP Act, are provided in Table 8-1.

Table 8-1 Principles of Ecologically Sustainable Development

Principle name	Principle	Phase	Theme	Environmental Factors Considered	How have ESD principles been considered
Decision making Principle	Decision-making processes should effectively integrate both long-term and short-term environmental and equitable (unbiased) considerations.	Project Planning / Approvals / Procurement. Construction Phase Operation Phase	Air	Atmospheric processes	Installation of a hybrid power station (diesel and solar) at Jabiru to reduce greenhouse gas emissions and to contribute to the NT Government's aspirational target of achieving net zero greenhouse emissions by 2050 and its Renewable Energy Target of 50% by 2030. The current power supply for the Jabiru Township is provided by diesel thermal generation. The new hybrid power station will have a reduced diesel requirement, thereby achieving a further reduction in greenhouse gas emissions due to deceased fuel transportation. Sustainable practices are at the forefront during planning and preparation in order to achieve long term success. Ongoing electricity supply is required critical infrastructure to ensure that Jabiru township (and Parks Australia's Kakadu operational headquarters) can continue to function.
Decision making Principle	Decision-making process should provide for community involvement in relation to decisions and actions that affect the community.	Project Planning / Approvals / Procurement. Construction Phase	People	Communities and economy	Consultation during permitting involving stakeholders' opinions/suggestions/approvals which benefit the Jabiru community (jobs, business development, tourism, infrastructure which service the environment and community).

Principle name	Principle	Phase	Theme	Environmental Factors Considered	How have ESD principles been considered
		Operation Phase			With the handover of Jabiru township to the Mirarr people will see ownership of a township led by traditional owners on their own land. This will not only economically benefit the community but also empower traditional owners in the decision making and planning for the future of the town.
Decision making Principle	Decision-making processes should effectively integrate both long-term and short-term environmental and equitable (unbiased) considerations.	Project Planning / Approvals / Procurement	All	Where relevant	The Commonwealth and Northern Territory approvals process includes a risk-based assessment on the potential impacts that may have the potential to have a significant impact on the environment. Cumulative and indirect impacts have also been considered in the approval process.
Principle of improved valuation, pricing and incentive mechanisms	Established environmental goals should be pursued in the most cost-effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems	Project Planning / Approvals / Procurement. Construction Phase Operation Phase	People	Aesthetics and lifecycle sustainable operation in line with NT Government policy re carbon and emission targets. Generating low cost, sustainable power with capacity for future development. Creation of ongoing employment opportunities, knowledge sharing and training	The design of the hybrid power station (diesel and solar) is based on a 50/ 50 mix; diesel being a backup for peak demand and night-time demand. The environmental benefits to this approach include: Life cycle cost reduction, sustainable power, low emissions, reliability, employment, training and provision of power for future development. CM&C, had engaged Ekistica to evaluate Jabiru's existing power system infrastructure, electrical demand, and planned developments, and determine the "most cost effective, low emissions, and reliable strategy" for the delivery of a new power system. Comparative assessment of electricity generation options for Jabiru against a range of criteria including financial and economic, technical, deployment, and social and environmental costs, benefits and risks; and the identification of a preferred future electricity generation solution for Jabiru. Assessment of potential power system management mechanisms to maximise both operating costs and use of non-renewable energy sources, and maximising power system reliability.
			Land	Terrestrial environmental quality	

Section 9 References

Australian Bureau of Statistics, 2016. *2016 Census quickstats*. Available at: https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC70136.

BMT WBM, 2010. *Ecological character description for Kakadu National Park Ramsar Site, s.l.*:. Prepared for the Australian Government Department of Sustainability, Environment, Water, Population and Communities.

Bureau of Meteorology, 2021. *Weather Station Directory*. Available at: http://www.bom.gov.au/climate/data/stations/

Connect Environmental, 2020. *Biodiversity Assessment Report Lot 2303, Jabiru, NT, Darwin,* Connect Environmental 2020.

Construction Sciences, 2020. *Geotechnical Investigation Report, Jabiru Redevelopment- Report No. 1 Power Station-Lot 2303*, Construction Sciences: Northern Territory.

Control Medical Entomology Centre for Disease, 2017. *Jabiru exotic mosquito survey March 2017, s.l.: s.n*.

Department of Agriculture, Water and Environment, 2020. *Protected matters search tool*. Available at: http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf.

Department of Agriculture, Water and the Environment, 2020a. *Directory of important wetlands in Australia*. Available at: https://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands.

Department of Agriculture, Water and the Environment, 2020b. *Migratory Birds*. Available at: https://www.environment.gov.au/biodiversity/migratory-species/migratory-birds.

Department of Agriculture, Water and the Environment, 2021. *World Heritage Places - Kakadu National Park.* Australian Government. Available at: http://www.environment.gov.au/heritage/places/world/kakadu.

Department of the Chief Minister, 2019. *Memorandum of Understanding on the Future of Jabiru Township*. Available at: https://dcm.nt.gov.au/__data/assets/pdf_file/0007/736936/future-jabiru-mou-signed.pdf.

Department of the Environment, 2013. *Matters of National Environmental Significance, Significant Impact Guidelines 1.1*. Available at: https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf.

Department of the Environment, 2015. *Referral guideline for 14 birds listed as migratory species under the EPBC Act*. Canberra: Australian Government.

Department of Environment and Natural Resources, 2019. *Land Clearing Guidelines Northern Territory Planning Scheme*. Available at: https://nt.gov.au/__data/assets/pdf_file/0007/236815/land-clearing-guidelines.pdf.

Department of Environment and Natural Resources, 2020a. *Fauna Atlas NT*. Available at: https://nrmaps.nt.gov.au/nrmaps.html.

Department of Environment and Natural Resources, 2020b. *Flora Atlas NT*. Available at: https://nrmaps.nt.gov.au/nrmaps.html.

Department of the Environment and Water Resources, 2007. *Determination Regarding Including World Heritage Places in the National Heritage List*. Australian Government. Available at: http://www.environment.gov.au/system/files/pages/bf8cd0a7-1fd2-4202-a62d-b998a4d93cb7/files/10569401.pdf.

Department of Housing and Community Development, 2017. *Indigenous community engineering guidelines (ICEG) for remote communities in the NT*. Available at: https://nt.gov.au/__data/assets/pdf_file/0007/373156/ICEG-for-remote-communities.pdf.

Department of Infrastructure, Planning and Logistics, 2019. *Jabiru Town Plan 2019, Northern Territory*. Northern Territory Government.

Department of Lands, Planning and the Environment, 2013. *Northern Territory land suitability guidelines*. Darwin: Northern Territory Government.

Department of Sustainability, Environment, Water, Population and Communities, 2013. *Actions on, or Impacting Upon, Commonwealth Land, and Actions by Commonwealth Agencies, Significant Impact Guidelines 1.2.* Available at: https://www.environment.gov.au/system/files/resources/a0af2153-29dc-453c-8f04-3de35bca5264/files/commonwealth-guidelines_1.pdf.

Director of National Parks, 2016. *Kakadu National Park mangement plan 2016- 2026*. Canberra: Australian Government.

Ekistica, 2019a. *Electricity generation options for Jabiru, s.l.*. Ekistica Pty Ltd.

Ekistica, 2019b. *Power- Pathway to land access*, Northern Territory: Ekistica Pty Ltd.

Energy Resources of Australia, 2014, *Air Quality Control Management Plan AMP001*. Prepared for Rio Tinto. Available at: https://www.energyres.com.au/uploads/general/Air_Quality_Control_Management_Plan_(AMP001).pdf.

Erskine, W. D. & Saynor, M. J., 2000. *Assessment of the off-site geomorphic impacts of uranium mining on Magela Creek, Northern Territory, Australia*. Canberra: Supervising Scientist.

Friend, G R (1987). *Population ecology of Mesembriomys gouldii*. Australian Mammalology 23: 181 – 183.

Greencap, 2020. *Detailed site investigation report, Lot 2303 (treated effluent spray irrigation area).* Darwin: Greencap.

Low Ecological Services, 2021. *Population and management assessment of the black-footed tree0rat for the Jabiru power station development*, Alice Springs, NT, Low Ecological Services 2021.

Lynch, B., Cuff, N. & Green, C., 2012. *Summary of the Origin and Derivation of the 1:250,000 Land System Descriptions for the Northern Part of the Northern Territory, DRAFT. In: Palmerston.* Northern Territory: Land Resource Assessment Unit, Department of Land Resource Management.

National Vegetation Information Systems, 2007. *Vegetation*. Available at: https://nrmaps.nt.gov.au/nrmaps.html.

Needham, R., 1988. *Geology of the Alligator Rivers uranium field, Norther Territory*. Bureau of Mineral Resources, Bulletin, Volume 224.

North Australia & Rangelands Fire Information, 2020. *Fire Maps*. Available at: https://firenorth.org.au/nafi3/.

Northern Territory Environment Protection Authority, 2018. *Northern Territory Noise Management Framework Guideline*. Available at: https://ntepa.nt.gov.au/__data/assets/pdf_file/0004/566356/noise_management_framework_guideline.pdf.

Northern Territory Environmental Protection Authority, 2018. *Northern Territory Ambient Air Quality Monitoring Report 2017 - Compliance with the National Environment Protection (Ambient Air Quality) Measure*. Darwin: Northern Territory Government.

Northern Territory Environmental Protection Authority, 2020. *Referring a proposal to the NT EPA: Environmental impact Guidance for proponents*. Darwin: Northern Territory Government.

Northern Territory Government, 2021, *Economic Development Framework: Renewable energy*. Available at: https://edf.nt.gov.au/home.

Petty, A., Douglas, M. & Ferdinands, K., 2008. *Riparian Zones and Paperbarks: Landscape change In: Kakadu National Park Landscape Symposia Series 2007–2009.. s.l., s.n.*

Press, T., Lea, D., Webb, A. & Alistair, G., 1995. *Kakadu natural and cultural heritage and management, Brinkin, NT: s.n.*

Rankmore, B., 2006. *Impacts of Habitat Fragmentation on the Vertebrate Fauna of the Tropical Savannas of Northern Australia; with Special Reference to Medium-sized Mammals*. PhD Thesis, Charles Darwin University, Darwin.

Surface Water Erosion Solutions, 2020. D*arwin - consultancy - provision of environment approvals for the construction and operations of a hybrid power station in Jabiru*, s.l.: EnviroConsult Australia Pty Ltd.

Threatened Species Scientific Committee, 2015a. *Conservation advice, Mesembriomys gouldii gouldii, black- footed tree- rat (Kimberly and mainland Northern Territory)*. Canberra: Australian Government.

Threatened Species Scientific Committee, 2015b. *Threatened species status assessment manual*. Canberra: Australian Government. United Nations Educational, Scientific and Cultural Organisation (UNESCO), no date. *Kakadu National Park*. Available at: https://whc.unesco.org/en/list/147/.

Williams, M., 1969. *Geomorphology of the Adelaide-Aligator area. In Lands of the Adelaide-Alligator area*. Northern Territory, CSIRO Land Research Series 25: s.n.

Woinarski, J., Russell-Smith, J., Andersen, A. & Brennan, K., 2009. *Fire management and biodiversity of the western Arnhem Land Plateau. In: Culture, Ecology and Economy of Fire Management in North Australian Savannas: Rekindling the Wurrk Tradition'(Eds J Russell-Smith, PJ Whitehead, PM Cooke)*. Collingwood: CSIRO Publishing.

Woinarski, J. & Winderlich, S., 2014. *A Strategy for the Conservation of Threatened Species and Threatened Ecological Communities in Kakadu National Park 2014-2024*. Northern Territory: Kakadu National Park.

Appendix A Preliminary Risk Assessment

Appendix B Surface Hydrological Assessment

Surface Water and Erosion Solutions, 2020.

Appendix C Biodiversity Assessment Report

Connect Environmental, 2020

Appendix D Black-footed Tree-Rat Population and Management Assessment Report

Low Ecological Services, 2021.

Appendix E Geotechnical Report

Construction Sciences, 2020

Appendix F Archaeological and Cultural Heritage Survey

Wallis Heritage Consulting, 2020

Appendix G Aboriginal Areas Protection Authority Certificate

Appendix H Draft Construction Environment Management Plan

EDL, 2021

Appendix I Appendix I Draft Erosion and Sediment Control Plan

Appendix J Contaminant Assessment Report