Appendices

Narwonah Material Distribution Centre

REVIEW OF ENVIRONMENTAL FACTORS

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APPENDIX A

Biodiversity Assessment Report

NARWONAH MATERIAL DISTRIBUTION CENTRE REVIEW OF ENVIRONMENTAL FACTORS

ARTC Inland Rail

Narwonah Material Distribution Centre

Biodiversity Assessment Report

Revision B

2-0001-250-EAP-00-RP-0415

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1. Introduction

1.1 Purpose

Australian Rail Track Corporation (ARTC) proposes to build and operate a Material Distribution Centre (MDC) (and the proposal) at Narwonah, located south of the township of Narromine (Figure 1-1). The MDC forms a key component of the Inland Rail Program.

This Biodiversity Assessment Report (BAR) has been prepared to support the Review of Environmental Factors (REF) being prepared for the Narwonah MDC.

1.2 The proposal

The Inland Rail route, which is about 1,700 kilometres (km) long, involves using the existing interstate rail line through Victoria and southern NSW, upgrading about 400 km of existing track, mainly in western NSW and providing about 600 km of new track in NSW and south-east Queensland.

The MDC will be used for track material storage and management prior to their distribution to multiple Inland Rail projects and sections across NSW, including Narromine to Narrabri (N2N), North Star to Border (NS2B), Illabo to Stockinbingal (I2S), Stockinbingal to Parkes (S2P) and potentially other projects along the Inland Rail route. Key design features for the proposal comprise access, rail welding, delivery and storage and semi-permanent/demountable buildings and storage.

ARTC is seeking to commence detailed design and construction from Q2 2022 so it can be receiving material by Q3 2022.

The proposal also involves the subdivision of Lot 16 DP755131, Lot 17 DP755131, Lot 1 DP1198931, Lot 232 DP755131 and Lot 233 DP755131 to create two lots.

Upon completion of the Inland Rail corridor works (which is currently anticipated to be in 2027), ARTC will consider the most effective ongoing use of the proposal site, and decommission the MDC according to what its proposed future use would be.

Any use of the proposal site following completion of ARTC's use in connection with Inland Rail construction works does not form part of the proposal and would need to be considered and assessed separately.

1.3 Location

The proposal will be situated to the north of the future Narromine to Narrabri (N2N rail alignment within the Narromine Shire Council local government area (LGA). The proposal location is approximately seven kilometres south of the Narromine township.

1.4 Definition of assessment area

- The ‘proposal site’ refers to the disturbance area required for the works described in section 1.2 (i.e. those areas that may be directly impacted by the proposed works). The ‘proposal site’ has a total area of about 328.61 hectares and would comprise the total area required for the MDC. The proposal site occurs within Lot 16 DP755131, Lot 1 DP1198931, Lot 232 DP755131 and Lot 233 DP755131
- The ‘N2N construction impact zone’ refers to the Inland Rail Narromine to Narrabri project site located immediately to the south of the proposal site, and subject to separate project approval. This is mapped on figures to provide geographic context to the proposal.

- The ‘study area’ refers to the proposal site and any additional areas which are likely to be indirectly impacted by the proposal. Survey effort and description of the existing environment for the purpose of this biodiversity assessment are at the ‘study area’ scale.
- The ‘locality’ is defined as the area within a 10 kilometre radius of the proposal site.

1.5 Proposed activities

The proposed activities are described in detail in the following sections.

1.5.1 Construction activities

Activities likely to be involved in the construction of the proposal include:

- Structural and engineering fill placement. Material will be won on site to be utilised as general and structural fill, with these borrow locations being in areas of cut which will then be utilised as a hardstand area for site offices and laydown.
- Track construction including placement of ballast, sleepers and rail. The track will be constructed using specialist excavator attachments, loaders, trucks and track mounted resurfacing machines.
- Steel structures (gantries, portal frames) installation. The portal frame installation involves concrete foundations being installed, with cranes placing the steel structures for fixing.
- In-situ concrete elements installation for flashbutt welding stations, rail handling rollers, and for the drop pits to be used for rollingstock maintenance.
- Topsoil stripping.
- Bulk earthworks and subgrade treatment.
- Diversion drain and erosion control installation.
- Electrical connection and site distribution infrastructure installation.
- Fuel storage infrastructure installation.
- Offices, amenities set up and installation.

1.5.2 Operational activities

The operation of the MDC would involve the delivery and management of concrete sleepers, rail shorts and ballast into the MDC for temporary storage and the delivery from the MDC to sections of the Inland Rail Route as required through train and road vehicle movements. This is expected to comprise around 18 train movements weekly for deliveries from suppliers and around 10 movements daily for deliveries to construction fronts.

1.6 Purpose of this report

The purpose of this BAR is to:

- Describe the biodiversity values of the existing environment within the proposal site, including vegetation types, fauna habitats and flora and fauna species known or likely to occur.
- Assess the condition and conservation significance of native vegetation and habitats in the proposal site.

- Compile a list of threatened biota previously recorded or predicted to occur in the locality and assess their potential to occur within the proposal site.
- Assess the likely impacts on threatened biota from the proposed works.
- Recommend mitigation measures to avoid, minimise and manage impacts on biodiversity values.
- Provide concluding statements regarding the likely significance of impact of the proposed works on threatened biota listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and *Fisheries Management Act* (FM Act) or matters of national environmental significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the requirement or otherwise for further assessment or approvals at the State or Federal level.

1.7 Scope and limitations

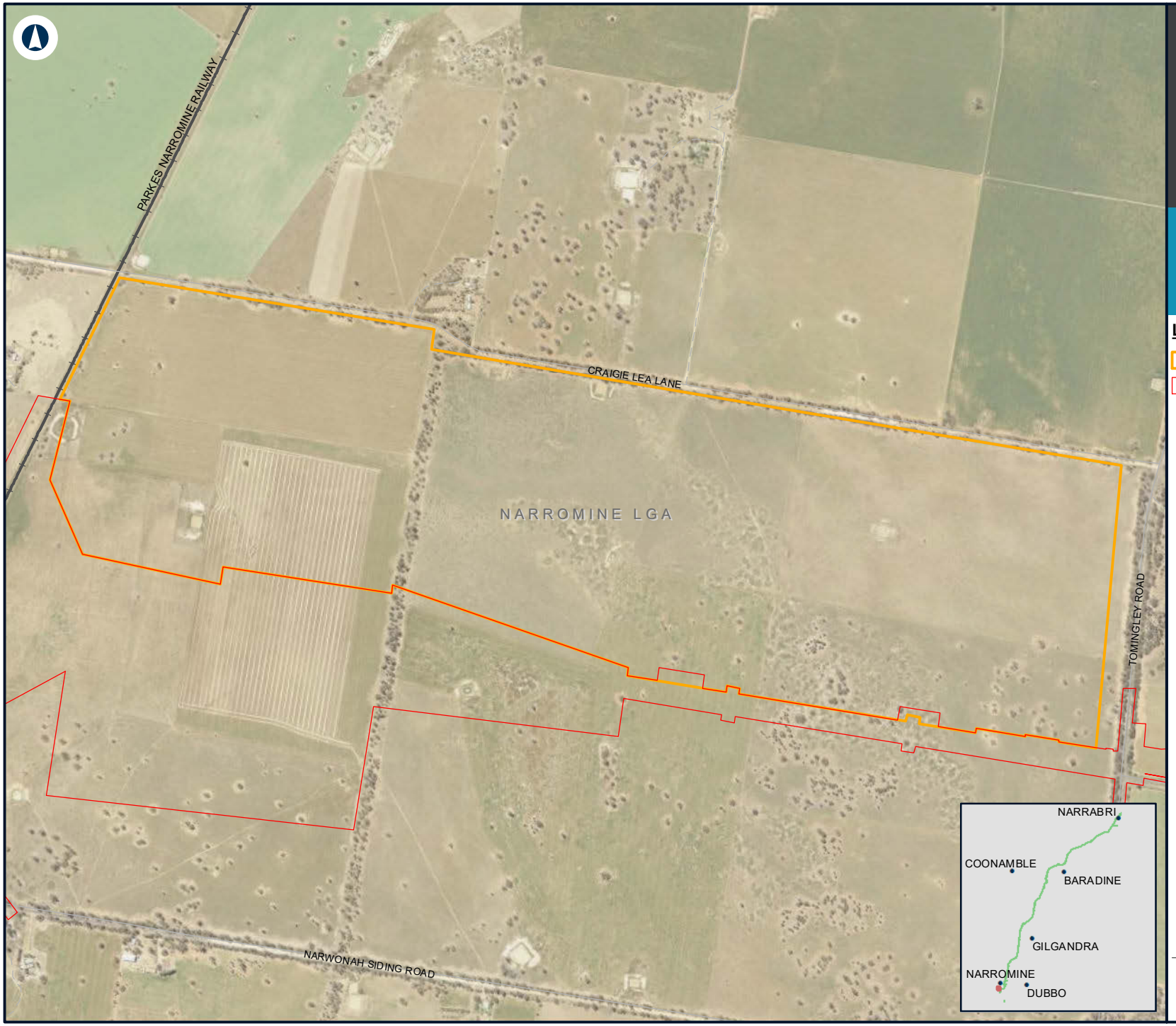
This report has been prepared by JacobsGHD for ARTC and may only be used and relied on by ARTC for the purpose agreed between JacobsGHD and ARTC, as set out in section 1.1 of this report.

JacobsGHD otherwise disclaims responsibility to any person other than ARTC arising in connection with this report. JacobsGHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by JacobsGHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. JacobsGHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by JacobsGHD described in this report. JacobsGHD disclaims liability arising from any of the assumptions being incorrect.



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The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

NARROMINE TO NARRABRI
Narromine Materials Distribution Centre
Figure 1-1: Proposal site

LEGEND

- Narwonah Multi-function Compound
- N2N construction impact zone

0 0.3 0.6 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 26/04/2022 Paper: A4
Author: JacobsGHD Scale: 1:18,000
Data Sources: Basemap layers: NSWSS;

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2. Legislative context

2.1 NSW legislation

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) provide the framework for development assessment and approval in NSW. The EP&A Act and the EP&A Regulation include provisions to ensure that the potential environmental impacts of a development are considered in the decision-making process prior to proceeding to construction.

ARTC is identified as a public authority in Schedule 1, clause 1(1)(a) of the EP&A Regulation, for the purposes of making it a "determining authority" under Division 5.1 of the EP&A Act, fin relation to "rail infrastructure facilities".

The construction and operation of the MDC are being assessed under Part 5, Division 5.1 of the EP&A Act. The proposal is being assessed via a REF. ARTC is both the proponent and determining authority for the proposal, in accordance with Section 5.1 of the EP&A Act.

Section 5.5 of the EP&A Act requires that a determining authority *'*examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment' in relation to an activity such as the proposal. The REF has been prepared to fulfil this requirement. Further, Clause 171 of the EP&A Regulation details the *'environmental* factors to be taken into account when considering the likely impact of an activity on the environment*'*. All relevant factors for consideration are addressed in the REF.

This BAR has been prepared to support the REF and to specifically address the potential impacts of the proposal on biodiversity values.

2.1.2 Biodiversity Conservation Act 2016

The BC Act provides lprotection for certain biota of conservation significance in NSW. The BC Act aims to, amongst other things, 'maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development'. It provides for the listing of threatened species and communities, establishes a framework to avoid, minimise and offset the impacts of proposed development (i.e. the Biodiversity Offsets Scheme (BOS)), and establishes a scientific method for assessing the likely impacts on biodiversity values and calculating measures to offset those impacts (i.e. the Biodiversity Assessment Method (BAM)).

Section 7.3 of the BC Act lists five factors that must be taken into account when determining the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the BC Act. The 'five-part test' or 'assessment of significance' is used to assist in the determination of whether a proposal is 'likely' to 'significant effect' threatened biota. Where a proposal is 'likely to significantly affect' the environment or threatened species or ecological communities, the proponent must prepare a species impact statement (SIS) , or, if the proponent so elects, a biodiversity development assessment report (BDAR) (which must be prepared in accordance with the BOS and BAM). The proponent must also prepare an EIS.

The BC Act has been addressed in this assessment through:

- Desktop review to determine the threatened species, populations or ecological communities (referred to collectively as threatened biota) and migratory species that

have been previously recorded within the locality and hence could occur in the site subject to the habitats present

- Field surveys for threatened biota
- Identification, assessment and mapping of threatened biota (or their habitat)
- Assessment of potential impacts on listed threatened biota and migratory species
- Identification of suitable impact mitigation and environmental management measures to minimise potential impacts on threatened biota and migratory species, where required.

Threatened biota and migratory species recorded or likely to occur in the site are detailed further in section 5 and section 6.5 and potential impacts are identified in section 6. Five-part tests have been prepared for relevant threatened biota that and are provided in Appendix C.

The proposal is not likely to have a significant impact on the environment, threatened species or ecological communities and consequently neither an SIS or a BDAR are required.

2.1.3 Fisheries Management Act 1994

The objectives of the FM Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for the listing of threatened species, populations, ecological communities and key threatening processes and otherwise sets out requirements for the preparation of a SIS.

The proposal site does not contain any watercourses that provide suitable habitat for threatened fish listed under the FM Act. The species predicted to occur in the locality are associated large river systems, and as a result can be reliably excluded from occurring within the proposal site.

The proposal is not expected to impact on key fish habitat, marine vegetation or present any obstruction to fish passage.

2.1.4 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, a person who knows (or ought reasonably to know) of a biosecurity risk has a duty to ensure that the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

The *Biosecurity Act 2015* identifies priority weeds in NSW that have been assigned a biosecurity duty (such as prohibitions on sale and control measures). Under the *Australian Weeds Strategy 2017 to 2027* (Invasive Plants and Animals Committee 2016), 32 introduced plants have been identified as Weeds of National Significance (WONS). These weeds are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts. Priority weeds recorded in the study area during site surveys are identified in section 0.

2.2 Commonwealth legislation

2.2.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to, among other things, provide for the protection of the environment, especially matters of national environmental significance (MNES) and to conserve Australian biodiversity values.

The EPBC Act is primarily concerned with 'actions'. Under section 523 of the EPBC Act, an action includes a proposal, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that the Commonwealth Minister for the Environment determines 'has, will have or is likely to have a significant impact' on a MNES or an action taken on Commonwealth land that 'has, will have or is likely to have a significant impact on the environment' more broadly is a 'controlled action' and may not be conducted without prior approval from the Commonwealth Minister for the Environment.

Potential MNES of relevance to this assessment include:

- Threatened species and ecological communities; and
- Migratory species.

The EPBC Act has been addressed in this assessment through:

- Desktop review to determine the listed biodiversity matters that are predicted to occur within the locality and hence could occur, subject to the habitats present.
- Detailedfield surveys to identify the presence of potential habitat for listed threatened biota and migratory species.
- Assessment of potential impacts on threatened and migratory biota, including assessments of significance in accordance with the *EPBC Act Significant Impact Guidelines 1.1* (DEE 2013).
- Identification of suitable impact mitigation and environmental management measures for threatened and migratory biota, where required.

Threatened biota and migratory species recorded or likely to occur in the study area are detailed further in section 5 and potential impacts are identified in section 6. Assessments of significance have been prepared for threatened biota listed under the EPBC Act that would be impacted or are likely to be impacted by the proposal and are provided in Appendix D.

3. Methods

3.1 Desktop assessment

A desktop assessment was initially carried out to compile a list of threatened flora and fauna species, populations and ecological communities (threatened biota) listed under the BC Act and FM Act, as well as MNES listed under the EPBC Act, that could be expected to occur in the locality based on previous records, known distribution ranges, and habitats present. The assessment also assisted with focusing field survey techniques and effort. Biodiversity databases and existing literature and information pertaining to the study area and locality that were reviewed prior to conducting field investigations included:

- NSW Department of Planning, Industry and Environment (DPIE) BioNet Atlas for records of threatened biota previously recorded in the locality (website for the Atlas of NSW Wildlife) (DPIE 2021a) and Threatened Biodiversity Data Collection (TBDC) profiles of threatened species listed under the BC Act (DPIE 2021b) (original search undertaken in 2018, updated in 2019, 2021 and 2022).
- DPIE Threatened biodiversity profile search online database for threatened ecological communities and species listed under the BC Act (DPIE 2021b)
- Department of Agriculture, Water and the Environment (DAWE) EPBC Act Protected Matters Search Tool – for a 10-kilometre radius around the proposal site (DAWE 2021a)
- DAWE online Species Profiles and Threats database (SPRAT) (DAWE 2021b)
- NSW BioNet Vegetation Classification (DPIE 2021c) to identify matching plant community types (PCTs) in the site
- DPI Fisheries NSW Spatial Data Portal
- NSW Department of Primary Industries (DPI) priority weed declarations – North-West region (DPI 2021a)
- Aerial photographs and satellite imagery of the site
- Available broad/regional vegetation mapping of the lower Macquarie catchment (VIS 816) and Narromine area (VIS 1609), available from the SEED portal.

Dependence (or interaction) of the vegetation communities identified within the proposal site on groundwater was determined by searching the Groundwater Dependent Ecosystems Atlas (BOM 2021a). The Atlas predicts the occurrence of groundwater dependent ecosystems (GDEs) and ecosystems that potentially use groundwater. It shows ecosystems that interact with the subsurface expression of groundwater (including vegetation ecosystems) or the surface expression of groundwater (such as rivers and wetlands). The Atlas also shows the likelihood that landscapes are accessing water in addition to rainfall, such as soil water, surface water or groundwater.

The desktop assessment also drew on the extensive findings of the N2N Biodiversity Development Assessment Report (BDAR) prepared to inform the N2N Environmental Impact Statement (EIS). The N2N BDAR and EIS were placed on exhibition in December 2020, and that project is currently in the response to submissions phase. Additional targeted and seasonal surveys have been conducted along the N2N alignment since the public exhibition and the findings included in an updated BDAR, not currently publicly available. Given the proximal location of the proposal and the southern end of the N2N project alignment, the assessment for this proposal has drawn on all relevant research and survey findings form the N2N project.

Following collation of database records, consideration of records from other studies and species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats present. This was further refined following field surveys and assessment of habitats present. The results of this assessment are presented in Appendix B.

3.2 Identification of plant community types

Broad/regional vegetation types from existing mapping available from the SEED portal were used during preparation of the N2N BDAR and survey of the MDC to determine areas that required plot and targeted surveys. These datasets were selected based on these being the best current publicly available datasets that cover the investigation area and additional areas beyond the study area. Analysis of soil type, landscape position and landuse maps in conjunction with existing regional vegetation mapping was used to determine potential PCT classification in areas where no access at all was possible. Rapid ground-truthing of regional vegetation mapping via rapid surveys was conducted in September 2018 through the collection of dominant stratum species. This included surveys of vegetation in road reserves and viewing vegetation in adjacent paddocks (GHD 2021).

3.3 Site survey

Seasonal site surveys were conducted in the locality as part of the BDAR assessments for the N2N project between September 2018 and November 2020. Additional surveys were undertaken specifically for the area of the proposal site on 5-6 July 2021.

Survey effort to date has included:

- Site stratification and vegetation mapping
- Sampling of vegetation integrity plot/transects
- Habitat assessments
- Seasonal targeted surveys for threatened flora
- Seasonal targeted surveys for threatened fauna.

Survey effort that has contributed to this BAR is summarised in Table 3-1 and is described in detail below.

Table 3-1 Survey techniques, timing and location

Date	Survey technique	Methods	Location
September, November 2018	Rapid assessment*	Vegetation mapping, habitat assessment	Road reserves near the proposal site
March 2019	Detailed flora and fauna surveys	Vegetation mapping Targeted flora searches Targeted fauna searches, including diurnal and nocturnal surveys, trapping	Road reserves near the proposal site
August 2019	Winter fauna surveys	Targeted fauna searches, including diurnal and nocturnal surveys	Road reserves near the proposal site

Date	Survey technique	Methods	Location
September/October 2019	Detailed flora and fauna surveys	Vegetation mapping Targeted flora searches	Surveys in and adjacent to the proposal site
November 2020	Detailed flora and fauna surveys	Vegetation mapping Targeted flora searches Targeted fauna searches, including diurnal and nocturnal surveys	Surveys in and adjacent to the proposal site
July 2021	Detailed flora and fauna surveys	Vegetation mapping Targeted flora searches Targeted fauna searches, including diurnal and nocturnal surveys	Targeted surveys within the proposal site
August 2021	Targeted fauna surveys	Surveys by Koala and raptor experts	Road reserves near the proposal site

3.3.1 Terrestrial flora surveys

Vegetation mapping

Existing vegetation mapping of the site (DPIE 2009) was ground-truthed in the field. Necessary adjustments were made by hand on aerial photographs of the proposal site with reference to a handheld Global Positioning System (GPS) unit. Intact native vegetation communities were defined into PCTs based on vegetation structure, species composition, soil type and landscape position with reference to the BioNet Vegetation Classification (DPIE 2021c). PCTs were further split into vegetation zones, depending on condition.

Vegetation integrity survey plot/transects

Plot/transect surveys were conducted on site for with reference to the BAM. The results of these vegetation plots were used to determine plant community types and vegetation quality and condition for the purpose of this assessment. Plots are mapped on Figure 3-1.

The site value was determined by assessing ten attributes used to assess function, composition and structure of vegetation within a 50 metre by 20 metre plot centred on a 50 metre transect. These attributes were then assessed against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement and are set for PCTs at the Vegetation Class level (DPIE 2021c). The overall condition of vegetation was assessed through general observation and comparison against the PCT condition benchmark data as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health.

All flora species within a 20 metre by 20 metre quadrats nestled within the 50 metre by 20 metre plot were identified according to the current nomenclature of PlantNet (Royal Botanic Gardens and Domain Trust (2021). Each species identified was allocated a growth form group and designated as either native, exotic or high threat exotic in accordance with lists provided by DPIE.

Targeted threatened flora surveys

Threatened species surveys have been conducted for species with the potential to occur within the proposal site given known distributions, previous records in the locality and habitat requirements for each species

Survey methods included surveys within previously conducted plots and surveys using random meander transects in areas of suitable potential habitat where possible (see Figure 3-1).

3.3.2 Terrestrial fauna surveys

Fauna habitat assessment

Indicative habitat criteria for targeted threatened species (i.e. those determined as having the potential to occur within the proposal site following the desktop review) were identified prior to fieldwork. Habitat criteria is based on information provided in DPIE and DAWE threatened species profiles, field guides, and the knowledge and experience of GHD field ecologists.

Specifically, habitat assessments would include searches for resources of potential value to threatened fauna including:

- Trees with bird nests, hollows or other potential fauna roosts with a particular focus on suitable habitat for threatened forest owls, parrots or cockatoo hollows and threatened raptor nest trees
- Rock outcrops, caves or overhangs providing potential shelter sites for fauna
- Burrows, dens and warrens
- Distinctive scats or latrine sites, owl white-wash and regurgitated pellets under roost sites
- Tracks or animal remains
- Evidence of activity such as feeding scars, scratches and diggings
- Specific food trees and evidence of foraging (for example chewed Allocasuarina cones).

The locations and quantitative descriptions of habitat features would be captured with a handheld GPS unit and photographed where appropriate.

Detailed fauna surveys

Detailed fauna surveys as part of the N2N BDAR were conducted in the area, and focused on identifying habitat for species credit species identified by the BAM and threatened fauna listed under the EPBC Act. Surveys were conducted in adjacent areas in September and November 2018 and August 2019 (eg Craigie Lea Lane, Tomingley Road). Surveys in and adjacent to the proposal site were conducted in November 2020 and July 2021 (Figure 3-1). Methods included:

- Diurnal bird surveys
- Diurnal fauna surveys
- Active searches, including searches for Koala scats
- Spotlighting and call playback
- Targeted searches for Sloane's Froglet in gilgai (August 2021).

Opportunistic observations

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys conducted for the N2N BDAR and this assessment. This included a conscious focus on suitable areas of habitat during flora surveys, for instance fallen timber was scanned and/or turned for reptiles and mature trees and stags were scanned for roosting birds. The results of fauna surveys in the proposal site are provided in Appendix A.

3.4 Geographical Information System (GIS) analysis

GIS was used to:

- Plot the proposal site on a high-resolution aerial photo base and to map PCTs, survey effort, habitat resources and biodiversity values across the proposal site and areas investigated in the site
- Calculate the extent of native vegetation to be impacted.

Native vegetation cover, extent and connectivity were assessed using aerial photography. Air photo interpretation was used to identify and record distinct vegetation patches, determine the broad condition state of vegetation types and the location and extent of vegetated habitat corridors.

3.5 Weather

Weather observations during the survey period (refer Table 3-2) were taken from the Dubbo weather station ~35km from the proposal site (BOM 2021a).

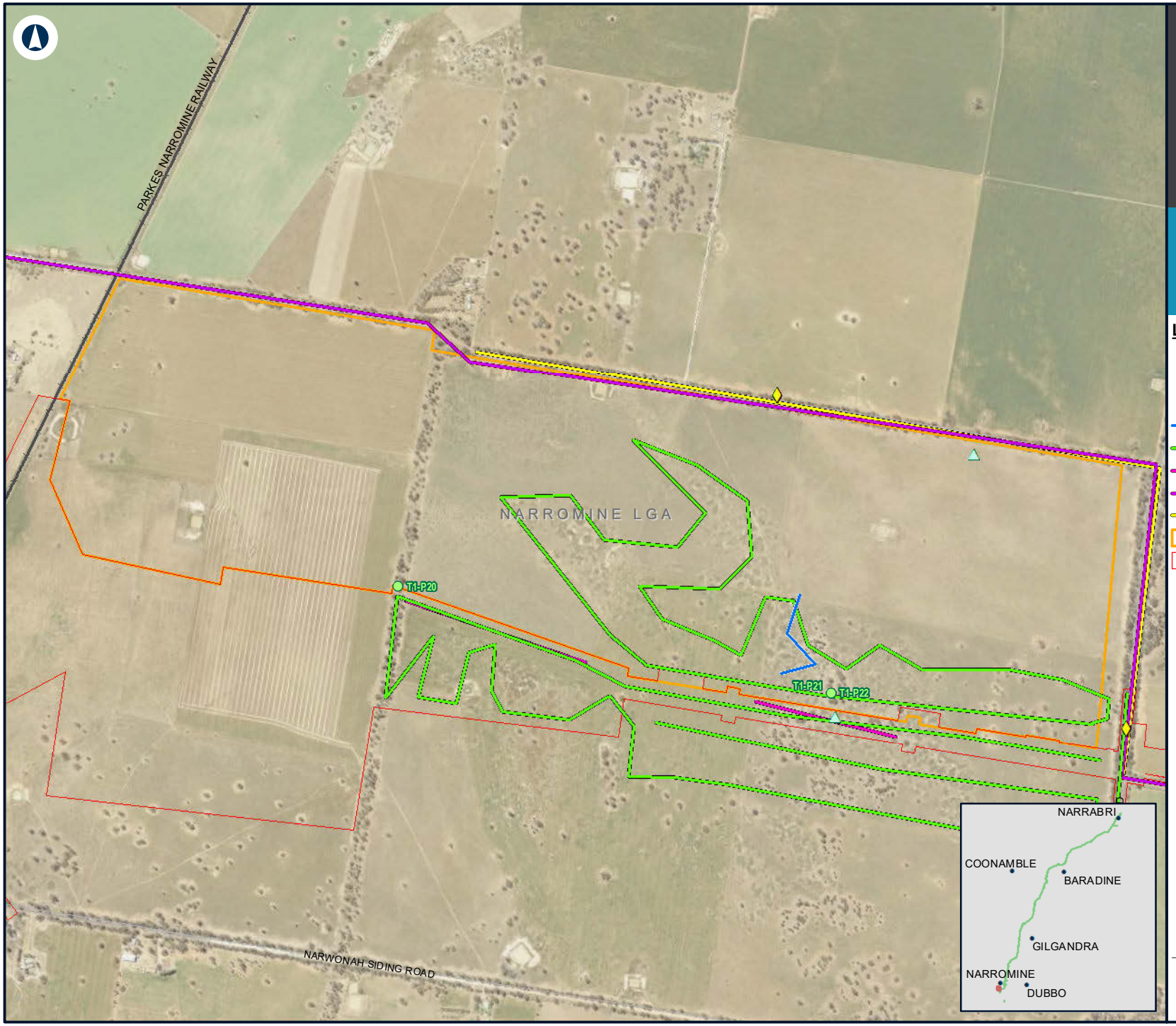
Table 3-2 Daily weather observations during the survey period

Date	Minimum temp (Deg Celsius)	Max temp (Deg Celsius)	Rainfall (mm)
24 September 2018	11.7	22.9	0
21 November 2018	18.5	24.4	7.2
26 August 2019	4.3	19.9	0
14 November 2020	10.4	31.2	0.2
5 July 2021	-2.3	14.3	0.2
6 July 2021	-0.7	13.6	0

3.6 Limitations

The years of 2018 and 2019 were exceptionally dry and very warm in NSW and particularly in inland NSW. November rainfall in 2018 was above average across large areas of NSW which eased short to medium term rainfall deficiencies, but at the longer 20-month timescale, rainfall deficiencies remain largely unchanged (BOM 2018b). Given these prevailing drought conditions, lower plant species diversity was likely to be present during these surveys. This in turn can affect identification of PCTs, distribution of vegetation zones and the likelihood of detecting threatened flora and fauna species. Additional surveys were conducted in November 2020 and July 2021 following cessation of drought conditions.

Despite these limitations, detailed surveys conducted over multiple years and seasons allowed for detection of many flora and fauna species.



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NARROMINE TO NARRABRI
Narromine Materials Distribution Centre
Figure 3-1: Survey methods

LEGEND

- Vegetation plot
- Active search
- General fauna survey
- Spotlighting and frog survey
- Threatened flora survey
- Bird survey (Spring 2020)
- General fauna survey
- Spotlighting
- Narwonah Multi-function Compound
- N2N construction impact zone

0 0.3 0.6 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 26/04/2022 Paper: A4
Author: JacobsGHD Scale: 1:18,000
Data Sources: Basemap layers: NSWSS;

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4. Existing environment

4.1 Site description

4.1.1 Location and land uses

The proposal site is located seven kilometres south of the township of Narromine, in western NSW. The proposal site is bounded by Craigie Lea Lane to the north, Tomingley Road to the east, Narwonah Siding Road to the south and the Parkes Narromine Railway to the west. The proposal site is located immediately to the north of a section of the N2N project proposed rail alignment and construction compound area .

The majority of the site is largely agricultural, and contains cleared lands from cropping and grazing. Small patches of semi-intact native vegetation is present along existing fencelines, as scattered trees or along adjacent road reserves. Small dams and gilgais occur throughout the proposal site.

4.1.2 Bioregions and IBRA subregions

The proposal site is located in the Darling Riverine Plains IBRA Bioregion and the Bogan-Macquarie subregion. This subregion is described in Table 4-1.

Table 4-1 Subregion description (Morgan and Terrey 1992)

Subregion	Geology	Characteristic landforms	Typical soils	Vegetation
Bogan-Macquarie	Bogan and Macquarie River alluvial fans of Quaternary age. Western margin is bedrock of the Cobar bioregion. Alluvial sediments from mixed Palaeozoic bedrock bury basement rock to 100 metres. Underlying sediments of Cretaceous and Jurassic age form part of the Great Artesian Basin.	Channels, floodplains, and through flow swamps of past and present river systems.	Grey and brown clays on the plains and depressions with texture contrast soils on the low rises of former levees and channels.	River Red Gum and River Cooba on the channels. White Cypress Pine and Bimble Box on coarser levees. Black Box, Belah, Weeping Myall and Lignum on floodplains. Complex patterns of Common Reed, Cumbungi, and Water Couch depending on water levels in marshes. Bimble Box woodland with Wilga, Budda, White Cypress Pine, Grey Box, Yellow Box and Blakely's Red Gum on red soils on fan margins.

4.1.3 NSW (Mitchell) landscape

The proposal site crosses one NSW (Mitchell) landscape region (Table 4-2).

Table 4-2 NSW (Mitchell) landscape description (DECC 2002)

NSW (Mitchell) landscape	General location	Description
Boggy Cowal Alluvial Plains	Bogan-Macquarie (Narromine)	Pleistocene fluvial sediments of backplain facies of the Carrabear Formation associated with the Boggy Cowal distributary stream system. Medium to heavy grey cracking

NSW (Mitchell) landscape	General location	Description
		clays with extensive gilgai. Carbonate nodules common in the subsoil and worked to gilgai crests, local relief to two metres. Extensive grasslands with scattered stands of myall (*Acacia pendula*), Bimble Box (*Eucalyptus populnea*), Black Box (*Eucalyptus largiflorens*) and Belah (*Casuarina cristata*).

4.1.4 Climate

The climate of the proposal site is warm and temperate. The average rainfall is 579 millimetres, with the lowest rainfall in June and the highest in January, although there is little difference between the months. January is the hottest month, with the overall average of 25.5 °C and average maximum of 32.8 °C. July is the coldest month, with an overall average of 9.5 °C and average minimum of 3.6 °C.

4.1.5 Hydrology

The proposal is located within the major water catchment of the Macquarie River. The proposal site does not cross any important wetlands listed in Environment Australia's *Directory of Important Wetlands in Australia: Third Edition* (DIWA). The proposal site does not cross any Ramsar wetlands, the nearest being the Macquarie Marshes Nature Reserve. Due to the significant distance from the study area, it is unlikely the wetland will be affected in any way by the proposed activity.

4.2 Vegetation

4.2.1 Flora species

A total of 44 native flora species and 11 introduced species were recorded during surveys (Appendix A). Of these 16 species are Poaceae (grasses). No threatened flora species were recorded in the proposal site, or in the locality during surveys for the N2N BDAR.

4.2.2 Plant community types

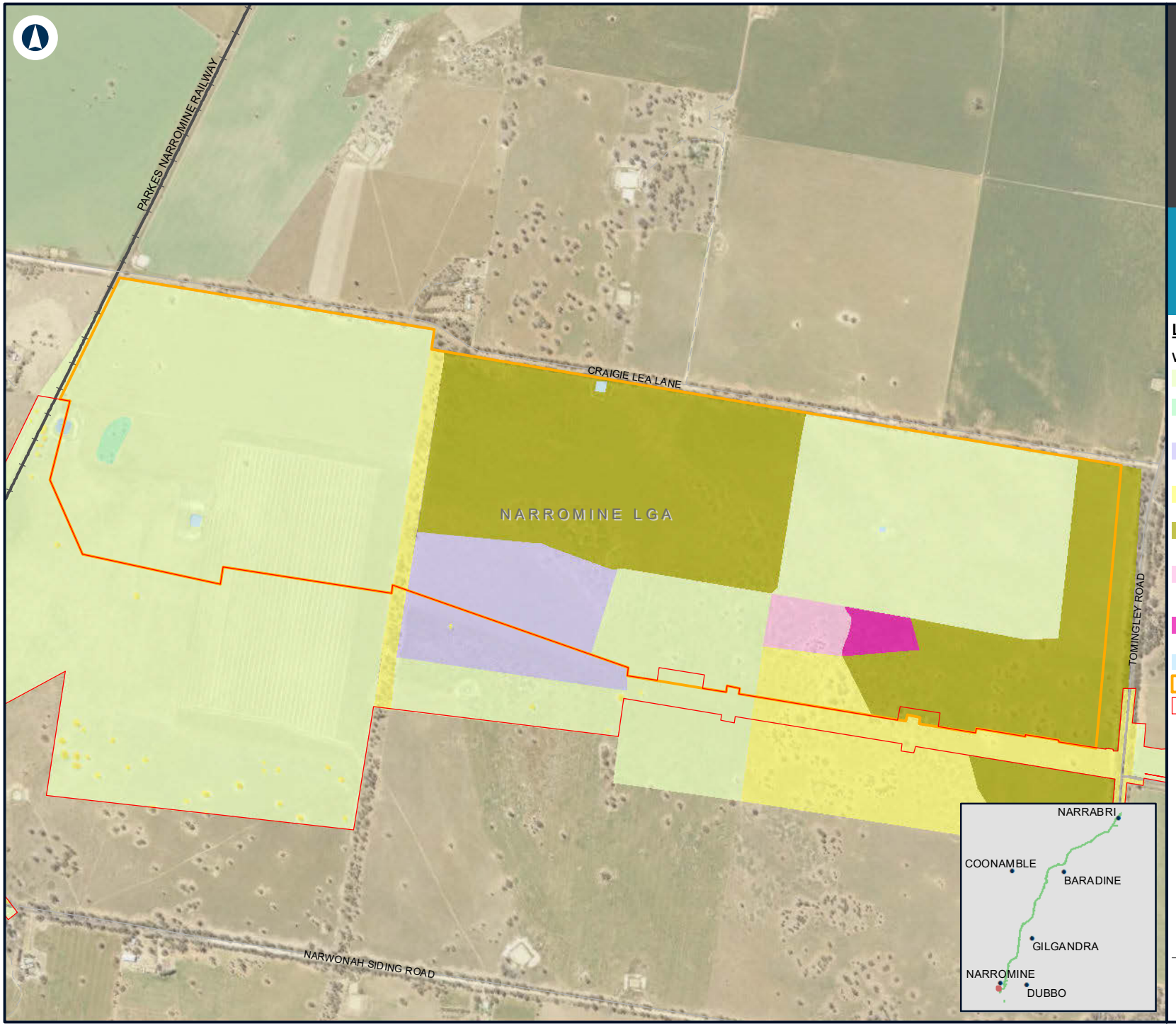
Regional vegetation mapping of the Macquarie catchment identified one native vegetation community in the proposal site: Poplar Box / Bulloak woodland on grey-brown clay flats. One additional PCT was identified in adjacent areas: Mugga Ironbark / Dwyer's Red Gum / Black Cypress Pine woodland on gravelly slopes.

On-ground surveys conducted for the proposal and the N2N BDAR identified four PCTs within and adjacent to the proposal site, including the Poplar Box / Bulloak community (refer to Table 4-3 and Figure 4-1).

Table 4-3 Plant community types within the proposal site

PCT ID	PCT name	Description	Conservation status
27	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South bioregion	A small woodland patch dominated by Weeping Myall (Acacia pendula) occurs in the western portion of the proposal site. A forb understorey layer includes *Einadia nutans*, *Austrostipa scabra*, *Bulbine semibarbata* and *Chloris truncata*.	Weeping Myall Woodland, listed under the BC Act
49	Partly derived Windmill Grass – Copperburr alluvial plains shrubby grassland of the Darling Riverine Plains Bioregion and Brigalow Belt South bioregion	This community occurs in the central section of the proposal site. This community is a tussock grassland dominated by *Chloris truncata* (Windmill Grass), *Enteropogon acicularis* (Curly Windmill Grass) and *Austrostipa scabra subsp. scabra* (Corkscrew grass) as well as *Convolvulus spp.* Scattered small shrubs include *Sclerolaena muricata* (Black Roly Poly), *Sclerolaena birchii* (Galvanized Burr), *Atriplex leptocarpa, Atriplex muelleri, Vachellia (Acacia) farnesiana, Sida trichopoda, Acacia stenophylla* (River Cooba) and *Geijera parviflora* (Wilga) and *Solanum esuriale*.	Not listed as a threatened ecological community under BC Act and EPBC Act.
88	Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	The dominant PCT present is PCT 88 - Pilliga Box – White Cypress Pine – Buloke shrubby woodland, which is dominated by Pilliga Box (*Eucalyptus pilligaensis*) and occurs extensively within the proposal site. The community occurs in both woodland form along the fenceline in the central part of the proposal site and as scattered woodland in the south-eastern section. This community is a tall woodland or open forest dominated by Pilliga Box *(Eucalyptus pilligaensis*) and Buloke *(Allocasuarina luehmannii*). The ground cover is sparse and includes the chenopods (*Sclerolaena spp.*). Forb species include *Calotis cuneifolia* and *Calotis lappulacea*. PCT 88 also occurs as derived native grassland dominated by a mixture of native groundcover species including Purple Lovegrass (*Eragrostis lacunaria*), Curly Windmill Grass (*Enteropogon acicularis*), Yellow Burr-daisy (*Calotis lappulacea*) and Galvanised Burr (*Sclerolaena birchii*).	Not listed as a threatened ecological community under BC Act and EPBC Act.

PCT ID	PCT name	Description	Conservation status
		Gilgais occur predominantly scattered through the woodland remnant and part of the derived native grassland of PCT 88 in the western and central section of the proposal site. They do not meet the description of any other PCT.	
244	Poplar Box grassy woodland on alluvial clay - loams soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)	The community is a mid-high to tall open woodland, averaging 13 metres high, dominated by *Eucalyptus populnea subsp. bimbil* (Poplar Box) with sparse occurrences of *Brachychiton populneus* (Kurrajong). The shrub layer is absent or sparse with some thickets in places. Tall shrub species include *Geijera parviflora* (Wilga) and *Eremophila glabra*. Low shrubs include *Maireana microphylla* and *Abutilon spp*. The ground cover is mid-dense to sparse and may contains low shrubs. A range of grass species is also present including *Austrostipa scabra subsp. scabra, Chloris truncata, Chloris divaricata, Austrodanthonia racemosum* and *Digitaria brownii*. Forb species include *Calotis lappulacea*, *Arthropodium minus* and *Rostellularia adscendens* subsp. *adscendens*. PCT 244 also occurs as derived native grassland dominated by a mixture of native groundcover species.	Not listed as a threatened ecological community under BC Act Does not meet condition criteria for community listed under the EPBC Act.
Exotic grassland	NA	The western portion of the proposal site and a portion in the eastern section is dominated by introduced groundcover species due to past disturbance from cropping. Weed species present in these areas include Saffron Thistle (*Carthamus lanatus*) and African Boxthorn (*Lycium ferocissimum*)	NA



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NARROMINE TO NARRABRI
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Figure 4-1: Vegetation Zones

LEGEND

Vegetation Zone

- 0:Crop and/or introduced grassland:N/A
- 27:Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion:Good
- 49:Partly derived Windmill Grass - Copperburr alluvial plains shrubby grassland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion:Good
- 88:Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion:Good
- 88:Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion:DNG
- 244:Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt):Good
- 244:Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt):DNG
- Waterbody
- Narwonah Multi-function Compound
- N2N construction impact zone

0 0.3 0.6 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 26/04/2022 Paper: A4
Author: JacobsGHD Scale: 1:18,000
Data Sources: Basemap layers: NSWSS;

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4.2.3 Weeds

One priority weed species and WONS (African Boxthorn) was recorded in plots in the proposal site (see Table 4-4). This species has a general biosecurity duty which requires any person who deals with the plant to ensure the biosecurity risk of the weed is prevented, eliminated or minimised, so far as is reasonably practicable. Regional measures for many species include the requirement that land managers should mitigate the risk of new weeds being introduced to their land.

Table 4-4 Weed species recorded in survey plots

Common name Scientific Name	WoNS (CoA 2017)	Priority weed	Biosecurity Duty (NSW WeedWise)	High Threat Exotic
African Boxthorn *Lycium ferocissimum*	Yes	Yes	**General biosecurity duty** Any person who knows (or ought to reasonably know) of any biosecurity risk, has a duty to ensure that the risk is prevented, eliminated or minimised, so far as is reasonably practicable. **Prohibition on dealings** Must not be imported into the State or sold **Regional recommended measure*** Land managers mitigate the risk of the plant spreading from their land. Land managers reduce impact of plant on priority assets (riparian areas and floodplains).	Yes

4.3 Fauna and habitat resources

4.3.1 Fauna species

A total of 26 fauna species were recorded in the study area during surveys, including 35 bird species, one introduced mammal species (Red Fox – *Vulpes vulpes*), two native mammals, two reptile species and four frog species. The most commonly occurring birds included Willie Wagtail (*Rhipidura leucophrys*), Red-rumped Parrot (*Psephotus haematonotus*) and Australian Magpie (*Cracticus tibicen*).

Three frog species that were recorded during targeted winter surveys are commonly occurring species and were recorded within the gilgai habitat and farm dam within the proposal site. The gilgais at the time of survey were full of water and provided optimal conditions for frog habitat. Gilgais are surrounded by aquatic vegetation dominated by Spikerushes (*Eleocharis* sp.).

The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), which is listed as a vulnerable species under the BC Act, was recorded in the woodland patch along the fenceline near the center of the proposal site. Threatened species are discussed further in section 5.2.3.

4.3.2 Fauna habitats

The locality contains the following broad habitat types for fauna:

- Grassland with scattered paddock trees
- Woodland patches in agricultural land
- Dams and soaks.

The various habitats and their biodiversity value are discussed in further detail in Table 4-5.

Table 4-5 Fauna habitats

Habitat type	Description
Grassland with scattered paddock trees 	Dominated by exotic crop species (eg Oats) or derived native grassland. Occasional isolated paddock trees or small groups of paddock trees are present. Many paddock trees are hollow-bearing, and could provide roosting habitat for microbats and parrots. These trees would provide foraging habitat and 'stepping stone' connectivity for small birds, and may also provide connectivity for species such as the Koala (where spacing is closer).
Woodland patches in agricultural land 	Woodland vegetation is present as various-sized patches. This can comprise small patches within a larger paddock, riparian vegetation retained along creek lines, linear strips along roadsides and paper roads or 'laneways', and larger patches associated with travelling stock reserves. This vegetation comprises a canopy of eucalypts, often with a sparse understory and grassy ground layer. A high density of leaf litter and fallen timber is present, particularly along paper roads and in travelling stock reserves. Hollow-bearing trees and stags are present. Vegetation along fencelines and road reserves provides connectivity to other patches in the wider area. The Grey-crowned Babbler, listed as a vulnerable species under the BC Act, was recorded in the narrow corridor of vegetation along the fence line. This species is likely to nest in the proposal site. A range of threatened woodland birds and microbats may also occur. Patchy and isolated records of the Koala occur in the Narromine area. No evidence of the species was recorded in the area during targeted surveys for the N2N BDAR and this report. An expert report was prepared for the N2N BDAR by Dr Stephen Phillips. Analysis of contemporaneous koala records to identify areas of generational persistence identified approximately 20.3 km of the N2N alignment as currently supporting resident Koala populations, all of which was located in the Pilliga and Bohena Creek areas near Narrabri (Phillips 2021). Linear and riparian woodland in the Narromine area may support a very low density of Koalas at best.

Habitat type	Description
Dams and gilgai 	Farm dams are present in agricultural land. These provide water for stock as well as native fauna including frogs, turtles, birds, macropods and bats. Few contain emergent aquatic vegetation, and little floating or submerged aquatic vegetation was observed, although this may be a result of ongoing drought conditions and heavy use by stock. Common waterbirds including ducks and herons were recorded. Gilgai are present in the south-east of the proposal site. These are flooded depressions, vegetation with emergent vegetation. Water was present during surveys in 2020 and 2021, following cessation of drought conditions. A number of common frog species were recorded during surveys. No evidence of Sloane's Froglet was recorded in the study area, despite targeted surveys in appropriate season (July) in gilgai habitat. It is noted that records for Sloane's Froglet north of Dubbo in NSW are likely to be misidentification of other *Crinia* species (Spark 2015). Sloane's Froglet has disappeared from much of its former range and now appears to be restricted to a very small area of NSW near Albury and Corowa, as well as the Wahgunyah and Rutherglen regions in Victoria (Knight 2015).

5. Conservation significance

5.1 FM Act

The proposal site does not contain any watercourses that provide suitable habitat for threatened fish listed under the FM Act. The species predicted to occur in the locality (refer to Appendix B) are associated large river systems, and as a result can be reliably excluded from occurring within the proposal site.

5.2 BC Act

5.2.1 Threatened ecological communities

The small woodland patch dominated by Weeping Myall (*Acacia pendula*) in the western portion of the property classifies as Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions, which is listed as endangered under the BC Act (Table 5-1).

Table 5-1 Threatened ecological communities listed under the BC Act

PCT ID	PCT	BC Act status
27	Weeping Myall open woodland of the Darling Riverine Plains bioregion and Brigalow Belt South Bioregion EEC	Weeping Myall Woodland
244	Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions EEC	Does not conform to this TEC due to the lack of Brigalow.

5.2.2 Threatened flora species

Threatened flora species previously recorded or having the potential to occur in the locality are presented in Appendix B. No threatened species were recorded during targeted surveys. Species predicted to occur in the locality using database searches are considered unlikely to occur in the study area or to be affected by the proposal based on known geographic range, and/or an absence of suitable habitat within the study area, and/or these species would be readily detected if present and were not detected despite targeted surveys in the required survey months.

5.2.3 Threatened fauna species

One threatened fauna species; the Grey-crowned Babbler was recorded within the proposal site during surveys (Figure 5-2). Based on the results of the desktop assessment and habitat assessment during field surveys, a number of additional threatened fauna species are 'possible' or 'likely' to occur within the proposal site (see Appendix B). These include a range of other birds including forest owls and raptor species. These species were not recorded at the proposal site despite targeted survey effort and there is no evidence of roosting, breeding or frequent use of the proposal site.

Table 5-2 Threatened fauna species recorded or likely to occur

Common name	BC Act Status	EPBC Act Status	Likelihood of occurrence	Likelihood of impact
BIRDS				
Barking Owl *Ninox connivens*	V	-	**Possible** Only foraging habitat likely present in the site. Could breed and roost along large watercourses in surrounding areas, where large hollows are present.	**Low**
Black Breasted Buzzard *Hamirostra melanosternon*	V	-	**Possible** Scattered records in locality. Considered a vagrant to the area. Potential foraging habitat present only.	**Low**
Black Falcon *Falco subniger*	V	-	**Possible** Scattered records around Narromine. Could breed along large watercourses in locality. Potential foraging habitat present.	**Low**
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis*	V	-	**Possible** Likely to occur in largest woodland remnants in landscape where nectar resources are abundant. May use habitat in the proposal site as a stepping stone between other areas of better quality habitat.	**Moderate**
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	V	-	**Possible** Potential foraging and breeding habitat in woodland only.	**Moderate**
Diamond Firetail *Stagonopluera guttata*	V	-	**Possible** Potential foraging habitat throughout. Breeding habitat restricted to woodlands.	**Moderate**
Dusky Woodswallow *Artamus cyanopterus*	V	-	**Possible** Potential foraging habitat throughout. Breeding habitat restricted to woodlands.	**Moderate**
Flame Robin *Petroica phoenicea*	V	-	**Possible**	**Moderate**

Common name	BC Act Status	EPBC Act Status	Likelihood of occurrence	Likelihood of impact
			May occur on occasion in larger woodland remnants. Potential foraging and breeding habitat in woodland only. May use habitat in the proposal site as a stepping stone between other areas of better quality habitat.	
Gilbert's Whistler *Pachycephala inornata*	V		**Possible** Potential foraging and breeding habitat in woodland only.	**Moderate**
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis*	V	-	**Recorded** Individuals recorded in the site, records in the local area, habitat in the proposed site area is suitable to support the species.	**High**
Grey Falcon *Falco hypoleucos*	E	-	**Possible** Potential foraging habitat present. Could breed along large watercourses in locality.	**Low**
Hooded Robin (south-eastern form) *Melanodryas cucullata*	V	-	**Possible** Potential foraging and breeding habitat in woodland only. May occur in larger woodland remnants in locality.	**Moderate**
Little Eagle *Hieraaetus morphnoides*	V	-	**Possible** Potential foraging habitat present. No large stick nests recorded. May occur in larger woodland remnants in locality.	**Low**
Little Lorikeet *Glossopsitta pusilla*	V		**Possible** However likely to occur in largest woodland remnants in landscape where nectar resources are abundant.	**Low**
Masked Owl *Tyto novaehollandiae*	V	-	**Possible** Only foraging habitat likely present in the site. Could breed and roost along large watercourses in surrounding areas, where large hollows are present.	**Low**
Painted Honeyeater *Grantiella picta*	V	V	**Possible**	**Moderate**

Common name	BC Act Status	EPBC Act Status	Likelihood of occurrence	Likelihood of impact
			Limited suitable habitat present in the proposal site for this species. May use habitat in the proposal site as a stepping stone between other areas of better quality habitat.	
Scarlet Robin *Petroica boodang*	V	-	**Possible** Potential foraging and breeding habitat in woodland only. May occur in larger woodland remnants in locality.	**Moderate**
Spotted Harrier *Circus assimilis*	V	-	**Possible** Potential foraging habitat present. No large stick nests observed.	**Low**
Square-tailed Kite *Lophoictinia isura*	V	-	**Possible** Potential foraging habitat present. No large stick nests observed.	**Low**
Superb Parrot *Polytelis swainsonii*	V	V	**Possible** Previously recorded in the local region, suitable habitat occurs in the proposal site area. Unlikely to breed in the proposal site.	**Low**
Turquoise Parrot *Neophema pulchella*	V	-	**Possible** However likely to occur in largest woodland remnants in landscape where nectar resources are abundant.	**Low**
Varied Sittella *Daphoenositta chrysoptera*	V	-	**Possible** Potential foraging and breeding habitat in woodland only. May occur in larger woodland remnants in locality.	**Moderate**
MAMMALS				
Corben's Long-eared Bat *Nyctophilus corbeni*	V	V	**Possible** Could forage and breed in woodland remnants.	**Moderate**
Koala *Phascolarctos cinereus*	V	E	**Possible** Potential foraging and breeding habitat in woodland only, particularly in Pilliga Box Woodland.	**Moderate**

Common name	BC Act Status	EPBC Act Status	Likelihood of occurrence	Likelihood of impact
Large Bent-winged Bat	V		**Possible** Would forage throughout the proposal site. No roosting or breeding habitat is present	**Low**
Little Pied Bat *Chalinolobus picatus*	V	-	**Possible** Could forage and breed in woodland remnants.	**Moderate**
Northern Free-tailed Bat *Ozimops lumsdenae*	V		**Possible** Could forage and breed in woodland remnants.	**Moderate**
Yellow-bellied Sheathtail-Bat *Saccolaimus flaviventris*	V	-	**Likely** Would forage throughout the proposal site. Roosting habitat limited to woodland remnants.	**Moderate**

Key: M – migratory, V – vulnerable, E-endangered

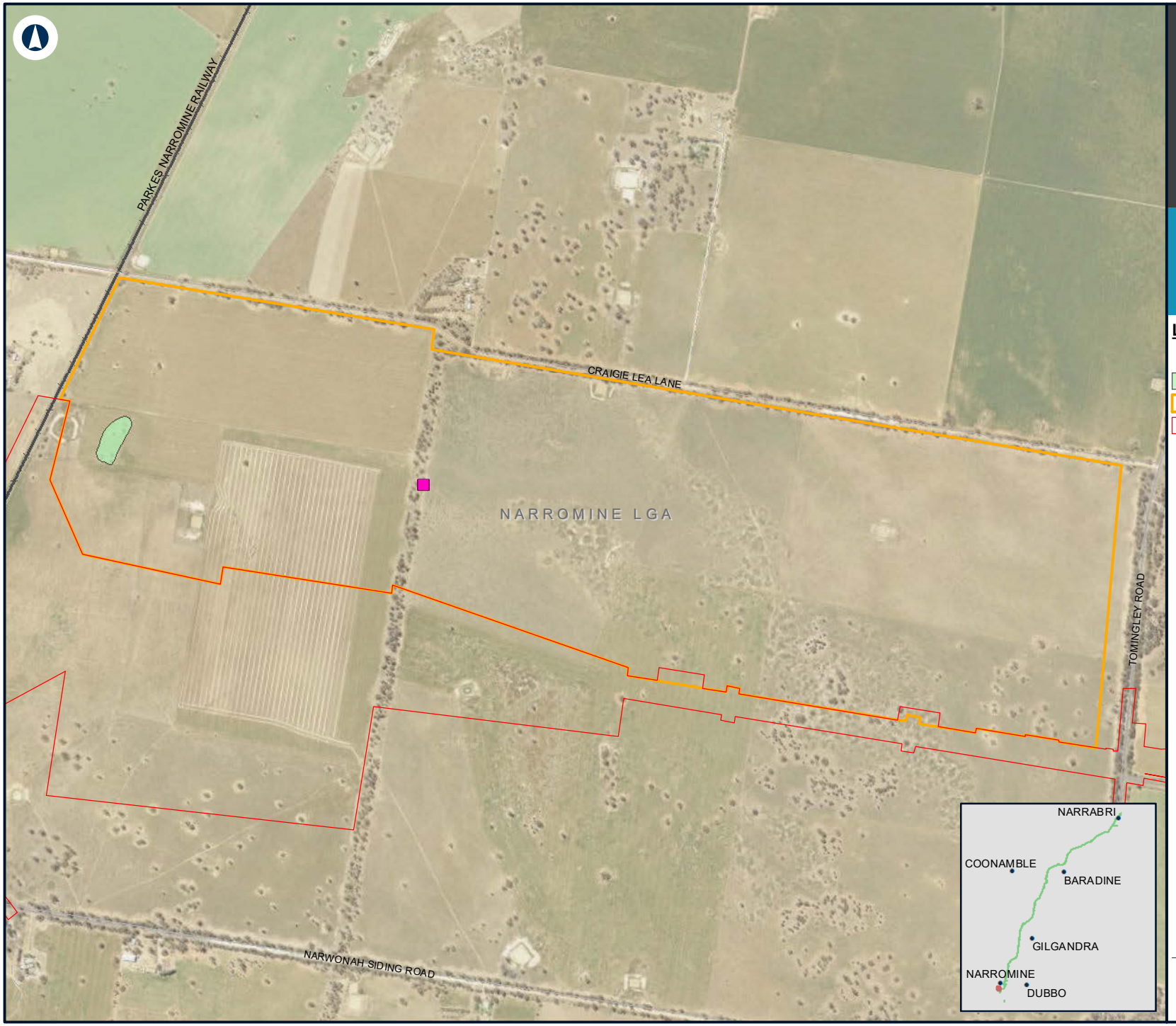

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Figure 5-1: Threatened biota – BC Act

LEGEND

- Grey-crowned Babbler
- Weeping Myall Woodland EEC (BC Act)
- Narwonah Multi-function Compound
- N2N construction impact zone

0 0.3 0.6 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 26/04/2022 Paper: A4
Author: JacobsGHD Scale: 1:18,000
Data Sources: Basemap layers: NSWSS;

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5.3 EPBC Act

5.3.1 Threatened ecological communities

Two PCTs which can comprise a component of local TECs under the EPBC Act were recorded in the proposal site. These were discounted because PCTs were not in a suitable condition to meet the EPBC Act criteria (see Table 5-3). No Inland Grey Box or Box Gum Woodland was recorded at the site, although have been recorded in the locality during surveys for the N2N BDAR (see Figure 5-2). These TECs are discussed in further detail below.

Table 5-3 Threatened ecological communities with the potential to occur on site

TEC	PCT	Comment
Weeping Myall Woodlands	PCT 27: Weeping Myall open woodland of the Darling Riverine Plains bioregion and Brigalow Belt South Bioregion	Vegetation at the site is of a condition that does not conform to EPBC listing for Weeping Myall TEC
Poplar Box Grassy Woodland on Alluvial Plains	PCT 244: Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) – woodland	Does not conform to EPBC listing for Poplar Box TEC
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia	PCT 81: Western Grey Box – Cypress Pine grass shrub tall woodland in the Brigalow Belt South bioregion PCT 248: Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – Good	PCTs not recorded during surveys. Recorded elsewhere in N2N construction impact zone in the Narromine area

Weeping Myall Woodlands

Weeping Myall Woodlands occur in a range of forms from open woodlands to woodlands, in which Weeping Myall (*Acacia pendula*) trees are the sole or dominant overstorey species. Areas that have a total absence of native species in the understorey or that consist of single paddock trees with no native understorey are generally excluded from the EPBC Act listing. In order to meet the EPBC Act condition criteria, the patch must have at least five per cent tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees per hectare (DEWHA 2009). The small woodland patch dominated by Weeping Myall (*Acacia pendula*) in the western portion of the property does not classify for listing under the EPBC Act due to the small size of the patch (only three trees), dominance of introduced species in the groundcover and lack of regeneration (see Table 5-4).

Table 5-4 Key diagnostic characteristics of Weeping Myall Woodlands

Characteristic	Description	Site comment
Location	Occurs in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Murray-Darling Depression, Nandewar and Cobar Peneplain IBRA bioregions	Yes. Site is located in the Darling Riverine Plains bioregion
Physical environment	Generally occurs on flat areas, shallow depressions or gilgais on raised alluvial plains	Yes. Suitable soils present.
Condition	The patch of woodland must be at least 0.5 ha (5,000 m²) in size The overstorey must have at least 5 per cent tree canopy cover or at least 25 dead or defoliated mature weeping myall trees per hectare	No. Canopy cover is less than 5%. Only three trees present across about 1 ha

Poplar Box Grassy Woodland on Alluvial Plains

National listing focuses legal protection on areas or patches of the ecological community that are the most functional, in a relatively natural state and in comparatively good condition. As the ecological community exhibits various degrees of disturbance and degradation, condition thresholds, classes and categories have been developed. The ecological community that is protected under national environment law comprises patches that meet the key diagnostic characteristics and at least the minimum condition thresholds (DEE 2019). As shown in Table 5-5, Poplar Box grassy woodland at the site is dominated by native species in the groundcover, however, due to the low canopy cover does not classify as Poplar Box Grassy Woodland on Alluvial Plains EEC under the EPBC Act. This PCT also occurs as derived native grassland in the proposal site, which also does not form part of the EPBC Act listing of the community according to the listing criteria.

Table 5-5 Key diagnostic characteristics of Poplar Box Grassy Woodland

Characteristic	Description	Site comment
Location	Occurs in the Brigalow Belt North, Brigalow Belt South, Southeast Queensland, Cobar Peneplains, Darling Riverine Plains, NSW South Western Slopes, Riverina and Murray Darling Depression IBRA bioregions	Yes. Site is located in the Darling Riverine Plains bioregion.
Physical environment	Associated with ancient and recent depositional alluvial plains with clay, clay-loam, loam and sandy loam, typically duplex soils or sodosols.	Yes. Suitable soils present.

Characteristic	Description	Site comment
Structure	A grassy woodland to grassy open woodland with a tree crown cover of 10% or more at patch scale. Mid layer (1-10 m) crown cover of shrubs to small trees is low, about 30% or less. A ground layer (<1 m) mostly dominated across a patch by native grasses, other herbs and occasionally chenopods (during extended dry periods), ranging from sparse to thick	No. Canopy cover is less than 10%.

Poplar Box grassy woodland (PCT 244) at the site comprises a relatively small patch. About 4.7 hectares is mapped as good condition (has a canopy layer), while around 3.1 hectares comprises a derives grassland form of the community (canopy lacking). Land to the north and west of the patch is cropped. Land to the north-west and east is a derived grassland form of Pilliga Box - White Cypress Pine - Buloke shrubby woodland (PCT 88). Good condition Pilliga Box - White Cypress Pine - Buloke shrubby woodland occurs to the south of the Poplar Box grassy woodland patch. Both good condition forms of PCT 88 and PCT 244 have scattered trees over a disturbed groundlayer. The patch is subject to grazing.

Taking into account the canopy cover, PCT 244 at the site is below the minimum patch condition for the EPBC Act TEC. This TEC was recorded about one kilometre to the east of the proposal site during surveys for the N2N BDAR (Figure 5-2).

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia occurs in two forms. The most common form is as grassy woodland comprising a tree layer and an understorey that must have native grasses but with a varying proportion of shrubs and herbs. The derived native grassland form can occur in patches where the tree canopy and mid layer have been almost entirely removed but the native ground layer remains largely intact with high flora diversity.

No Grey Box was recorded in the proposal site. Woodland vegetation was dominated either by Poplar Box or Pilliga Box. This TEC was recorded in the N2N construction impact zone about three kilometres to the east along Dappo Road (Figure 5-2), where Grey Box occurred in combination with Poplar Box (JGHD 2021).

5.3.2 Threatened flora species

Threatened flora species previously recorded or having the potential to occur in the locality are presented in Appendix B. No species were recorded during targeted surveys. Species predicted to occur in the locality using database searches are considered unlikely to occur in the study area or to be affected by the proposal based on known geographic range, and/or an absence of suitable habitat within the study area, and/or these species would be readily detected if present and were not detected despite targeted surveys.

5.3.3 Threatened and migratory fauna species

Threatened fauna species previously recorded during surveys or having the potential to occur in the locality based on previous database records in the locality and the presence of suitable habitat are presented in Appendix B. Many species are considered unlikely to occur in the study area or to be affected by the proposal based on known geographic range, and/or an absence of

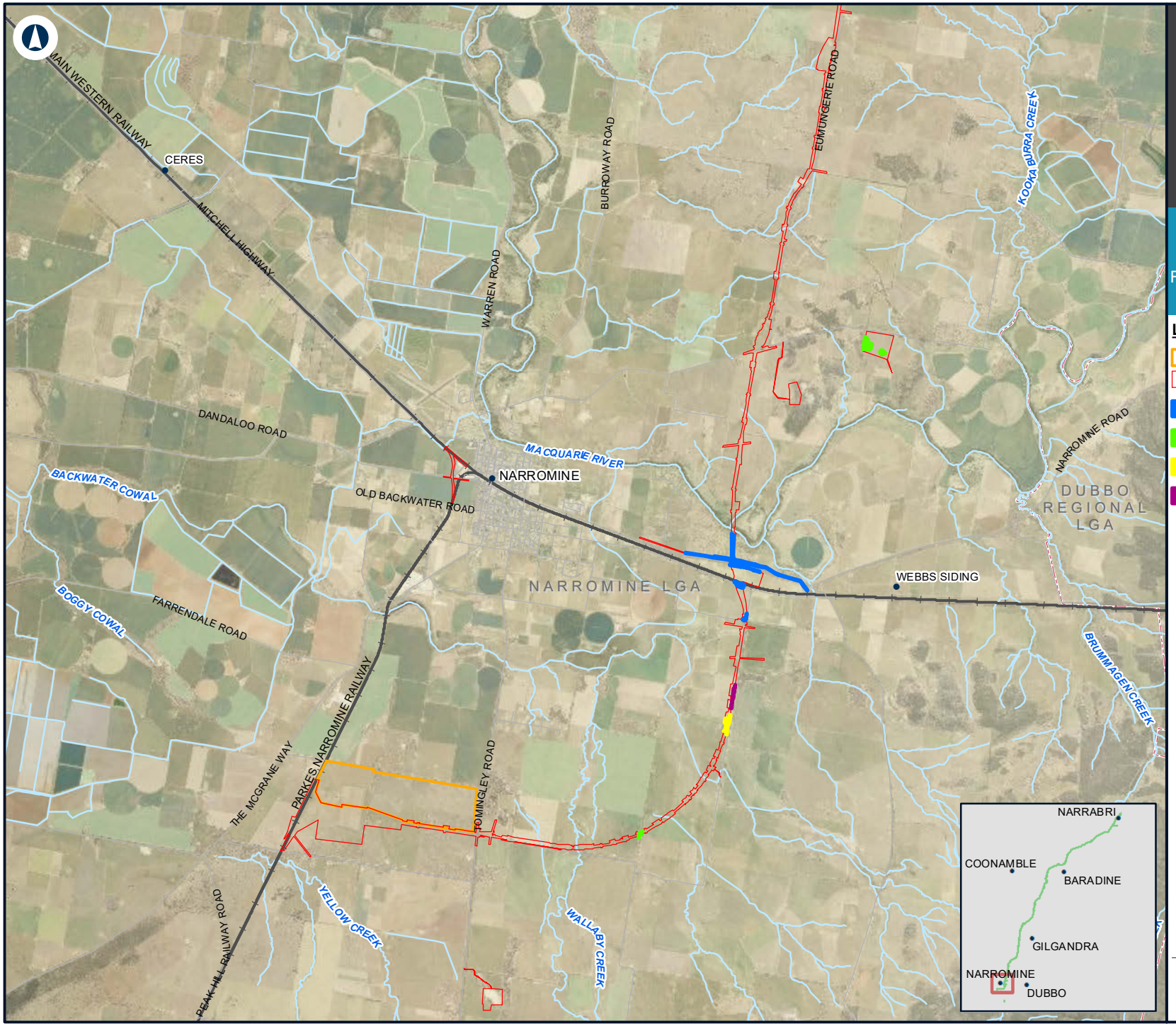
suitable habitat within the study area, and/or these species would be readily detected if present and were not detected despite targeted surveys. Justifications for threatened species considered unlikely to occur are provided in Appendix B.

Species known or likely to occur within the study area are summarised in Table 5-6 below. No migratory fauna species are likely to occur in the proposal site.

Table 5-6 Threatened fauna species recorded or likely to occur

Common name	BC Act	EPBC Act	Likelihood of occurrence	Likelihood of impact
Corben's Long-eared Bat *Nyctophilus corbeni*	V	V	**Likely** May use habitat in proposal site area for foraging and roosting. Site also may provide connectivity to surrounding patches of woodland.	**Moderate**
Koala *Phascolarctos cinereus*	V	E	**Possible** Suitable tree species occur in the site for the species, may also provide connectivity between patches in the degraded landscape.	**Moderate**
Painted Honeyeater *Grantiella picta*	V	V	**Possible** Limited suitable habitat present in the proposal site for this species. May use habitat in the proposal site as a stepping stone between other areas of better quality habitat.	**Moderate**
Superb Parrot *Polytelis swainsonii*	V	V	**Possible** Previously recorded in the local region, suitable habitat occurs in the proposal site area. Unlikely to breed in the proposal site.	**Low**

Key: V – vulnerable, E-endangered



INLAND RAIL

ARTC

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

NARROMINE TO NARRABRI
Narromine Materials Distribution Centre
Figure 5-2: Threatened biota – EPBC Act

LEGEND

- Narwonah Multi-function Compound
- N2N construction impact zone
- Grey Box (Eucalyptus microcarpa) Grassy Woodlands and derived native grasslands of South-eastern Australia
- Poplar Box grassy woodland on alluvial plains
- White Box - Yellow Box - Blakeys Red Gum Grassy Woodland and Derived Native Grassland
- Inland Grey Box Woodland

0 2 4 Km

Coordinate System: GDA 1994 MGA Zone 55

Date: 26/04/2022 Paper: A4
Author: JacobsGHD Scale: 1:120,000
Data Sources: Basemap layers: NSWSS;

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6. Potential impacts

6.1 Direct impacts

The proposal would result in direct impacts on native biota and their habitats within the proposal site. There is also the potential for indirect impacts on retained areas of native vegetation adjacent to the proposal site during the proposed works. Impacts to native vegetation have been considered through siting of the majority of the proposal site within areas of crop and/or introduced grassland.

The proposal site is shown in Figure 3-1. The proposal would include the potential removal and disturbance of up to 146.30 hectares of native vegetation, for the construction and operation of the MDC including for the storage and management of track material (concrete sleepers, rail and ballast), prior to their distribution to multiple Inland Rail projects.

Specific mitigation measures are recommended to minimise likely impacts on biodiversity values. These measures are presented according to the hierarchy of avoidance and mitigation of impacts in section 7.2 of this report.

6.1.1 Vegetation clearing

The proposal is bounded to the south by the N2N construction impact zone fand abuts Craigie Lea Lane to the north. All works would be undertaken within lands mostly cleared historically for agriculture and grazing regimes and is highly modified. About 1.23 hectares of the vegetation to be removed occurs within the construction footprint for the N2N project. The remaining 327.28 hectares occurs outside of the N2N construction impact zone and has not previously been assessed.

The proposal would primarily remove up to 181.89 hectares of cropland and introduced grasslands which do not contain any midstorey or canopy (Table 6-1).

The proposal would remove up to 33.72 hectares of good condition vegetation within Weeping Myall Woodland, Pilliga Box- White Cypress pine- Buloke shrubby woodland and Poplar Box Grassy Woodland which also comprise a canopy and are restricted to fence lines and small fragmented patches within paddocks. Up to 112.58 hectares of Pilliga Box- White Cypress pine- Buloke shrubby woodland and Poplar Box Grassy Woodland also occur as a derived native grassland within large blocks in the central and eastern portions of the proposal site and would be removed as part of the proposal (Table 6-1). About 0.5 hectares of this native vegetation removal has also been assessed as part of the N2N BDAR.

The proposal would remove a small proportion of individual plant species, PCTs and associated habitats comparative to that in the surrounding area and locality. The clearing of native vegetation would involve the removal of a moderate diversity of non-threatened native plants. Where possible mature trees, and habitat trees (hollow-bearing trees, nest trees and stags) would be avoided, as these provide higher ecological value to biota. Mature trees have particular value within plant populations because they take longer to replace and are sources of pollen and seed, and habitat trees provide valuable roosting, shelter, nesting and breeding habitat for fauna.

Mitigation measures to minimise impacts on native vegetation during construction are recommended in Section 7.

Impacts to vegetation communities are summarised below in Table 6-1.

Table 6-1 Impacts to vegetation communities

PCT ID	PCT name	BC Act Status	EPBC Act Status	Area of clearing (Ha)
27	Weeping Myall open woodland of the Darling Riverine Plains bioregion and Brigalow Belt South Bioregion	Comprises a component of Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions EEC	Does not conform to the EPBC Act listing for Weeping Myall TEC	1.07
49	Partly derived Windmill Grass – Copperburr alluvial plains shrubby grassland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	-	-	17.86
88	Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion (Woodland)	-	-	10.07
88	Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion (DNG)	-	-	109.51
244	Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) (Woodland)	Does not conform to the BC Act listing for the Brigalow TEC	Does not conform to the EPBC Act listing for the Poplar Box TEC	4.71
244	Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) – Derived Native Grassland	Does not conform to the BC Act listing for the Brigalow TEC	Does not conform to the EPBC Act listing for the Poplar Box TEC	3.08
Total amount native vegetation				**146.30**
N/A	Introduced vegetation	-	-	181.89
Total				**328.19**

6.1.2 Removal of terrestrial fauna habitat

The proposal site occurs primarily within lands that occur as cropland, introduced grassland or derived native grasslands. This broad fauna habitat does not contain a midstorey or canopy and would be used by a low to moderate diversity of species, capable of persisting in modified and fragmented landscapes (see Section 4.3, Appendix A). No threatened species are likely to depend on this habitat for their survival.

Other areas of the proposal site contain an open grassy woodland that occur as small isolated patches or as linear strips along existing fencelines and contain canopy species including Poplar Box and Pilliga Box. The removal of 15.85 hectares of semi-intact native woodland would comprise habitat for local populations of woodland fauna species, including birds, bats and mammals. Native woodland in the proposal site would provide habitat resources such as mature trees that provide foraging resources such as nectar and fruit, woody debris, leaf litter and hollows. Linear and riparian woodland in the Narromine area may support a very low density of Koalas at best (see Section 4.3, Appendix A). The removal of woodland would reduce the availability of foraging, roosting and nesting habitat for a variety of woodland dependent fauna.

In areas where excavation is required (e.g. back-filling or levelling of the proposal site), there would be disturbance to habitat for small, common, less mobile ground-dwelling fauna such as lizards and frogs. More mobile fauna displaced during construction activities would likely seek refuge in areas of adjoining habitat. Impacts to fauna habitat are likely to be permanent, depending on the final land use decided for the proposal site following decommissioning (expected in 2027).

In the context of the areas of remaining native vegetation surrounding the proposal site, the proposal will remove a very small proportion of available foraging resources for local populations of native fauna with intact native woodland restricted mostly to road reserves and creeklines in the locality. A large patch of native woodland ~15km to the east within private lands at Narromine would also continue to provide habitat resources of local fauna populations.

6.1.3 Aquatic habitat impacts

The proposal site contains small farm dams and gilgais, that may contain habitat for commonly occurring frog species and wetland birds. The proposal would remove all foraging and refuge habitat for these guilds within the proposal site. Given the relative immobility of frogs, local individuals are likely to be dependant on these aquatic habitats within the proposal site and unlikely to be able to avoid direct impacts from construction.

Common wetland birds resident to gilgais and dams in the proposal site would avoid direct impacts from the proposal by utilising foraging, breeding and refuge habitat in a number of large dams is present in the locality and associated with similar habitats as well as the Macquarie River, which occurs only around eight kilometres to the north of the proposal site.

No areas of KFH are mapped within the proposal site. The proposal will not alter natural flow regimes of rivers and streams and their floodplains and wetlands.

6.1.4 Fauna injury and mortality

The study area provides habitat resources for native fauna species, including foraging, roosting and shelter resources for threatened species as well as common native fauna. Groundcover vegetation, leaf litter and woody debris would provide shelter and foraging substrate for small birds and mammals, reptiles, frogs and invertebrates. The proposed vegetation clearing is likely to result in the injury or mortality of some individuals of these less mobile fauna species, nestlings, and other small terrestrial fauna that may be sheltering in vegetation within the proposal site during clearing activities.

More mobile native fauna such as birds, bats, and terrestrial mammals that may be sheltering in vegetation in the proposal site are likely to evade injury during vegetation clearing and disturbance activities by moving away from clearing activities. Recommendations have been made in section 7 below to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

6.1.5 Fragmentation and isolation of habitat

Native fauna may also use the fragmented patches of native woodland as 'stepping stones' to larger patches of habitat in the locality. Clearing of vegetation would sever some movement corridors, such as that along the fence line in the centre of the property. Similar narrow roadside and fence line corridors are present elsewhere in the area, and connectivity would be retained in these areas.

6.2 Indirect impacts

6.2.1 Weed invasion and edge effects

'Edge effects' can include increased noise and light or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Edge effects could result from vegetation clearing activities and then continue to affect vegetation and habitats adjoining the proposal site.

Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators.

Weed invasion and edge effects are already present throughout the proposal site, given the location of the proposal within a heavily cleared semi-rural landscape. The potential for the proposal to exacerbate existing edge effects and weed invasion would be limited, given the extent of existing modification within the construction footprint.

Management measures including the development of a weed management sub-plan as part of the Construction Environmental Management Plan (CEMP) will be implemented to mitigate these potential impacts (refer to section 7).

Other relevant mitigation measures to reduce the impacts of edge effects include dust suppression and erosion and sediment measures during vegetation clearing and disturbance.

6.2.2 Introduction and spread of weeds, pests and pathogens

Disturbance associated with vegetation clearing and vehicle and machinery traffic of the proposal during vegetation clearing would increase the potential for the spread, introduction and establishment of weed and pest species, and diseases and pathogens. Weed species are effective competitors for food and habitat resources and have the potential to exclude native species and modify the composition and structure of vegetation communities.

Activities within the proposal site may, in general, have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), and Myrtle Rust (*Uredo rangelii*) into adjacent native vegetation through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats.

Diseases and pathogens can be introduced or spread to site via dirt or organic material attached to machinery, vehicles, equipment and employees. The potential for significant or new impacts associated with these pathogens is relatively low, given the existing development presence and extent of human visitation across the proposal site and surrounding study area. To help mitigate the risk of pathogens being brought onto and/or spread through the site all machinery brought to site will be washed down and inspected to be free of soils, seeds and other organic material in accordance with section 7.

6.2.3 Noise, vibration and light impacts on fauna

Construction activities, including site establishment and unloading activities, would be sought to be undertaken during the recommended standard hours for construction work as per the NSW Interim Construction Noise Guideline (ICNG) (DECC 2009). Noise levels during the proposed works would result in an increase above existing background levels for construction and operation of the MFC. Noise levels would vary during this period, with some activities being louder and producing higher levels of vibration than others (e.g. vegetation clearing). Fauna are likely to be habituated to some noise, due to use of agricultural machinery in the area and vehicle movements on roads.

Noise, vibration and light have been shown to have a variety of impacts on fauna, including changing foraging behaviour, impacting breeding success and changing species occurrences. Fauna most at risk would be those residing in close proximity to the works area, and in particular any species that may be nesting, roosting or denning in the area. Some fauna may vacate areas in proximity to the proposal site during construction. Hollow-bearing trees or other habitat trees in adjacent areas may provide habitat for species including a variety of threatened microbat species. Disturbance has the potential to interrupt breeding activities for some individuals. Other more resilient fauna species are likely to become accustomed to the noise, and this increased or novel impact is unlikely to result in a decrease in population numbers or diversity of these species. Given the availability of alternate habitat in surrounding areas, it is unlikely the temporary increase in noise during construction of the proposal would significantly impact on fauna that occur in the locality.

6.2.4 Erosion and sedimentation

Loose soil generated by construction activities may increase the risk of sedimentation and run-off on aquatic habitats in the study area in times of high rainfall. The risk of erosion and sedimentation is generally low due to the lack of ephemeral aquatic habitats in the study area.

It is recommended that no disturbance or vegetation removal works be undertaken during times of predicted rainfall, wet weather or when standing water is present, to reduce impacts of sedimentation into adjacent areas.

Measures will be implemented to minimise the risk of movement of materials in the event of a significant rainfall and in the event of forecast heavy rainfall, works will be postponed to prevent the potential for sediment laden run-off into adjacent properties or waterways. Mitigation measures are presented in section 7.2.

6.3 Operational impacts

The proposal would form part of the rail network managed and maintained by ARTC until it is decommissioned. Potential impacts of operational impacts of the MDC are discussed in Table 6.2.

Table 6.2 Operational impacts of the MDC

Impact	Description
Injury and mortality	Operation of the MDC will create a novel strike risk in the area via the movement of trains, truck and other machinery. This would include impacts on terrestrial fauna that may cross tracks and roads. Given the clearing of vegetation in the proposal site and adjacent N2N construction impact zone, noise and vibration of works, fauna are likely to move away from the proposal site, or use vegetated corridors along roads in the area.
Noise	Operation of the MDC would introduce regular noise and vibration into the proposal site, through the movement of trains, trucks and machinery, and through activities such as welding and loading of materials. As described above, noise has been shown to have a variety of impacts on fauna, including changing foraging behaviour, impacting breeding success and changing species occurrences (Barber et al 2009). Species less tolerant to disturbance may be displaced from remaining vegetation in adjacent areas. Other more resilient fauna species typical of disturbed areas are likely to become accustomed to the noise.
Fire	Activities at the MDC will create a risk of fire from sparks. The risk of fires spreading to adjacent habitat areas would be expected to be minimal given the cleared N2N corridor and MDC, and surrounding agricultural land, however a residual risk of fire does exist. The risk of fires spreading to adjacent areas would be minimised through a fire hazard management plan and other measures to contain and control the outbreak of fire.
Biosecurity	Operation of the MDC has the potential to spread weeds and pests. The surroundings of railways (eg verges and embankments) often host a high diversity of non-native species, in many cases due to their transportation as stowaways in or on trains. Introduction and spread of weeds can impact agricultural land and native vegetation. Mitigation measures to minimise the risk of weed introduction and spread are provided in section 7.

6.4 Cumulative impacts

Cumulative impacts can be defined as the successive, incremental, and combined effect of multiple impacts, which may in themselves be minor, but could become significant when considered together. The proposal is for the construction of an MDC adjacent to the N2N project. The N2N project would also remove vegetation and habitat values in the area, increasing the impact on vegetation communities and threatened fauna species. Given the location of the MDC and the adjacent Narromine portion of the N2N project in a predominantly agricultural landscape, the cumulative impacts of the proposal is unlikely to significantly impact any threatened fauna species considered in this assessment.

6.5 Key threatening processes

A key threatening process (KTP) is a process that threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community. A process can be listed as a KTP if it could:

- Cause a native species or ecological community to become eligible for inclusion in a threatened list (other than the conservation dependent category).
- Cause an already listed threatened species or threatened ecological community to become more endangered.
- Adversely affect two or more listed threatened species or threatened ecological communities.

KTPs listed under the BC Act, FM Act and EPBC Act relevant to this proposal are listed in Table 6-3 below. The proposal is not a KTP in itself but would exacerbate KTPs during construction and operation, as detailed in Table 6-3. Mitigation measures to limit the impacts of these KTPs (where possible) are discussed in section 7.

Table 6-3 Key threatening processes

KTP	Listing	Discussion
Clearing of native vegetation	BC Act EPBC Act	The proposal involves the clearing of about 146.30 hectares of native vegetation, of which only 33.72 hectares is in good condition. Given the extent of vegetation removal and further habitat fragmentation in the locality, this would comprise a moderate contribution to the operation of this KTP. Mitigation measures are proposed in section 7 to minimise the impact of the proposal on native vegetation in adjacent areas as far as possible.
Removal of hollows	BC Act	The proposal would result in the removal of hollow-bearing trees during vegetation clearing. Habitat management procedures are recommended to limit impacts on fauna and their habitats (see section 7)
Removal of dead wood and dead trees	BC Act	The proposal would result in the removal and movement of dead wood and dead trees during vegetation clearing. Habitat management procedures are recommended to limit impacts on fauna and their habitats (see section 7)
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners (*Manorina melanocephala)*	BC Act EPBC Act	The Noisy Miner was recorded during field surveys. It is unlikely the proposal would encourage the occupation by the Noisy Miner, and subsequently lead to further impacts on small woodland birds, including threatened species.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	BC Act EPBC Act	Chytrid fungus is a water borne pathogen and could be spread through water or mud on vehicles, machinery, footwear and other equipment. Chytrid invades the skin of frogs causing skin legions, which can kill them or make them susceptible to other threats (e.g. predators, climate change). This highly virulent fungal pathogen of amphibians is capable at a minimum of causing sporadic deaths in some populations, and 100 percent mortality in other populations. While the chance of introducing or spreading this virus is low, mitigation measures to minimise the risk of introduction or spread of Chytrid fungus are proposed in section 7.
Infection of native plants by *Phytophthora cinnamomi*	BC Act EPBC Act	Vegetation clearing activities, in general, have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*) and Myrtle

KTP	Listing	Discussion
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	BC Act	Rust (*Uredo rangelii*) into native vegetation. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. No evidence of these pathogens was observed during surveys. As such, the risk of spread is low, however suitable hygiene protocols are recommended in section 7.
Invasion of native plant communities by exotic perennial grasses	BC Act	Areas of exotic grassland are present within the study area, along with cropped areas, derived native grassland and woodland vegetation. There is the potential for perennial exotic grasses from the wider locality to invade adjacent native vegetation through disturbance during construction impacts of the proposal. The CEMP will include weed management measures and specific consideration of potential impacts on soil, water and native vegetation (see section 7).
Competition from feral honeybees	BC Act	Breeding colonies of honeybees occupy large hollows in trees. These hollows are completely taken over by honeybees and are removed from the pool of hollows available to native species. The proposal is unlikely to spread feral honeybees.
Competition and grazing by the feral European rabbit	BC Act EPBC Act	The Fox was record during field surveys. It is also likely that other feral species including the European Rabbit, goats, pigs and cats also occur, given the broad distribution of these species and the broad fauna habitats present within the proposal site. Further fragmentation of native vegetation may encourage movement of these species. However, given the minor extent of vegetation clearing to occur, this would be minimal.
Competition and habitat degradation by Feral Goats, *Capra hircus* Linnaeus 1758	BC Act	
Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)	BC Act	
Predation by feral cats	BC Act EPBC Act	
Predation by the European Red Fox	BC Act EPBC Act	
Human-caused climate change	BC Act EPBC Act	Vegetation clearing associated with construction of the proposal and combustion of fuels associated with construction and operation would contribute to a minor extent to anthropogenic emissions of greenhouse gases. The proposal would remove about 146.30 hectares of native vegetation. Given the extent of vegetation clearing to occur, exacerbation of this KTP would be minimal

6.6 Impacts on threatened biota listed under the BC Act

The proposal would result in direct impacts on a threatened ecological community and threatened species and their habitats within the proposal site. The potential impacts on

threatened biota are described below with assessments of the significance of impacts included in Appendix C.

6.6.1 Threatened ecological communities

The proposal would impact up 1.07 hectares of PCT 27, which is commensurate with Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed under the BC Act. It does not conform to the EPBC Act listing for the community as it only comprises three trees, is dominated by introduced species in the groundcover and showed no signs of regeneration.

An assessment of the likely significance of impacts of the proposal on Myall Woodland pursuant to Section 7.3 of the BC Act (five-part test) has been prepared and is presented in Appendix C. The outcome of this assessment is that the proposal would be unlikely to have a significant impact on this community, given:

- Up to 1.07 hectares of the community would be removed.
- The proposal would result in a very minor increase in the fragmentation of woodland in the locality.
- The community comprises only three trees, and while in good condition, showed no signs of regeneration and is unlikely to viable in the future
- The removal of hollow-bearing trees and mature trees would be avoided where possible.

Consequently, a SIS is not required for Myall Woodland.

Mitigation measures to minimise impacts on Myall Woodland will be implemented (see section 7.2).

6.6.2 Threatened flora species

No threatened flora have been recorded, or are assumed present within the proposal site, and subsequently none are likely to be impacted directly or indirectly by the proposal. No assessments of significance have been prepared.

6.6.3 Threatened fauna species

An assessment of the likelihood of occurrence of threatened fauna predicted to occur in the locality (attached as Appendix B, and refined in section 5.2.3) found the following threatened fauna species outlined in Table 6-4 have a moderate or high potential to be impacted by the proposal.

Table 6-4 Threatened fauna potentially impacted by the proposal (BC Act)

Species	BC Act status	EPBC Act status	Impact (ha)
Woodland birds			
Black-chinned Honeyeater (eastern subspecies)	V	-	15.85
Brown Treecreeper	V		15.85
Diamond Firetail	V		328.16
Dusky Woodswallow	V		15.85

Species	BC Act status	EPBC Act status	Impact (ha)
Flame Robin	V		15.85
Gilbert's Whistler	V		15.85
Grey-crowned Babbler (eastern subspecies)	V		15.85
Hooded Robin (south-eastern form)	V		15.85
Painted Honeyeater	V	V	15.85
Scarlet Robin	V		15.85
Varied Sittella	V		15.85
Microbats			
Corben's Long-eared Bat	V	V	15.85
Little Pied Bat	V		15.85
Northern Free-tailed Bat	V		15.85
Yellow-bellied Sheathtail-Bat	V		328.16
Arboreal mammals			
Koala	V	E	15.85

As such, assessments of significance pursuant to Section 7.3 of the BC Act (five-part test) have been prepared for these species (refer to Appendix C).

In summary, the outcomes of these assessments conclude that the proposal is unlikely to result in a significant impact on these species, given:

- Only a relatively small area of potentially suitable habitat will be removed from small patches or along narrow linear tracks. Large expanses of suitable habitat occur in adjacent areas.
- Habitat in the locality is highly fragmented, and Koalas, if present, may use habitat in the proposal site as occasional movement habitat on a transient basis only. The proposal would result in minor fragmentation and isolation of the species habitat, mostly from the removal of small woodland patches. Narrow roadside and fence line corridors are present elsewhere in the area, and connectivity would be retained in these areas.
- The presence of an ecologist to supervise vegetation clearing in areas of higher value fauna habitat (e.g. hollow-bearing trees, nests)

Consequently, a SIS would not be required for the above outlined species. Mitigation measures to minimise impacts on these species would be implemented (see section 7.2).

6.7 Impacts on threatened biota listed under the EPBC Act

6.7.1 Threatened ecological communities

No TECs listed under the EPBC Act were recorded in the proposal site, and subsequently none are likely to be impacted directly or indirectly by the proposal. PCTs which can comprise a component of local TECs under the EPBC Act were discounted because the PCTs were not in a suitable condition to meet the EPBC Act criteria (see Table 5-3). No Inland Grey Box or Box Gum Woodland was recorded at the site, although have been recorded in the locality during surveys for the N2N BDAR (see Section 5.3.1). Although no TECs listed under the EPBC Act were recorded in the proposal site, assessments of significance have been prepared.

6.7.2 Threatened flora species

No threatened flora species have been recorded, or are assumed present within the proposal site, and subsequently none are likely to be impacted directly or indirectly by the proposal. No assessments of significance have been prepared.

6.7.3 Threatened fauna species

An assessment of the likelihood of occurrence of threatened fauna predicted to occur in the locality (attached as Appendix B, and refined in section 5.3.3) found the following threatened fauna species outlined in Table 6-4 have a moderate or high potential to be impacted by the proposal.

Table 6-5 Threatened fauna impacted by the proposal (EPBC-Act)

Species	BC Act status	EPBC Act status	Impact (ha)
Painted Honeyeater	V	V	15.85
Corben's Long-eared Bat	V	V	15.85
Koala	V	E	15.85

6.7.4 Migratory fauna species

A critical consideration in assessing the significance of potential impacts on listed migratory species is whether or not a proposed action is likely to affect 'important habitat' (DEE 2017a). No important habitat for any migratory species would be impacted by the proposal. Any migratory species that may occur would be transient individuals and would not rely on the limited wetland or woodland habitat present in the proposal site.

6.7.5 Summary of findings

The assessments of significance of threatened biota listed under the BC Act and/or EPBC Act predicted to occur in the proposal site found that the proposal is unlikely to have a significant impact on any biota listed under the BC or EPBC Act.

7. Mitigation and management measures

7.1 Introduction

Alternatives to the proposal were investigated, as documented in the REF, but were considered unviable due to the size, access, and rail delivery restrictions they each imposed. The construction of the Inland Rail Route is the underlying reason for the proposal and has been informed by detailed environmental, economic and logistical investigations. The proposed MDC requires access to an operational train line, as well as future Inland Rail sections, so that materials can be delivered by train, and minimising traffic impacts to the region.. Therefore, there it was not possible to locate the proposal entirely away from the sensitive environmental receptors identified in this assessment.

Much of the proposal site falls within land which has been cleared or substantially modified. Impacts on native flora and fauna have thus been avoided or minimised to a large extent and are substantially less than would be associated with an undisturbed ‘greenfield’ site. Impacts on native biota will be avoided as far as is practicable through pre-clearing surveys and impact mitigation procedures described below.

7.2 Mitigation of impacts

The proposal would affect a small area of native vegetation including a small area of a TEC in degraded condition, and potential habitat for threatened flora and fauna species. In order to minimise the potential impacts of the proposal on biodiversity, the mitigation measures outlined in Table 7-1 are recommended.

A CEMP (or equivalent) will be prepared by the contractor and approved by ARTC prior to commencement of works. The CEMP will include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures, including the procedures outlined below. The proposed mitigation measures will include environmental safeguards for protection of neighbouring ecological values in accordance with relevant policy documentation and Government guidelines.

In order to address the potential impacts of the proposal on biodiversity as discussed in section 6, the mitigation and management measures outlined in Table 7-1will be implemented as part of the CEMP for the site.

Table 7-1 Safeguards and mitigation measures

Impact	Mitigation	Timing	Responsibility
General	A flora and fauna management sub-plan will be prepared prior to construction and implemented as part of the CEMP. The plan will include measures to manage biodiversity values and minimise the potential for impacts during construction and operation. The plan will be prepared in accordance with the relevant guidelines, legislation and standards and will include, but not be limited to: • Establishing protocols for the staged clearing of vegetation and safe tree-felling and log removal to reduce the risk of fauna mortality. • An unexpected finds protocol. • Processes for notification of a wildlife rescue organisation (e.g. WIRES) in case any injured fauna are found. All animals encountered will be treated humanely, ethically, and in accordance with relevant codes under the *NSW Prevention of Cruelty to Animals Act 1979.*	Prior to commencement of construction	Site contractor, ARTC
	All workers will be provided with an environmental induction prior to starting work on site. This will include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches.	Prior to clearing/site works.	Site contractor
	Measures to suppress dust, prevent erosion and sedimentation will be implemented during clearing and site work.	Throughout construction and operation phases	Site contractor
	Temporary stockpiles are to be located within cleared areas (and not within areas of adjoining native vegetation) or within the dripline of trees.	Construction and operation	Site contractor
Vegetation clearing	A suitably qualified ecologist is to be present during clearing activities in order to manage the rescue or relocation of fauna as necessary. If a Koala is observed in the area during vegetation clearing, works are to cease and not recommence until the Koala has moved on of its own accord. •	Prior to commencement of clearing	Site contractor

Impact	Mitigation	Timing	Responsibility
	Disturbance of vegetation will be limited to the minimum necessary to undertake the proposal.	During clearing	Site contractor
	Suitable bush rock habitat, hollow-bearing logs or limbs, and woody debris will be relocated to nearby adjacent areas outside of the proposal site footprint by the supervising ecologist or contractor	Prior to and during clearing works	Site contractor and qualified ecologist
Introduction of weeds and pathogens	A weed and pest species management protocol will be prepared as part of the CEMP to manage weeds and pathogens during site activities. It will include, but not be limited to, the following: • Process to identify, control and remove all priority weeds in accordance with the requirements of the *Biosecurity Act 2015*. • Process to minimise the introduction and spread of weeds, such as exclusion areas for native vegetation, driving instructions etc. • Communication of responsibilities of all site personnel regarding the management of weeds and pathogens through site inductions and toolbox talk meetings. • Measures to ensure all trucks transporting weed waste from the site are covered to avoid the spread of weed-contaminated material, Disposal must be documented, and evidence of appropriate disposal must be kept.	Prior to commencement of clearing	Site contractor
	All machinery entering the site must be appropriately washed down and disinfected prior to mobilisation on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust (*Pucciniales fungi*), in accordance with the national best practice guidelines for Phytophthora (O'Gara et al. 2005) and the Myrtle Rust factsheet (DPI 2015b) for hygiene control. Daily and weekly weed inspections of vehicles should also be undertaken and documented as part of the CEMP.	Prior to any plant or machinery being brought onto the site	Site contractor
	Protocols to prevent introduction or spread of chytrid fungus will be implemented following *Hygiene guidelines for wildlife, Protocols to protect priority biodiversity areas in NSW from Phytophthora cinnamomi, myrtle rust, amphibian chytrid fungus and invasive plants* (DPIE, 2020).	Prior to clearing/ throughout site works	Site contractor

Impact	Mitigation	Timing	Responsibility
Sedimentation run-off leaving the site following storm events	Sediment controls are to be established around the proposal site perimeter as a minimum, in accordance with the Blue Book and the contractor's EMP. Measures will be implemented to minimise the risk of movement of materials in the event of a significant rainfall, such as covering stockpiles with impervious covers (tarps) or temporary trenching upslope of stockpiles to diver surface runoff around stockpiles. In the event of forecast heavy rainfall, works will be postponed to prevent the potential for sediment laden run-off into adjacent properties or waterways.	Prior to clearing/ throughout site works	Site contractor

8. Conclusion

The proposal involves the construction and operation of a Material Distribution Centre (MDC) through the delivery and management of concrete sleepers, rail shorts and ballast from the MDC to sections of the Inland Rail Route as required through train and road vehicle movements. It also involves the subdivision of 5 into 2 lots.

The proposal site is located immediately to the north of the proposed N2N construction impact zone and primarily comprises cropped areas and exotic grassland and derived native grassland. Native vegetation types including shrubby grasslands, derived native grasslands and grassy and shrubby woodlands also occur.

The proposal could remove and disturb up to 146.30 hectares of native vegetation, of which only 15.85 hectares contains a semi-intact canopy. The proposal would remove up to 1.07 hectares of Weeping Myall Woodland listed under the BC Act. The removal of 15.85 ha of woodland would remove potential habitat for a variety of threatened biota such as small woodland birds and microbats, as well as the Koala.

Assessments of significance were completed with reference to section 1.7 of the EP&A Act and section 7.3 of the BC Act for threatened ecological communities, woodland birds, microbats and the Koala. The assessments concluded the proposal is unlikely to have a significant impact on threatened biota listed under the BC Act and therefore a SIS or a BDAR is not required.

Assessments of significance were also prepared for threatened biota listed under the EPBC Act. The proposal is also unlikely to have a significant impact on any biota listed under the EPBC Act, such as the Koala or Corben's Long-eared Bat.

A number of safeguards and mitigation measures are proposed, including the implementation of a CEMP, to minimise the impacts of the proposal on native flora and fauna, including threatened ecological communities and species known, and likely to occur in the study area.

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APPENDIX

A

Biodiversity Assessment Report

Appendix A Species recorded during surveys

NARWONAH MATERIAL DISTRIBUTION CENTRE REVIEW OF ENVIRONMENTAL FACTORS

Flora species recorded during surveys

GF	Family	Exotic	Scientific name	Common Name	T1-P20			T1-P21		T1-P22		J1	J2		J3		Not in plot
					%	Ab	%	Ab	%	Ab	%	Ab	%	Ab	%	Ab	
FG	Amaranthaceae		*Alternanthera denticulata*	Lesser Joyweed	0.1	20	0.1	10									
EX	Asteraceae	*	*Arctotheca calendula*	Capeweed	0.1	5			0.1	20	0.1	1			0.2	30	
FG	Asteraceae		*Calotis cuneifolia*	Purple Burr-Daisy									0.1	10	0.1	2	
FG	Asteraceae		*Calotis hispidula*	Bogan Flea	0.1	1											
FG	Asteraceae		*Calotis lappulacea*	Yellow Burr-daisy	0.1	2					5	100	1	50	0.2	10	
HT	Asteraceae	*	*Carthamus lanatus*	Saffron Thistle					0.1	50	0.2	20	0.1	5	0.2	20	
EX	Asteraceae	*	*Conyza sumatrensis*	Tall fleabane							0.1	10	0.1	5			
FG	Asteraceae		*Eclipta platyglossa*	-	0.1	2											
EX	Asteraceae	*	*Hedypnois rhagadioloides*	Cretan Weed					0.1	20							
EX	Asteraceae	*	*Hypochaeris radicata*	Catsear							0.1	50	0.2	50			
EX	Asteraceae	*	*Sonchus oleraceus*	Common Sowthistle									0.1	1			
EX	Asteraceae	*	*Taraxacum officinale*	Dandelion									0.1	1	0.1	1	
FG	Asteraceae		*Vittadinia cuneata*	A Fuzzweed							1	200	0.1	10	0.1	3	
EX	Boraginaceae	*	*Echium plantagineum*	Patterson's Curse									5	200	2	200	
EX	Brassicaceae	*	*Brassica* spp.	Brassica									1	20	0.1	10	
EX	Brassicaceae	*	*Lepidium africanum*	Common Peppercress							0.1	10	0.2	20	0.2	20	
HT	Boraginaceae	*	*Heliotropium amplexicaule*	Blue Heliotrope					0.1	1							
FG	Campanulaceae		*Lobelia concolor*	Poison Pratia			0.1	1									
FG	Campanulaceae		*Lobelia purpurascens*	Whiteroot	0.1	10											
FG	Campanulaceae		*Wahlenbergia communis*	Tufted Bluebell					0.1	20							
FG	Campanulaceae		*Wahlenbergia gracilis*	Sprawling Bluebell	0.1	5											
TG	Casuarinaceae		*Allocasuarina luehmannii*	Bulloak	20	4											
SG	Chenopodiaceae		*Atriplex semibaccata*	Creeping Saltbush											0.1	2	
EX	Chenopodiaceae	*	*Chenopodium* spp.	Goosefoot, Crumbweed							1	20	0.1	5			
FG	Chenopodiaceae		*Dysphania pumilo*	Small Crumbweed					0.1	5							
FG	Chenopodiaceae		*Einadia nutans*	Climbing Saltbush							1	20			0.1	1	
FG	Chenopodiaceae		*Einadia polygonoides*	-			0.1	1									
FG	Chenopodiaceae		*Einadia trigonos*	Fishweed									15	200	1	20	
SG	Chenopodiaceae		*Enchylaena tomentosa*	Ruby Saltbush							0.1	4			0.1	2	
FG	Chenopodiaceae		*Maireana enchylaenoides*	Wingless Bluebush	0.1	10					0.1	5					
SG	Chenopodiaceae	0	*Maireana microphylla*	Small-leaf Bluebush											0.1	6	
SG	Chenopodiaceae	0	*Salsola australis*	-							0.1	3					
SG	Chenopodiaceae		*Sclerolaena birchii*	Galvanized Burr	0.1	5			0.1	1	15	100	15	400	3	100	

GF	Family	Exotic	Scientific name	Common Name	T1-P20		T1-P21		T1-P22		J1	J2		J3		Not in plot
					%	Ab	%	Ab	%	Ab	%	Ab		%	Ab	%	Ab	
SG	Chenopodiaceae		*Sclerolaena muricata*	Black Rolypoly	0.1	20	0.1	10			0.1	10	0.2	10				
OG	Convolvulaceae		*Convolvulus erubescens*	Blushing Bindweed	0.1	2			0.1	5			0.1	3	0.1	6		
FG	Convolvulaceae		*Dichondra repens*	Kidney Weed	0.1	20	0.1	5					2	200	0.1	5		
EX	Crassulaceae	*	*Crassula* spp.	Stonecrop											0.1	5		
EX	Cucurbitaceae	*	*Cucumis myriocarpus* subsp. *leptodermis*	Paddy Melon									0.1	1				
GG	Cyperaceae		*Carex inversa*	-	5	100	0.1	20										
GG	Cyperaceae		*Eleocharis* spp.	Spike-rush, Spike-sedge							0.2	100						
GG	Cyperaceae		*Fimbristylis dichotoma*	Common Fringe-sedge	0.1	20												
FG	Euphorbiaceae		*Euphorbia drummondii*	Caustic Weed					0.1	10								
TG	Fabaceae		*Acacia pendula*	Weeping Myall														X
OG	Fabaceae		*Glycine clandestina*	-	0.1	5	0.1	5										
EX	Fabaceae (Faboideae)	*	*Medicago arabica*	Spotted Burr Medic							0.1	2	0.1	5				
EX	Fabaceae (Faboideae)	*	*Medicago laciniata*	Cut-leaved Medic									0.1	5				
EX	Fabaceae	*	*Medicago polymorpha*	Burr Medic	0.1	2												
FG	Fabaceae		*Neptunia gracilis*	Native Sensitive Plant					0.1	20								
EX	Fabaceae	*	*Trifolium arvense*	Haresfoot Clover					0.1	10								
EX	Fabaceae (Faboideae)	*	*Trifolium* spp.	A Clover											0.1	1		
FG	Geraniaceae		*Erodium crinitum*	Blue Storksbill	0.1	10	0.1	20			0.1	30	2	100	1	100		
GG	Juncaceae		*Juncus subsecundus*	-	0.1	10	0.1	5	0.1	10								
EX	Malvaceae	*	*Malva parviflora*	Small-flowered Mallow									0.1	5	0.1	5		
FG	Malvaceae		*Sida corrugata*	Corrugated Sida	0.1	20					0.1	5	0.1	5				
FG	Malvaceae		*Sida hackettiana*	Golden Rod	0.1	3	0.1	20										
EX	Malvaceae	*	*Sida* spp.	-									0.1	5	0.1	1		
EG	Marsileaceae		*Marsilea drummondii*	Common Nardoo	1	1												
SG	Myoporaceae		*Eremophila debilis*	Amulla									0.1	1				
TG	Myrtaceae		*Eucalyptus pilligaensis*	Narrow-leaved Grey Box	0.1	2			0.1	1			25	3	2	1		
TG	Myrtaceae		*Eucalyptus populnea* subsp. *bimbil*	Bimble Box							2	2						
FG	Nyctaginaceae		*Boerhavia dominii*	Tarvine					0.1	5								
FG	Oxalidaceae		*Oxalis exilis*	-	1	50			40	200								
FG	Oxalidaceae		*Oxalis perennans*	-									0.1	2	0.1	5		
GG	Poaceae		*Aristida ramosa*	Purple Wiregrass					0.1	20	5	100			0.2	10		
GG	Poaceae		*Austrostipa scabra*	Speargrass					0.1	5	20	300	5	200	10	300		
GG	Poaceae		*Austrostipa* spp.	A Speargrass							1	50						
GG	Poaceae		*Austrostipa verticillata*	Slender Bamboo Grass									8	50				
EX	Poaceae	*	*Avena barbata*	Bearded Oats					0.1	5								
EX	Poaceae	*	*Bromus molliformis*	Soft Brome	1	50												

GF	Family	Exotic	Scientific name	Common Name	T1-P20		T1-P21		T1-P22		J1	J2		J3		Not in plot
					%	Ab	%	Ab	%	Ab	%	Ab	Ab	%	Ab	
GG	Poaceae		*Chloris truncata*	Windmill Grass	1	100										
GG	Poaceae		*Chloris ventricosa*	Plump Windmill Grass					0.1	10			5	200		
GG	Poaceae		*Cynodon dactylon*	Couch					1	200					15	500
GG	Poaceae		*Digitaria brownii*	Cotton Panic Grass					0.1	10						
GG	Poaceae		*Digitaria divaricatissima*	Umbrella Grass	1	50	0.1	50								
GG	Poaceae		*Enteropogon acicularis*	Curly Windmill Grass					0.1	20	5	100	30	500	30	500
EX	Poaceae	*	*Eragrostis cilianensis*	Stinkgrass									0.2	50		
GG	Poaceae		*Eragrostis parviflora*	Weeping Lovegrass							10	200	10	300	20	500
GG	Poaceae		*Eragrostis lacunaria*	Purple Lovegrass	0.1	20										
EX	Poaceae	*	*Hordeum leporinum*	Barley Grass	5	200	0.1	20								
EX	Poaceae	*	*Lolium perenne*	Perennial Ryegrass			2	50								
EX	Poaceae	*	*Lolium rigidum*	Wimmera Ryegrass									15	1000	5	300
GG	Poaceae		*Panicum effusum*	Hairy Panic							0.2	20			2	100
GG	Poaceae		*Paspalidium distans*	-									5	100	10	300
GG	Poaceae		*Paspalidium jubiflorum*	Warrego Grass	0.5	30										
GG	Poaceae		*Rytidosperma fulvum*	Wallaby Grass			0.1	20								
GG	Poaceae		*Rytidosperma racemosum*	-			0.2	50								
GG	Poaceae		*Rytidosperma richardsonii*	Straw Wallaby-grass							0.2	50				
GG	Poaceae		*Sporobolus caroli*	Fairy Grass							0.1	5				
SG	Polygonaceae		*Duma florulenta*	Lignum	0.1	10					0.1	2				
FG	Polygonaceae		*Rumex brownii*	Swamp Dock			0.1	2					0.1	1		
FG	Polygonaceae	*	*Rumex* spp.	Dock											0.1	1
EG	Pteridaceae		*Cheilanthes* spp.	Cloak Fern, Mulga Fern, Rock Fern											0.1	4
HT	Solanaceae	*	*Lycium ferocissimum*	African Boxthorn	0.1	10	0.1	20	0.1	50						

Fauna species recorded in the study area

Scientific Name	Common Name	NSW Status	EPBC Status	Observation type
Crinia signifera	Common Eastern Froglet			W
Crinia parinsignifera	Eastern Sign-bearing Froglet			W
Litoria peronii	Emerald-spotted Tree Frog			W
Limnodynastes tasmaniensis	Spotted Grass Frog			W
Struthidea cinerea	Apostlebird			O
Cracticus tibicen	Australian Magpie			O
Corvus coronoides	Australian Raven			O
Chenonetta jubata	Australian Wood Duck			O
Milvus migrans	Black Kite			O
Cincloramphus cruralis	Brown Songlark			W
Nymphicus hollandicus	Cockatiel			O
Sturnus vulgaris	Common Starling	*		O
Ocyphaps lophotes	Crested Pigeon			O
Tyto javanica	Eastern Barn Owl			O
Platycercus eximius	Eastern Rosella			O
Petrochelidon ariel	Fairy Martin			N
Cacomantis flabelliformis	Fan-tailed Cuckoo			W
Eolophus roseicapillus	Galah			O
Rhipidura albiscapa	Grey Fantail			W
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V		O
Dacelo novaeguineae	Laughing Kookaburra			W
Corvus mellori	Little Raven			W
Grallina cyanoleuca	Magpie-lark			O
Falco cenchroides	Nankeen Kestrel			O
Manorina melanocephala	Noisy Miner			O
Anas superciliosa	Pacific Black Duck			O
Ardea pacifica	Pacific Heron			O
Cracticus nigrogularis	Pied Butcherbird			O
Psephotus haematonotus	Red-rumped Parrot			O
Pardalotus striatus	Striated Pardalote			W
Cacatua galerita	Sulphur-crested Cockatoo			O
Malurus cyaneus	Superb Fairy-wren			O
Podargus strigoides	Tawny Frogmouth			O
Aquila audax	Wedge-tailed Eagle			O
Smicrornis brevirostris	Weebill			W
Gerygone fusca	Western Gerygone			W
Corcorax melanorhamphos	White-winged Chough			O
Rhipidura leucophrys	Willie Wagtail			O
Acanthiza chrysorrhoa	Yellow-rumped Thornbill			O
Macropus giganteus	Eastern Grey Kangaroo			O
Tachyglossus aculeatus	Short-beaked Echidna			O
Cryptoblepharus pannosus	Ragged Snake-eyed Skink			O
Tiliqua rugosa	Shingle-back			O

Key: V – vulnerable, O – observed, W – heard, N - nest

APPENDIX

A

Biodiversity Assessment Report

Appendix B Likelihood of occurrence assessment

NARWONAH MATERIAL DISTRIBUTION CENTRE REVIEW OF ENVIRONMENTAL FACTORS

Appendix B - Likelihood of occurrence assessment

An evaluation of the likelihood and extent of impact to threatened and migratory fauna (BC Act threatened species); and within a 10 kilometre radius of the proposal site (EPBC Act threatened and migratory species). Records are from the EPBC Protected Matters Search Tool available from the Department of Agriculture, Water and the Environment (DAWE) website and the NSW BioNet Wildlife Atlas. Ecology information has been obtained from the Threatened Species Profiles on the NSW BCD website (http://www.environment.nsw.gov.au/threatenedspecies/) and from the Species Profiles and Threats Database on the Commonwealth DAWEE website (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl).

Likelihood of occurrence in study area

Recorded/present – The species was observed in the study area during the current survey.

Likely – It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (within 10 kilometres) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.

Possible – Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.

Unlikely – It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (within 10 kilometres). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area, or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.

None – Suitable habitat is absent from the study area.

Likelihood of impact

Low –The proposal would have a low possibility of impact on this species/community or its habitats. No five-part test is required for this species/community.

Moderate – The proposal would have a moderate possibility of impact on this species/community or its habitats. Further consideration of impacts via an Assessment of significance is required for this species/community.

High – The proposal would have a high possibility of impact on this species/community or its habitats. Further consideration of impacts via an Assessment of significance is required for this species/community.

Likelihood of occurrence of threatened flora species predicted to occur in the locality

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Austrostipa wakoolica	-	E	E	Species or species habitat may occur within 10km (DAWE, 2021)	Confined to floodplains of the Murray River tributaries of central and south-western NSW, in open woodland on grey, silty clay or sandy loam soils. Habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. Associated species include White Cypress Pine, Grey Box, Bimble Box, *Austrostipa eremophila*, *A. drummondii*, *Austrodanthonia eriantha* and Climbing Saltbush. Flowers from October to December.	**Unlikely:** Only marginally suitable habitat present, not recorded locally.	**Low**
Bertya opponens	Coolabah Bertya	V	V	Species or species habitat may occur regionally (OEH, 2022)	Known from three scattered sites in NSW: near Coolabah in western NSW, and two locations south of Narrabri. A fourth population near Cobar is considered possibly extinct. Occurs in a range of habitats including stony mallee ridges and cypress pine forest on red soils. Associated species at Jacks Creek SF (largest population) include Dirty Gum, White Cypress Pine and Red Ironbark. Flowering time is July and August.	**Unlikely**: Outside of geographic range. No habitat or PCTs associated with, or likely to support this species is present.	**Low**
Commersonia procumbens	-	V	V	Species or species habitat may occur within 10km (DAWE, 2021)	Mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas and recent collections from the Upper Hunter. Grows on sandy soils, often on roadsides. Has been recorded in Tumbledown Red Gum and Mugga Ironbark communities, Broombush scrub, under mallee eucalypts with a Common Fringe-myrtle understorey, and in a recently burnt Ironbark and Callitris area. Also, in *Eucalyptus fibrosa subsp. nubila*, Tumbledown Red Gum, White Box and White Cypress Pine woodlands north of Dubbo.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species is present.	**Low**

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Dichanthium setosum	Bluegrass	V	V	Species or species habitat may occur within 10km (DAWE, 2021)	Occurs on the New England Tablelands, North-west Slopes and Plains and the Central-west Slopes. Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Appears to have wide environmental tolerances.	**Unlikely:** No habitat or PCTs associated with, or likely to support this species is present.	**Low**
Digitaria porrecta	Finger Panic Grass	E	-	Species or species habitat known to occur regionally (OEH, 2022)	In NSW found on the North-West Slopes and Plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran. Inhabits native grasslands, woodland and open forests with grassy understorey on richer soils. Often found along roadsides and travelling stock routes where there is light grazing and occasional fire.	**Unlikely**: Minimal suitable grassy woodland or grassland habitat, or PCTs associated with this species occur in the proposal site. Outside geographic range	**Low**
Diuris tricolor	Pine Donkey Orchid	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Sporadic distribution on the western slopes of NSW, from south of Narrandera to the Queensland border. The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris* spp.). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Associated species include White Cypress Pine, Bimble Box, Gum Coolibah, Ironbark and Acacia shrubland.	**Unlikely**: Some suitable grassy woodland habitat present but no suitable soils.	**Low**

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Eriocaulon australasicum	Austral Pipewort	E	E	Species or species habitat known to occur regionally (OEH, 2022)	Known in NSW from widely separated populations: a very early “Murray River” collection and recent collections near Braidwood and in the Pilliga. Known from very few collections, with the type of habitat described as “wet places along the Murray towards junction of Murrumbidgee". It grows in mud in ephemeral water bodies. Adequate survey of the species is highly dependent on rainfall and should be surveyed when ephemeral wet areas are receding.	**Unlikely:** Outside of geographic area No records for the species in the locality	**Low**
Euphrasia arguta	-	CE	CE	Species or species habitat known to occur regionally (OEH, 2022)	Recently rediscovered near Nundle on the north-western slopes and tablelands, once known from scattered locations between Sydney, Bathurst and Walcha. Known populations occur in eucalypt forest with a mixed grass/shrub understorey, while previous records are described as occurring in open forest, grassy country and river meadows. Dense stands observed in cleared firebreak areas, suggesting it may respond well to disturbance.	**Unlikely:** Outside of geographic area No records for the species in the locality	**Low**
Homopholis belsonii	Belson's Panic	E	V	Species or species habitat known to occur regionally (OEH, 2022)	Occurs on the northwest slopes and plains of NSW, mostly between Wee Waa, Goondiwindi and Glen Innes. Grows in dry woodland often on poor soils though also found in basalt-enriched sites and alluvial clay soils.	**Unlikely:** Outside of geographic area No records for the species in the locality	**Low**
Homoranthus darwinioides	Fairy Bells	V	V	Species or species habitat may occur within 10km (DAWE, 2021)	Rare in the central tablelands and western slopes, occurring from Putty to the Dubbo area. Grows in various woodland habitats with shrubby understoreys, usually in gravelly sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species occurs in the proposal site. No records for the	**Low**

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
						species in the locality.	
Indigofera efoliata	Leafless Indigo	E	E	Species or species habitat known to occur regionally (OEH, 2022)	Very rare and possibly extinct, known only from a few records near Dubbo. Recorded in Goonoo State Forest in *Eucalyptus crebra* and *Callitris glaucophylla* dry sclerophyll forest, and in *Eucalyptus microcarpa* and *Callitris glaucophylla* tall woodland. Herbarium records note the species as growing on slight rises amongst ironstone formation in stony red-brown sandy loam.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species is present. No records for the species in the locality.	**Low**
Lepidium aschersonii	Spiny Peppercress	V	V	Species or species habitat may occur within 10km (DAWE, 2021)	Occurring in the marginal central-western slopes and north-western plains regions of NSW. Found on ridges of gilgai clays dominated by *Acacia harpophylla*, *Casuarina cristata*, *Allocasuarina luehmannii* and *Eucalyptus microcarpa*, with the understorey often dominated by introduced plants. Grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense, with sparse grassy understorey with introduced plants and occasional heavy litter.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species is present. No records for the species in the locality.	**Low**
Lepidium monoplocoides	Winged Peppercress	E	E	Species or species habitat may occur within 10km (DAWE, 2021)	Widespread in the semi-arid western plains regions of NSW. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Highly dependent on seasonal conditions, particularly rainfall. Occurs in periodically flooded and waterlogged habitats and does not tolerate grazing disturbance.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species occurs within the proposal site.	**Low**

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Monotaxis macrophylla	Large-leafed Monotaxis	E	-	Species or species habitat known to occur regionally (OEH, 2022)	Recorded from highly disjunct populations in NSW: Deua NP, the Cobar area, the Tenterfield area, Woodenbong and Bemboka portion of South-East Forests NP. Associated with a diverse range of communities in NSW, including coastal heath, arid shrubland, forests and montane heath. Species not found in absence of fire in NSW.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species occurs within the proposal site.	**Low**
Myriophyllum implicatum	-	CE	-	Species or species habitat known to occur regionally (OEH, 2022)	Previously thought to be extinct in NSW but recently discovered in the Pilliga National Park, south of Narrabri. Found in a large open partly inundated gilgai depression on cracking clay soil. Occurs in moist situations, extending away from fresh water.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species occurs within the proposal site.	**Low**
Polygala linariifolia	Native Milkwort	E	-	Species or species habitat known to occur regionally (OEH, 2022)	Found on the NSW north coast near Casino and Kyogle, and there is an isolated population in far western NSW near Weebah Gate, west of Hungerford. Grows in sandy soils in dry eucalypt forest and woodland with a sparse understorey. Recorded from the Inverell and Torrington districts growing in dark sandy loam on granite in shrubby forest of *Eucalyptus caleyi, Eucalyptus dealbata* and Callitris, and in yellow podsolic soil on granite in layered open forest. Recorded in Fuzzy Box woodland, White Cypress Pine - Bulloke - Ironbark woodland, RoughA-barked Apple riparian forb-grass open forest, and Ironbark - Brown Bloodwood shrubby woodland in the Pilliga area.	**Unlikely:** Only marginal suitable habitat in the study area	**Low**

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Pomaderris queenslandica	Scant Pomaderris	E	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widespread but uncommon in northeast NSW and in Queensland. Known only from a few locations on the New England Tablelands and northwest slopes, including near Torrington and Coolatai, and from the NSW north coast. Inhabits moist eucalypt forest or sheltered woAodlands with a shrubby understorey, and occasionally along creeks.	**Unlikely:** No suitable higher for the species in the study area.	**Low**
Prasophyllum petilum	Tarengo Leek Orchid	E	E	Species or species habitat may occur within 10km (DAWE, 2021)	Known from five sites near Boorowa, Queanbeyan area, Ilford, Delegate and west of Muswellbrook. Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Grows in grassy woodland in association with River Tussock, Black Gum and tea-trees near Queanbeyan and within grassy ground layer dominated by Kanagroo Grass under Box-Gum Woodland at Ilford. Flowers in October at Boorowa and Ilford, and December at sites near Queanbeyan and Delegate.	**Unlikely:** Not know from the region, and habitat within the proposal site is not known to support the species	**Low**
Prasophyllum sp. Wybong (C.Phelps ORG 5269)	-	-	CE	Species or species habitat may occur within 10km (DAWE, 2021)	Leek orchids are generally found in shrubby and grassy habitats in dry to wet soil (Jones 2006). *Prasophyllum sp*. Wybong is known to occur in open eucalypt woodland and grassland (Holzinger, pers. comm. 2006; Copeland, pers. comm. 2009 in TSSC 2009).	**Unlikely:** Minimal habitat associated with, or likely to support this species occurs within the proposal site.	**Low**
Pterostylis cobarensis	Greenhood Orchid	V	-	Species or species habitat may occur within 10km (OEH, 2022)	Recorded from Bourke, Nyngan, Cobar, Nymagee, Warren, Gilgandra, Narrabri and Coonabarabran districts. Grows in eucalypt woodlands, open mallee or Callitris shrublands on low stony ridges in skeletal sandy loam soils.	**Unlikely**: Minimal habitat or PCTs associated with, or likely to support this species occurs within the proposal site but these are degraded.	**Low**

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Swainsona murrayana	Slender Darling-pea	V	V	Species or species habitat likely to occur within 10km (DAWE, 2021)	Found throughout NSW, recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree. Grows in a variety of soil and vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Also found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.	**Unlikely**: Minimal habitat or PCTs associated with, or likely to support this species occurs within the proposal site but these are degraded.	**Low**
Swainsona recta	Small Purple-Pea	E	E	Species or species habitat may occur within 10km (DAWE, 2021)	Historically found in Carcoar, Culcain and Wagga Wagga. Populations still exist in Queanbeyan and Wellington-Mudgee area. Also known from the ACT and a single population in Victoria. Grows in open forest dominated by Red gum, Yellow Box, Candlebark Gum and Long-leaf Box.	**Unlikely**: Minimal habitat or PCTs associated with, or likely to support this species occurs within the proposal site.	**Low**
Swainsona sericea	Silky Swainson-pea	V	-	Species or species habitat known to occur regionally (OEH, 2022)	Silky Swainson-pea has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Its stronghold is on the Monaro. Also found in South Australia, Victoria and Queensland. Found in Natural Temperate Grassland and Snow Gum Eucalyptus pauciflora Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South-West Slopes. In the region, known from Box-Gum woodland and occasionally Callitris grassy habitats.	**Unlikely**: Only marginal suitable habitat present associated with, or likely to support this species occurs within the proposal site.	**Low**

Scientific name	Common name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Thesium australe	Austral Toadflax	V	V	Species or species habitat known to occur regionally (OEH, 2022)	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland or grassy woodland and is often found in association with Kangaroo Grass.	**Unlikely**: Outside of geographic area, no habitat or PCTs associated with, or likely to support this species occurs the proposal site.	**Low**
Tylophora linearis	-	V	E	Species or species habitat known to occur within 10km (DAWE, 2021)	Majority of records occur in the central western region from Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil and Eura State Forests, Coolbaggie NR, Goobang NP and Beni SCA. Grows in dry scrub and open forest on low-altitude sedimentary flats. Use flowers and fruit to locate and identify. Easily confused with other climbers when not in flower or fruit.	**Unlikely**: No habitat or PCTs associated with, or likely to support this species occurs within the proposal site.	**Low**
Zieria ingramii	Keiths Zieria	E	E	Species or species habitat known to occur regionally (OEH, 2022)	Known predominately from Goonoo SCA northeast of Dubbo, also known to occur west of Tuckland State Forest. Grows in dry sclerophyll forest on light sandy soils. All known populations have been recorded in Eucalyptus-Callitris woodland or open forest with a shrubby to heathy understorey.	**Unlikely**: Only marginal habitat or PCTs associated with, or likely to support this species occurs within the proposal site.	**Low**

Likelihood of occurrence of threatened and migratory fauna predicted to occur in the locality

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
BIRDS							
Australasian Bittern	*Botaurus poiciloptilus*	E	E	Species or species habitat known to occur within 10km (DAWE, 2021)	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. The Species favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha spp*.) and spikerushes (*Eleocharis spp*.), it hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. The species may construct feeding platforms over deeper water from reeds trampled by the bird; platforms are often littered with prey remains.	**Unlikely:** No suitable wetland areas present. Various farm dams, generally with little emergent vegetation may be in vicinity	**Low**
Australian Bustard	*Ardeotis australis*	E	-	Species or species habitat known to occur within 10km (OEH, 2022)	Occurs in inland Australia. In NSW mainly found in the north-west corner, less often in the lower western and central west plains regions, with occasional vagrants east to the western slopes and riverine plain. Breeding confined to the north-west region. Mainly inhabits tussock and hummock grasslands, also occurs in low shrublands and low open grassy woodlands. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and shrubland cover. Travels long distances, presumably in response to habitat and climatic conditions.	**Unlikely:** On eastern edge of distribution, minimal suitable habitat. Not observed during surveys in the study area.	**Low**
Australian Painted Snipe	*Rostratula australis*	E	E	Species or species habitat known to occur within 10km (DAWE, 2021)	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	**Unlikely:** On eastern edge of distribution, no suitable habitat	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Barking Owl	*Ninox connivens*	V	-	Species or species habitat known to occur within 10km (DAWE, 2021)	Found throughout continental Australia except for the central arid regions. Occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Sometimes extends home range into urban areas. Inhabit woodland and open forest, including fragmented remnants and partly cleared farmland. Flexible in its habitat use, hunting can extend in to closed forest and more open areas. Typically roosts in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species.	**Possible**: Only foraging habitat likely present in the site. Could breed and roost along large watercourses in surrounding areas, where large hollows are present.	**Low**
Black-Breasted Buzzard	*Hamirostra melanosternon*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Sparsely distributed in areas of less than 500mm rainfall, north from north-western NSW. Inhabits a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Breeds from August to October near water in a tall tree.	**Possible**: Scattered records in locality. Considered a vagrant to the area. Potential foraging habitat present only.	**Low**
Black Falcon	*Falco subniger*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widely, but sparsely, distributed in NSW, mostly occurring in inland regions. Occurs in plains, grasslands, foothills, timbered watercourses, wetland environs, crops, and occasionally over towns and cities. Breeding occurs along timbered waterways in in land areas.	**Possible**: Scattered records around Narromine. Could breed along large watercourses in locality. Potential foraging habitat present.	**Low**
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widespread in NSW, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. Recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, but very rare in the latter. Occupies mostly upper levels of drier open	**Possible**: Likely to occur in largest woodland remnants in landscape where nectar resources are abundant. May use habitat in the proposal site as a stepping stone between other areas of better quality habitat.	**Moderate**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tetricornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.		
Black-necked Stork	*Ephippiorhynchus asiaticus*	E	-	Species or species habitat known to occur within 10km (OEH, 2022)	In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Buladelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	**Unlikely**: No suitable wetland areas present. Various farm dams, generally with little emergent vegetation are present.	**Low**
Blue-billed Duck	*Oxyura australis*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widespread in NSW, but most common in the southern Murray-Darling Basin area. Disperses during the breeding season to deep swamps up to 300 km away, and generally seen in coastal areas only during summer or in drier years. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	**Unlikely**: No suitable wetland areas present. Various farm dams, generally with little emergent vegetation are present.	**Low**
Brolga	*Grus rubicunda*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. Very sparse distribution across the southern part of its range. Dependent on wetlands for foraging, especially shallow swamps, but also feed in dry grassland, ploughed paddocks and even desert claypans.	**Unlikely**: May only occur on occasion in dry grasslands and sub-optimal dam habitat.	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-	1 recording within 10km. Species or species habitat known to occur within 10km (OEH, 2022)	The western boundary of the range of the Brown Treecreeper runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper which then occupies the remaining parts of the state. The species is often found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	**Possible:** Potential foraging and breeding habitat in woodland only where woody debris is present.	**Moderate**
Bush Stone-curlew	*Burhinus grallarius*	E	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and, in the south-east, it is either rare or extinct throughout its former range. It inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber, its diet consists of insects and small vertebrates, such as frogs, lizards and snakes. It is largely nocturnal, being especially active on moonlit nights and nests on the ground in a scrape or small bare patch.	**Unlikely:** Degraded habitat unlikely to support this species	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Diamond Firetail	*Stagonopleura guttata*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South-Western Slopes and the North-West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. Scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities, and often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	**Possible:** Potential foraging habitat throughout. Breeding habitat restricted to woodlands.	**Moderate**
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Dusky Woodswallow is widespread from the coast to inland, including the western slopes of the Great Dividing Range and farther west. It is often recorded in woodlands and dry open sclerophyll forests, and has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. It is also recorded in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. The nest is an open shallow untidy cup frequently built in an open hollow, crevice or stump. Although Dusky Woodswallows have large home ranges, individuals may spend most of their time in about a 2 hectare range and defend an area about 50 m around the nest. Dusky Woodswallows prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (*Manorina*	**Possible:** Potential foraging habitat throughout. Breeding habitat restricted to woodlands.	**Moderate:**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					melanocephala) is a significant threat to this species.		
Eastern Osprey	*Pandion cristatus*	V	-	Species or species habitat may occur within 10km (OEH, 2022)	Eastern Ospreys are found right around the Australian coastline, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. The species favour coastal areas, especially the mouths of large rivers, lagoons and lakes. The species breeds in NSW from July to September.	**Unlikely:** Outside usual distribution. May occur on rare occasions.	**Low**
Flame Robin	*Petroica phoenicea*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Breeds in upland areas in NSW and moves to the inland slopes and plains in winter. Likely two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys.	**Possible:** Species may occur in area, especially during winter.	**Moderate**
Freckled Duck	*Stictonetta naevosa*	V	-	Species or species habitat known to occur within	Found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. Breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system,	**Unlikely:** Limited water bodies present. May occur on rare occasions at dams, however fringing	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
				10km (OEH, 2022)	particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. Forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. May also occur as far as coastal NSW and Victoria during such times. Prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	and ephemeral vegetation is limited.	
Gilbert's Whistler	*Pachycephala inornata*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Occurs in arid and semi-arid timbered habitats in mallee shrubland, and occasionally in box-ironbark woodlands, Cypress Pine, Belah woodlands and River Red Gum forests. Within mallee, the species often occurs in association with an understorey of spinifex and low shrubs of acacias, hakeas, sennas and grevilleas. In woodland habitats, the understorey contains areas of dense shrubbery, particularly dense regrowth thickets of Callitris. Occurs across most of NSW's semi-arid and arid regions. Diet consists primarily of insects and spiders, but may also include seeds and fruits. Breeding occurs from August - November, with nesting occurring 2 metres above the ground in the fork of densely foliaged prickly plants such as acacias.	**Possible:** Potential foraging and breeding habitat in woodland only.	**Moderate**
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. It inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and	**Unlikely**: Minimal Casuarina habitat present that could support this species	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *A. diminuta*, and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations. The species is dependent on large hollow-bearing eucalypts for nest sites.		
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	4 records in 10km. Species or species habitat known to occur within 10km (OEH, 2022)	Occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. Also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. Inhabits open Box-Gum Woodlands on the slopes, Box-Cypress-pine and open Box Woodlands on alluvial plains and woodlands on fertile soils in coastal regions.	**Recorded:** Individuals recorded at site. Likely to forage and breed in these areas.	**Moderate**
Grey Falcon	*Falco hypoleucos*	E	-	Species or species habitat known to occur within 10km (OEH, 2022)	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	**Possible:** Potential foraging habitat present. Could breed along large watercourses in locality.	**Moderate**
Hall's Babbler	*Pomatostomus halli*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Hall's Babbler occurs in central-eastern Australia, from Cobar north into south-western Queensland, particularly along or west of the Warrego River. Most records are west of Lightening Ridge and Cobar. There is one recent record in the Pilliga, well outside the usual range of this species. This could be a misidentification of a White-browed Babbler. It inhabits dry Acacia scrub, mainly Mulga, with a grassy understorey including spinifex, on ridges	**Unlikely:** On far eastern fringes of its range, habitat not perfectly suitable	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					and plains with either sandy or stony soils. Occasionally occurs in open dry Eucalyptus (Bimblebox) woodland, and mulga- or eucalypt-lined watercourses.		
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The south-eastern form (*ssp cucullata*) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies picata. Prefers lightly wooded country, usually open eucalypt woodland, Acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	**Possible:** Potential foraging and breeding habitat in woodland only. May occur in larger woodland remnants in locality.	**Moderate**
Little Eagle	*Hieraaetus morphnoides*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Also found in Sheoak or Acacia woodlands and riparian woodlands of inland NSW. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	**Possible:** Potential foraging habitat present. No large stick nests recorded. May occur in larger woodland remnants in locality.	**Low**
Little Lorikeet	*Glossopsitta pusilla*	V	-	Species or species habitat known to occur regionally (OEH, 2022)	Distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year. Forages primarily in the canopy of open Eucalyptus Forest and woodland, yet also finds	**Possible:** On the far western fringes of occurrence	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.		
Magpie Goose	*Anseranas semipalmata*	V	-	3 species records within 10km. Species or species habitat known to occur within 10km (OEH, 2022)	The Magpie Goose is still relatively common in the Australian northern tropics but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. It inhabits shallow wetlands containing dense rushes or sedges, and nearby dry land used for grazing. It feeds on grasses, bulbs and rhizomes and roosts in tall vegetation within wetland areas. Breeding occurs predominantly in monsoonal areas and is unlikely in SE NSW. Nests are formed in trees over deep water.	**Unlikely:** No suitable wetland areas present. Various farm dams, generally with little emergent vegetation, provide suboptimal habitat.	**Low**
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Occurs across the arid and semi-arid inland and regularly found as far east as about Bourke and Griffith, and sporadically further east. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines.	**Unlikely:** Minimal habitat present, study are is on far east of the species range.	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Malleefowl	*Leipoa ocellata*	E	V	Species or species habitat known to occur within 10km (OEH, 2022)	Stronghold in the mallee in the south-west centred on Mallee Cliffs NP and extending east to near Balranald and scattered records as far north as Mungo NP. Eastern boundary distribution follows a line from Wagga-Grenfell-Orange. Typically occurs in mallee eucalypt woodlands with a dense but discontinuous canopy and varied shrubby understorey, especially where the mallee trees are multi-stemmed. Prefers areas of light sandy to sandy loam soils. Occasionally occur in other types of dry eucalypt forests. Found in unburnt habitat, with habitat unburnt for 40–60 years preferred. Also occurs in Red Ironbark (*E. sideroxylon*) woodland at the eastern limit of their distribution	**Unlikely:** No habitat present suitable for the species	**Low**
Masked Owl	*Tyto novaehollandiae*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. Lives in dry eucalypt forests and woodlands from sea level to 1100 m and often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	**Possible:** Only foraging habitat likely present in the site. Could breed and roost along large watercourses in surrounding areas, where large hollows are present.	**Low**
Painted Honeyeater	*Grantiella picta*	V	V	Species or species habitat known to occur within 10km (OEH, 2022)	Nomadic species occurring at low densities throughout its range. Most commonly found on the inland slopes of the Great Dividing Range in NSW, where almost all breeding occurs. More likely to be found in the north of its distribution in winter. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. Specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.	**Possible:** Limited suitable habitat present in the proposal site for this species. May use habitat in the proposal site as a stepping stone between other areas of better quality habitat.	**Moderate**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Pied Honeyeater	*Certhionyx variegatus*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Pied Honeyeater is widespread throughout acacia, mallee and spinifex scrubs of arid and semi-arid Australia. It occasionally occurs further east, on the slopes and plains and the Hunter Valley, typically during periods of drought. The species is highly nomadic, following the erratic flowering of shrubs; can be locally common at times.	**Possible:** Eastern edge of range, unlikely to utilize habitat in proposal area consistently but may be present	**Low**
Powerful Owl	*Ninox strenua*	V	-	Species or species habitat known to occur regionally (OEH, 2022)	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 metres deep), in large eucalypts (dbh 80-240 centimetres) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 hectares. Forages within open and closed woodlands as well as open areas.	**Unlikely:** Outside of usual geographic range, unlikely to utilize habitat in proposal area	**Low**
Red-backed Button-quail	*Turnix maculosus*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Red-backed Button-quail is recorded only infrequently in NSW, with most records from the North Coast Bioregion; there are historical records south as far as Sydney and three outlying records from western NSW. The population around Sydney was last recorded in 1912. In NSW, the Red-backed Button-quail is said to occur in grasslands, heath and crops. Said to prefer sites close to water, especially when breeding. The species has been observed associated with the following grasses (in various vegetation formations): speargrass *Heteropogon*, Blady Grass *Imperata cylindrica*, Triodia, Sorghum, and Buffel Grass *Cenchrus ciliaris*.	**Unlikely:** Isolated records in western NSW, unlikely to utilise habitat in proposal area	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Red-tailed Black-Cockatoo (inland subspecies)	*Calyptorhynchus banksii samueli*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Red-tailed Black-Cockatoo (inland subspecies) is known to occur around watercourses and overflows of the Darling, Paroo, Bogan, Macquarie and Barwon Rivers extending in an arc along the Darling River from Wentworth (though rare south of Menindee) in the south to Bourke and thence through to Brewarrina in the north. It extends east to Walgett and perhaps Boggabilla on the Barwon and south through to the Macquarie Marshes. The species prefers Eucalyptus forest and woodlands, particularly river red gum and coolabah lined water courses. In the arid zone it usually occurs mainly near eucalypts along larger watercourses and associated Acacia and Casuarina woodlands nearby. Also utilise grasslands, scrublands, wetlands and vegetation on floodplains.	**Unlikely:** Eastern edge of range, unlikely to utilise habitat in proposal area	**Low**
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species or species habitat known to occur regionally (OEH, 2022)	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species	**Unlikely:** Far western edge of range, no suitable habitat	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.		
Scarlet Robin	*Petroica boodang*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Occurs from the coast to the inland slopes in NSW. Disperses to the lower valleys and plains of the tablelands and slopes after breeding. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. Found in dry eucalypt forests and woodlands with usually open and grassy understorey with few scattered shrubs. Lives in both mature and regrowth vegetation and occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Abundant logs and fallen timber are important components of its habitat.	**Possible:** Potential foraging and breeding habitat in woodland only. May occur in larger woodland remnants in locality	**Moderate**
Speckled Warbler	*Chthonicola sagittata*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies, typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	**Unlikely:** Suitable undisturbed remnants of habitat are not present.	**Low**
Spotted Harrier	*Circus assimilis*	V	-	1 record in 10km. Species or species habitat known	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single	**Possible:** Recorded south of Macquarie River. Potential foraging habitat present. No large stick nests observed.	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
				to occur within 10km (OEH, 2022)	population. The species occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.		
Square-tailed Kite	*Lophoictinia isura*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Ranges along coastal and subcoastal areas from south-western to northern Australia. Scattered records throughout NSW indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. Summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. Observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland in arid north-western NSW.	**Possible:** Potential foraging habitat present. No large stick nests observed.	**Low**
Superb Parrot	*Polytelis swainsonii*	V	V	1 record in 10km. Species or species habitat known to occur within 10km (DAWE, 2021)	Found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	**Possible:** Previously recorded in the local region, suitable habitat occurs in the proposal site area. Unlikely to breed in the proposal site.	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Swift Parrot	*Lathamus discolor*	CE	CE	Species or species habitat known to occur within 10km (DAWE, 2021)	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. Eucalyptus robusta, Corymbia maculata and C. gummifera dominated coastal forests are also important habitat.	**Unlikely:** Habitat in proposal site is unlikely to support this species	**Low**
Turquoise Parrot	*Neophema pulchella*	V	-	1 record in 10km. Species or species habitat known to occur within 10km (OEH, 2022)	Extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Typically lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	**Possible:** However likely to occur in largest woodland remnants in landscape where nectar resources are abundant.	**Low**
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	**Possible:** Potential foraging and breeding habitat in woodland only. May occur in larger woodland remnants in locality.	**Moderate**
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widespread along the NSW coast, and along all major inland rivers and waterways. Habitats characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or seashore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal	**Unlikely:** Habitat in proposal site is unlikely to support this species	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat.		
White-fronted Chat	*Epthianura albifrons*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	This species occurs from southern Queensland to Western Australia and down to Tasmania, mostly in temperate to arid climates and very rarely in sub-tropical areas. It is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands. Along the coast they are found in estuarine and marshy habitats with vegetation <1m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, saltlakes and saltpans along waterway margins.	**Unlikely:** Habitat in proposal site is unlikely to support this species	**Low**
FISH							
Macquarie Perch	*Macquaria australasica*	-	E	Species or species habitat known to occur within 10km (DAWE, 2021)	Known only from scattered localities in the cool upper reaches of the Murray-Darling system of NSW, including the Hawkesbury-Nepean and Shoalhaven catchments, Victoria and the Australian Capital Territory. Also found in man-made lakes on the NSW coast and in lakes and reservoirs, where adults aggregate in small shoals during the spawning season. Inhabits cool, clear freshwaters of rivers with deep holes and shallow riffles. They are also found	**None:** No aquatic habitat to support the species	**None**
Murray Cod	*Maccullochella peelii*	-	V	Species or species habitat known to occur within 10km (DAWE, 2021)	Endemic to river systems of the Murray–Darling Basin in south-eastern Australia. Once widespread throughout the Murray-Darling system, it is now uncommon in much of its range and restricted to the lower Murray-Darling. Found in a variety of habitats ranging from clear, rocky streams to slow flowing turbid rivers, lakes and billabongs and are more common in waterways	**None:** No aquatic habitat to support the species	**None**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					with large rocks, snags and undercut banks with overhanging vegetation.		
Trout Cod	*Maccullochella macquariensis*	-	E	Species or species habitat known to occur within 10km (DAWE, 2021)	Endemic to the Murray-Darling Basin. Once widespread in the southern tributaries, the species has declined dramatically in both abundance and distribution and are now known only from scattered localities. The last remaining natural populations in the wild are in the Murray River between Yarrawonga, Barmah and Seven Creeks. The Occurs in a range of habitats but is strongly associated with the presence of woody debris and snags.	**None:** No aquatic habitat to support the species	**None**
MAMMALS							
Black-striped Wallaby	*Macropus dorsalis*	E	-	Species or species habitat known to occur within 10km (OEH, 2022)	Distribution from the Townsville area to northern NSW occurring on both sides of the Great Divide. Occurs in Brigalow remnants to south of Narrabri on the north-west slopes of NSW. Confined to the upper catchments of the Clarence and Richmond Rivers on the north coast. Preferred habitat characterised by dense woody or shrubby vegetation within 3m of the ground. Dense vegetation must occur near a more open, grassy area to provide suitable feeding habitat.	**None:** Outside geographic range	**None**
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	Species or species habitat known to occur within 10km (OEH, 2022)	Occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. It typically shelters or basks during the day in rock crevices, caves and overhangs and are most active at night when foraging.	**None:** No suitable habitat present	**None**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					Browse on vegetation in and adjacent to rocky areas.		
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	Species or species habitat known to occur within 10km (DAWE, 2021)	Found throughout the Murray-Darling Basin and the Pilliga Scrub region. Inhabits a variety of vegetation types, including mallee, bulloke, *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	**Possible:** Could forage and breed in woodland remnants.	**Moderate**
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Found on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs, recorded roosting in disused mine workings. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Forage over a small area but are capable of flying 500 m over clear paddocks.	**Unlikely:** Proposal site is outside of its range	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	Species or species habitat known to occur regionally (OEH, 2022)	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. The species is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. It feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes and is an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	**Unlikely:** Proposal site is outside of its range, no suitable habitat present	**Low**
Greater Broad-nosed Bat	*Scoteanax ruepellii*	V	-	Species or species habitat known to occur regionally (OEH, 2022)	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees.	**Unlikely:** Proposal site is outside of its range, degraded habitat present	**Low**
Greater Glider	*Petauroides volans*	-	V	Species or species habitat known to occur regionally (OEH, 2022)	Restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. Prefers taller montane, moist eucalypt forest with relatively old trees and abundant hollows.	**None:** Outside known range, no suitable habitat	**None**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Foraging, feeding and related behaviour known to occur within 10km (DAWE, 2021)	Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. May be found in unusual locations in times of natural resource shortage. Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	**Unlikely:** Individuals may forage on site on occasion. No known roosting camps present	**Low**
Koala	*Phascolarctos cinereus*	V	E	1 record within 10km, Species or species habitat known to occur within 10km (DAWE, 2021)	Found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests of NSW, with some smaller populations on the plains west of the Great Dividing Range. Inhabits eucalypt woodlands and forests, and feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species but will select preferred browse species in any one area.	**Possible:** Suitable tree species present but in a degraded landscape	**Moderate**
Kultarr	*Antechinomys laniger*	E	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widespread across arid and semi-arid NSW but present in very low numbers, recent records have come primarily from the Cobar and Brewarrina region. A terrestrial insectivore that inhabits open country, especially claypans among Acacia woodlands. It shelters by day in hollow logs or tree-stumps, beneath saltbush and spinifex tussocks, in deep cracks in the soil and in the burrows of other animals. Populations appear to fluctuate seasonally in response to environmental stresses, including declines following periods of drought and intensive flooding.	**Unlikely:** Proposal site is fringes of its range, degraded habitat present	**Low**
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Species or species habitat known to occur	Occurs along the east and north-west coasts of Australia. Uses caves as the primary roosting habitat, but also uses derelict mines, storm-water tunnels, buildings and other man-made	**Possible:** On edges of range but calls detected regionally (to the north) before. Would forage	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
				regionally (OEH, 2022)	structures. Hunts in forested areas, catching moths and other flying insects above the treetops.	throughout the area. No roosting or breeding habitat present.	
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Species or species habitat known to occur within 10km (DAWE, 2021)	The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North-West Slopes. The species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. It is found in well-timbered areas containing gullies.	**Unlikely:** On edges of range. Would possibly forage throughout the area but habitat is not perfectly suitable. No roosting or breeding habitat present.	**Low**
Little Pied Bat	*Chalinolobus picatus*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. It occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. The species is known to roost in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	**Possible:** Could forage and breed in woodland remnants.	**Moderate**
Pilliga Mouse	*Pseudomys pilligaensis*	V	V	Species or species habitat known to occur regionally (OEH, 2022)	Distribution restricted to the Pilliga region. Typically occurs at low densities and appears to prefer areas with sparse ground cover. Evidence exists of marked population fluctuations. Largely restricted to low-nutrient deep sand soils within the Pilliga region, which are recognised as supporting a distinctive vegetation type referred to as the Pilliga Scrub. Found in greatest	**None:** Outside known distribution range of the species. No suitable habitat present.	**None**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					abundance in recently burnt moist gullies, areas dominated by broombush and areas containing an understorey of kurricabah (*Acacia burrowii*) with a bloodwood (*Corymbia trachyphloia*) overstorey.		
Rufous Bettong	*Aepyprymnus rufescens*	V	-	Species or species habitat known to occur regionally (OEH, 2022)	The range of the Rufous Bettong has been reduced to a patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park. In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. Inhabits a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter. Sleeps during the day in cone-shaped nests constructed of grass in a shallow depression at the base of a tussock or fallen log. At night feeds on grasses, herbs, seeds, flowers, roots, tubers, fungi and occasionally insects.	**Unlikely:** Proposal site is outside of its range, no suitable habitat present	**Low**
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	Species or species habitat known to occur within 10km (DAWE, 2021)	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. The species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares.	**Unlikely:** Degraded habitat present	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					Are known to traverse their home ranges along densely vegetated creeklines.		
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species or species habitat known to occur regionally (OEH, 2022)	Widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites.	**Unlikely:** Degraded habitat present, isolated from forests	**Low**
Stripe-faced Dunnart	*Sminthopsis macroura*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Widespread across northern and central Australia. In NSW rare on the Central and North West Slopes, with eastern-most records in recent times around Dubbo, Coonabarabran, Warialda and Ashford. Inhabit native dry grasslands and low dry shrublands, often along drainage lines. Shelter in soil cracks, grass tussocks or under rocks and logs. Prefers relatively ungrazed habitats with higher diversity and understorey cover.	**Unlikely:** Degraded habitat present, isolated from forests	**Low**
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Species or species habitat known to occur within	Wide-ranging species found across northern and eastern Australia. Rare visitor of south-western NSW in late summer and autumn. Scattered records of this species across the New England	**Likely:** Wide range incorporates many areas, may feed in the site.	**Moderate**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
				10km (OEH, 2022)	Tablelands and North-West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. It forages in most habitats across its very wide range, with and without trees.	Possible roosting habitat present.	
REPTILES							
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	Species or species habitat known to occur within 10km (OEH, 2022)	Historically recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north-west slopes, and from the north coast from Queensland to Sydney. Small number of historical records are known for the New England Tablelands from Glenn Innes and Tenterfield; however, the majority of records appear to be from sites of relatively lower elevation. Cryptic distribution, found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest.	**Unlikely:** No suitable habitat is present in isolated woodland remnants Species prefers riparian vegetation.	**Low**
Pink-tailed Worm-lizard	*Aprasia parapulchella*	V	V	Species or species habitat known to occur within 10km (DAWE, 2021)	The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South-Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. It's found to inhabit sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*), The sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. They are commonly found beneath small, partially embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are	**Unlikely:** No suitable rocky habitat is present.	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
					often still inhabited by small black ants and termites.		
Striped Legless Lizard	*Delma impar*	V	V	Species or species habitat may occur regionally (OEH, 2022)	The Striped Legless Lizard occurs in the Southern Tablelands, the South-West Slopes, the Upper Hunter and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma, Muswellbrook and Tumut areas. Individuals are found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. They are also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland.	**Unlikely:** On fringes of range, marginally suitable habitat present.	**Low**
Woma	*Aspidites ramsayii*	V	-	Species or species habitat may occur within 10km (OEH, 2022)	The Woma occurs in north-western NSW, east to about Louth and Bourke. In was last recorded in these eastern districts in the late 1890s, and in 1983 from the Tibooburra region. Its range and abundance in south-eastern Australia is considered to be undergoing serious decline. It inhabits subtropical to temperate deserts and sandy plains, as well as dunefields and deep cracking black soil plains in semi-arid areas. It can also occur in hummock grasslands, shrublands and woodlands.	**Unlikely:** On fringes of predicted range, no suitable habitat present	**None**
FROGS							
Sloane's Froglet	*Crinia sloanei*	V	E	2 records within 20 km (OEH 2022)	Typically associated with periodically inundated areas in grassland, woodland and disturbed habitats. Majority of records are from the Riverina. This species has been recorded over 900 times in the first year of the FrogID App, with all records from the Albury-Corowa area along the Murray.	Low. Recent research has found no evidence of the species in the northern portion of the range, and previous records are likely to be misidentifications.	Low
MIGRATORY BIRDS							

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Common Sandpiper	*Actitis hypoleucos*	-	C,J,K	Species or species habitat may occur within 10km (DAWE, 2021)	Does not breed in Australia. When in Australia it is found on all coastlines and in inland areas but is concentrated in the north and west with important areas in WA, the NT and Qld. Utilises a wide range of coastal and inland wetlands with varying salinity levels.	**Possible:** No suitable wetland areas present, however there are some dams. Unlikely to be found outside of Narromine wetlands	**Low**
Curlew Sandpiper	*Calidris ferruginea*	-	CE,C,J,K	Species or species habitat may occur within 10km (DAWE, 2021)	The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed.	**Possible:** No suitable wetland areas present, however there are some dams. Unlikely to be found outside of Narromine wetlands	**Low**
Eastern Curlew	*Numenius madagascariensis*	-	CE,C,J,K	Species or species habitat may occur within 10km (DAWE, 2021)	Occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. Generally, occupies coastal lakes, inlets, bays and estuarine habitats, and is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts in NSW. Rarely seen inland.	**Unlikely:** No suitable wetland areas present, however there are some dams. Unlikely to be found outside of Narromine wetlands	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Fork-tailed Swift	*Apus pacificus*	-	C,J,K	Species or species habitat likely to occur within 10km (DAWE, 2021)	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines.	**Likely:** Would occur on occasion above the proposal.	**Low**
Latham's Snipe	*Gallinago hardwickii*	-	J,K	1 record within 10km Species or species habitat known to occur within 10km (DAWE, 2021)	Non-breeding migrant to the south-east of Australia. Breeds in Japan and on the east Asian mainland. Seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. Found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. Also uses crops and pasture.	**Possible:** No suitable wetland areas present, however there are some dams. Unlikely to be found outside of Narromine wetlands	**Low**
Pectoral Sandpiper	*Calidris melanotos*	-	J,K	Species or species habitat may occur within 10km (DAWE, 2021)	Widespread but scattered records across NSW, east of the divide and in the Riverina and Lower Western regions. Breeds in the northern hemisphere. In Australasia, prefers shallow fresh to saline wetlands and is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. Usually in coastal or near coastal habitats and prefers wetlands with open mudflats and low emergent or fringing vegetation such as grass or samphire.	**Possible:** No suitable wetland areas present, however there are some dams. Unlikely to be found outside of Narromine wetlands	**Low**

Common name	Scientific name	BC Status	EPBC Status	Source	Habitat association	Likelihood of occurrence	Likelihood of impact
Satin Flycatcher	*Myiagra cyanoleuca*	-	Mi	Species or species habitat known to occur within 10km (DAWE, 2021)	Found along the east coast of Australia from far northern Queensland to Tasmania. Uncommonly seen species, especially in the far south of its range, where it is a summer breeding migrant. Inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	**Unlikely:** Habitat not typically suitable for this species	**Low**
Sharp-tailed Sandpiper	*Calidris acuminata*	-	C,J,K	Species or species habitat known to occur within 10km (DAWE, 2021)	Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Australasia, prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Breeds in northern Siberia.	**Possible:** No suitable wetland areas present, however there are some dams. Unlikely to be found outside of Narromine wetlands	**Low**
White-throated Needletail	*Hirundapus caudacutus*	-	V,C,J,K	Species or species habitat known to occur within 10km (DAWE, 2021)	Migrates to eastern Australia from October to April. Almost exclusively aerial and most often seen before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. Occurs over most types of habitats, but mostly recorded above wooded areas, including open forest and rainforest. May also fly between trees or in clearings, below the canopy. Recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows.	**Likely:** Would occur on occasion above the proposal.	**Low**
Yellow Wagtail	*Motacilla flava*	-	C,J,K	Species or species habitat may occur within 10km (DAWE, 2021)	Occurs within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns. Breeds in temperate Europe and Asia.	**Unlikely** Proposal unlikely to have suitable habitat for this species.	**Low**

Key:

E - Endangered

CE - Critically endangered

EP - Endangered population

V - Vulnerable

Mi - Migratory

APPENDIX

A

Biodiversity Assessment Report

Appendix C Assessments of significance—Biodiversity Conservation Act

NARWONAH MATERIAL DISTRIBUTION CENTRE REVIEW OF ENVIRONMENTAL FACTORS

Appendix C - Assessments of significance (BC Act)

Part 5 tests of significance

Section 7.3 of the BC Act and section 1.7 of the EP&A Act list five factors that must be taken into account in the determination of the significance of potential impacts of an activity on 'threatened species', populations or ecological communities (or their habitats) listed under the BC Act.

The 'five-part test' is used to determine whether an activity is 'likely' to impose 'a significant effect' on threatened biota and thus whether a SIS is required. Should the five-part test conclude that a significant effect is likely, an SIS or BDAR must be prepared.

The desktop assessment, field surveys and habitat assessments described in this BAR have been used to identify the suite of threatened biota that may be affected by the proposal, through either direct or indirect impacts.

Five-part tests have been provided for threatened biota which were recorded or have a high or moderate likelihood of occurrence and could potentially be impacted by the proposal. Where feasible, threatened fauna have been grouped based on similar features or requirements.

The following threatened biota have been assessed:

- Weeping Myall Endangered Ecological Community
- Koala (vulnerable species)
- Threatened woodland birds (Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin, Speckled Warbler and Brown Treecreeper - vulnerable species)
- Microbats (Yellow-bellied Sheathtail-bat, Little Pied Bat and Corben's Long-eared Bat – vulnerable species).

Given the limited scale and magnitude of impacts arising from the proposal and impact mitigation and environmental management measures described in section 7.2, no additional threatened biota outside of the proposal site are likely to be affected by off-site impacts of the proposal.

Weeping Myall Woodland

The proposal would impact 1.07 hectares of PCT 27, which is commensurate with Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions listed under the BC Act. It does not conform to the EPBC Act listing for the community as it only comprises three trees, is dominated by introduced species in the groundcover and showed no signs of regeneration.

Weeping Myall Woodlands occur in a range of forms from open woodlands to woodlands, in which Weeping Myall (*Acacia pendula*) trees are the sole or dominant overstorey species. Areas that have a total absence of native species in the understorey or that consist of single paddock trees with no native understorey are generally excluded from the EPBC Act listing. In order to meet the EPBC Act condition criteria, the patch must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees per hectare (DEWHA 2009). The small woodland patch dominated by Weeping Myall (*Acacia pendula*) in the western portion of the property does not classify for listing under the EPBC Act due to the small size of the patch (only three trees), dominance of introduced species in the groundcover and lack of regeneration.

An assessment of the significance of impacts on the local occurrence of Weeping Myall Woodland has been prepared and is included in the table below. The outcome of this assessment is that the proposal is not likely to have a significant impact on the local occurrence of this TEC.

Weeping Myall Woodland (endangered)
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
N/A
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: **(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
The proposal would reduce the extent of this TEC by removing up to 1.07 hectares of Weeping Myall Woodland. A small woodland patch dominated by Weeping Myall (*Acacia pendula*) occurs in the western portion of the site, in a highly fragmented landscape surrounded by high intensity agriculture. Similar small patches are likely to occur elsewhere it the locality. The community comprises only three trees, is dominated by introduced species in the groundcover and showed no signs of regeneration. This small, disturbed patch is located in a paddock that has been cleared for cropping. Given the location of the patch, limited area, low numbers of trees, and isolation from other patches, this patch is unlikely to be contributing to other stands in the locality. While the small patch of Weeping Myall Woodland in the proposal site would be removed, it is unlikely that the occurrence of Weeping Myall Woodland in the locality would be placed at risk of extinction.

Weeping Myall Woodland (endangered)

(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The proposal would result in the removal of 1.07 hectares of Weeping Myall Woodland. The proposal also has the potential to further modify the composition of the ecological community by creating conditions conducive to the spread of weed species. This could occur through general disturbance from machinery, vehicles and foot traffic. These conditions could lead to further spread of invasive weed species African Boxthorn (*Lycium ferocissimum*), which are already present at the site. Given the location of the proposal site in an area that is already predominantly cleared for agriculture, there are already many weed species present within native vegetation in the area. Management measures would be implemented to reduce the spread of weeds, particularly into those areas that are dominated by native species. It is unlikely that the proposal would substantially and adversely modify the composition of the ecological community such that its local occurrence would be placed at risk of extinction.

c) In relation to the habitat of a threatened species or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposal would remove 1.07 hectares of Weeping Myall Woodland. The community in the proposal site comprises only three trees within a paddock cleared for cropping. It is dominated by introduced species in the groundcover and showed no signs of regeneration.

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The majority of the proposal site is largely agricultural and contains cleared lands from cropping and grazing. Small patches of semi-intact native vegetation are present along existing fencelines, as scattered trees or along adjacent road reserves. A small woodland patch dominated by Weeping Myall (*Acacia pendula*) occurs in the western portion of the site, in a highly fragmented landscape surrounded by high intensity agriculture. Similar small patches are likely to occur elsewhere it the locality.

The proposal would result in a very minor increase in the fragmentation of woodland in the locality through the loss of three Weeping Myall trees. In the context of the existing fragmented habitat in the local area, the proposal would comprise a minor increase in these negative effects. The Weeping Myall Woodland community within the proposal site comprises only three trees and showed no signs of regeneration and is unlikely to viable in the future.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The proposal would remove 1.07 hectares of Weeping Myall Woodland from within the proposal site. Habitat for Weeping Myall Woodland outside of the proposal site is likely to be of similar condition. Three Weeping

Weeping Myall Woodland (endangered)

Myall trees with a paddock cleared for cropping are unlikely to be important for the long-term survival of the community.

d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No areas of outstanding biodiversity value exist in the study area

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action will contribute to three listed key threatening processes relevant to the Weeping Myall Woodland ecological community:

– Clearing of native vegetation (the proposal would clear 1.07 hectares of Weeping Myall Woodland from the proposal site).
– Invasion of plant communities by perennial exotic grasses – The proposal could continue to spread exotic weeds throughout the study area

The proposal also has the potential to indirectly cause or increase the operation of the following KTPs that are of potential relevance to these ecological communities:

– Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

The proposal could introduce pathogens and disease, including Exotic Rust Fungi that could impact on native vegetation in the proposal site and study area. Agricultural weeds are already present throughout the proposal site.

The proposal would include environmental management measures, including specific consideration of potential impacts on soil, water and native vegetation, such as a ‘clean on entry clean on exit’ policy for construction vehicles. Given the limited extent and duration of construction and proposed mitigation the proposal is unlikely to result in a significant increase in the operation of these KTPs.

Conclusion

Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the local occurrence of Weeping Myall Woodland as:

– Only a small area (1.07 hectares) of Weeping Myall Woodland would be removed from the proposal site
– The community comprises only three trees in a paddock cleared for agriculture, showed no signs of regeneration and is unlikely to viable in the future
– The proposal would result in a very minor increase in the fragmentation of woodland in the locality

Inland Grey Box Woodland

No Grey Box was recorded in the proposal site. Woodland vegetation was dominated either by Poplar Box or Pilliga Box. This TEC was recorded in the N2N construction impact zone about 3 km to the east along Dappo Road, where Grey Box occurred in combination with Poplar Box (GHD 2021).

The proposal would not impact a local occurrence of Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Inland Grey Box Woodland), which is listed as an endangered ecological community under the BC Act.

An assessment of the significance of impacts on the local occurrence of Box-Gum Woodland has been prepared and is included in the table below. The outcome of this assessment is that the proposal is not likely to have a significant impact on the local occurrence of this TEC.

Inland Grey Box (endangered)
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
N/A
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: **(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
The proposal would not reduce the extent of this TEC. Vegetation within the proposal site has been ground-truthed and assessed by field staff and no Inland Grey Box was recorded. Inland Grey Box Woodland was recorded in the N2N construction impact zone about 3 km to the east of the proposal site along Dappo Road, where Grey Box occurred in combination with Poplar Box.
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
The proposal would not modify the composition of this TEC. Vegetation within the proposal site has been ground-truthed and assessed by field staff and no Inland Grey Box was recorded. The proposal would not substantially and adversely modify the composition of the ecological community such that its local occurrence would be placed at risk of extinction.
c) In relation to the habitat of a threatened species or ecological community: **(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
The proposal would not remove or modify this TEC. Vegetation within the proposal site has been ground-truthed and assessed by field staff and no Inland Grey Box was recorded. Inland Grey Box Woodland was

Inland Grey Box (endangered)
recorded in the N2N construction impact zone about 3 km to the east of the proposal site along Dappo Road, where Grey Box occurred in combination with Poplar Box
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
The proposal will not result in further fragmentation of the Inland Grey Box Woodland community as it is not present at the proposal site.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
No Inland Grey Box Woodland was recorded in the proposal site. Habitat for Inland Grey Box Woodland occurs outside of the proposal site, in the N2N construction impact zone about 3 km to the east along Dappo Road.
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),
No areas of outstanding biodiversity value exist in the study area
e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.
The proposed action will contribute to three listed key threatening processes, however these will not directly impact the Inland Grey Box Woodland ecological community as it is not present within the proposal area: – Clearing of native vegetation – Removal of dead wood and dead trees – Standing dead trees, logs and fallen timber from within this community would be removed by the proposal. As described in part c) the proposal would not remove local occurrences of this threatened ecological community. The proposal also has the potential to indirectly cause or increase the operation of the following KTPs: – Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae The proposal could introduce pathogens and disease, including Exotic Rust Fungi that could impact on native vegetation in the proposal site and study area The proposal would include environmental management measures, including specific consideration of potential impacts on soil, water and native vegetation, such as a ‘clean on entry clean on exit’ policy for construction vehicles. Given the proposed mitigation the proposal is unlikely to result in a significant increase in the operation of these KTPs.

Inland Grey Box (endangered)

Conclusion

Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the local occurrence of Box-gum Woodland as no Inland Grey Box Woodland would be removed from the proposal site.

Threatened woodland birds (Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin, Speckled Warbler, Brown Treecreeper, Flame Robin, Gilbert's Whistler, Scarlet Robin, Painted Honeyeater and Black-chinned Honeyeater - vulnerable species)

The following woodland birds assessed below are vulnerable listed species under the BC Act. Based on suitable habitat availability and local records, these species may occur in the study area:

- Grey-crowned Babbler (eastern sub-species) (*Pomatostomus temporalis temporalis*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Diamond Firetail (*Stagonopleura guttata*)
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Hooded Robin (south-eastern form) (Melithreptus gularis gularis)
- Speckled Warbler (*Chthonicola sagittata*)
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)
- Flame Robin *(Petroica phoenicea)*
- Gilbert's Whistler *(Pachycephala inornata)*
- Scarlet Robin *(Petroica boodang)*
- Painted Honeyeater (*Grantiella picta*)
- Black-chinned Honeyeater (*Melithreptus gularis gularis*)

The proposal would result in direct impacts on local populations of threatened woodland birds through the removal of 15.85 hectares of woodland containing a semi-intact canopy.

Assessments of significance of impacts on these species have been prepared and are included below. The outcome of these assessments of significance is that the proposal is not likely to have a significant impact on local populations of these threatened species (if present in the study area).

Woodland Birds

a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The Grey-crowned Babbler was recorded in remnant vegetation present along a fenceline at the proposal site. This species would forage and may also breed in the proposal site. The proposal site also comprises potential habitat for a number of other threatened birds. Many of these species are more likely to occur on a transient basis give the small patch size and disturbed nature of the vegetation.

The factors that could potentially disrupt the life cycle of these species, if they occur, are loss of nest trees, loss of foraging habitat, and fragmentation or isolation of habitat that would pose a barrier to movement for the species.

The proposal will remove woodland vegetation from within a predominantly agricultural landscape. This habitat may also support breeding of the Grey-crowned Babbler, which was observed in the proposal site. Given the fragmented nature and location in predominantly cleared agricultural land, other species are less likely to breed in the proposal site, and are more likely to occur on a transient basis.

Native woodland in the proposal site would comprise habitat resources such as mature trees that provide foraging resources such as nectar and fruit, woody debris, leaf litter and hollows. This habitat may provide foraging habitat, Derived native grassland may also provide foraging habitat for species that forage on the ground. The proposal would remove 15.85 ha of woodland habitat. The removal of woodland vegetation along fence lines and within small, fragmented patches in paddocks will reduce the availability of foraging, roosting and nesting habitat for woodland bird species, however this represents a small proportion of individual plant species, PCTs and associated habitats comparative to those in the surrounding area and locality. Noise and vibration during construction activities could disturb nesting individuals. It is likely that individuals are already habituated to some degree to agricultural noise, and would become habituated to the machinery noise, however particularly loud noises could cause adults to leave eggs or nestlings. This could impact breeding success for one season for a small proportion of the local population.

Vegetation in the proposal site is fragmented and occurs as small, isolated patches or linear strips along fence lines. Clearing of this vegetation will impact connectivity along the fence line in the centre of the site. As other areas of roadside vegetation would remain as linkages within the locality, vegetation removal for the proposal is unlikely to result in isolation of habitat for these mobile species.

Given the small area of clearing, location in a generally cleared landscape, and retention of habitat in nearby roadsides and other patches, the proposal is therefore unlikely to adversely affect the lifecycle of these species such that a viable local population of these species are placed at risk of extinction.

b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

Woodland Birds
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
N/A
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
N/A
c) In relation to the habitat of a threatened species or ecological community: **(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
The proposal will remove 15.85 ha of semi-intact native woodland that may provide foraging, movement and nesting habitat for the species. Habitat to be removed within the proposal area comprises small, isolated patches and linear strips of woodland vegetation along existing fence lines containing habitat resources such as mature trees that provide foraging resources such as nectar and fruit, woody debris, leaf litter and hollows. In the context of the areas of remaining native vegetation surrounding the proposal site, the proposal will remove a very small proportion of available foraging resources for local populations of native fauna with intact native woodland restricted mostly to road reserves and creeklines in the locality.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
The study area has undergone previous disturbance and modification by agricultural land use, which has resulted in fragmentation of patches of woodland habitat throughout the study area. The proposal would result in further fragmentation through the removal of linear strips of vegetation and small patches of woodland within paddocks. In the context of the fragmented habitat in the study area, the proposal would comprise a increase in these negative effects, however narrow roadside and fence line corridors are present elsewhere in the area, and connectivity would be retained in these areas. The proposal is unlikely to affect the connectivity of habitat to the extent that any habitat for these species would be isolated.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
The proposal will remove 15.85 ha of semi-intact native woodland occurring as small, isolated patches and linear strips along fence lines. The vegetation to be removed would provide foraging, nesting and movement habitat for these threatened woodland birds. In the context of the areas of remaining native vegetation surrounding the proposal site, the proposal will remove a very small proportion of available habitat for these species. Habitat for woodland birds outside of the proposal site includes intact native

woodland along road reserves and creeklines in the locality, and a large patch of native woodland ~15km to the east within private lands at Narromine which would continue to provide habitat resources such as woody debris, mature trees, shrubs and native understorey plants. Given the small loss of potential foraging, movement and nesting habitat within the proposal site in the context of the extent of potential habitat in the surrounding study area and locality, the habitat to be removed is unlikely to be important for the long-term survival of these woodland birds.

d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The proposal would not affect any habitat of outstanding biodiversity value.

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposal would contribute to the operation of the following KTPs of relevance to the Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin, Speckled Warbler, Brown Treecreeper, Flame Robin, Gilbert's Whistler, Scarlet Robin, Painted Honeyeater and Black-chinned Honeyeater (if they occur):

– Clearing of native vegetation - The proposal would directly contribute to the operation of this KTP through the removal of around 15.85 hectares of native vegetation that may provide habitat for these species as described above.
– Removal of hollow-bearing trees – The proposal site may contain hollow-bearing-trees that may comprise nest sites for the Brown Treecreeper
– Removal of dead wood and dead trees – Some unavoidable standing dead trees, logs and fallen timber may be removed by the proposal. This would remove potential foraging habitat for these species, and potential nesting habitat for the Dusky Woodswallow, Hooded Robin, Varied Sittella, Scarlet Robin and Flame Robin.

As described in part c) the proposal would remove or modify a relatively minor proportion of the habitat resources that support potentially occurring local populations of these threatened species through the operation of these KTPs.

The proposal also has the potential to indirectly cause or increase the operation of the following KTPs that are of potential relevance to habitat for these species:

– Invasion of plant communities by perennial exotic grasses – The proposal could create conditions conducive to the further spread of exotic weeds throughout the study area during investigations, via machinery and human traffic, which may degrade native foraging habitat for small woodland birds

The proposal would include environmental management measures, including specific consideration of potential impacts on soil, water and native vegetation, such as a 'clean on entry clean on exit' policy for construction vehicles. Given the limited extent and duration of investigations in areas of potential habitat and proposed mitigation the proposal is unlikely to increase in the operation of this KTP to the extent that it would cause habitat for these species to decline.

Woodland Birds

Conclusion of the test of significance

Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on a local population of these vulnerable woodland birds (if present) as:

- The removal of up to 15.85 ha is semi-intact native woodland habitat for these species is unlikely to significantly reduce the availability of forging habitat for these species, given the vegetation to be removed represents a very small proportion of available foraging resources, with intact native woodland restricted mostly to road reserves and creeklines in the locality. A large patch of native woodland ~15km to the east within private lands at Narromine would also continue to provide habitat resources.
- Where possible mature trees, and habitat trees (hollow-bearing trees, nest trees and stags) would be avoided as much as practical during vegetation clearing by an onsite ecologist supervising the works
- The proposal is unlikely to affect the connectivity of habitat to the extent that any habitat for these mobile species would be isolated. Narrow roadside and fence line corridors are present elsewhere in the area, and connectivity would be retained in these areas.
- The small area of potential foraging habitat to be removed represents a minor proportion of high-quality habitat available within the locality and is unlikely to be important for the persistence of a viable local population of these species

Koala

The Koala is a vulnerable species listed under the BC Act. Based on suitable habitat availability in the study area, and records for the species in the locality, the Koala may occur in the study area. The proposal would remove 15.85 hectares of potential foraging and breeding habitat for the Koala in the proposal site

An assessment of significance of impacts on this threatened species has been prepared and is included below. The outcome of the assessment of significance is that the proposal is not likely to have a significant impact on local population of Koala.

Koala (*Phascolarctos cinereus*)

Habitat occupied by the Koala is associated with vegetation containing nutritionally desirous Myrtaceous species (ie preferred feed tree species) capable of maintaining a positive nitrogen balance of slightly above 1 percent. In this respect higher value foraging habitat is often associated with vegetation on fertile soils and reliable access to water resources for drought affected regions. Up to 120 feed tree species are known to provide suitable foliage for the Koala although the Koala is known to exhibit regional, local and seasonal preferences (TSSC, 2012).

The size of an individual Koala's home range varies in accordance with two main factors these being the abundance of preferentially utilised food trees, and gender (ie males have larger home ranges than females). Stable populations are characterised by a well-structured network of overlapping adult Koala home ranges. Landscapes exceeding 60-70 percent native vegetation cover also appear to be linked

Koala (*Phascolarctos cinereus*)

with population stability, with 150 hectares being the minimum habitat patch area supporting non-declining populations (McAlpine et al. 2006).

Males and females disperse from natal home ranges. Dispersal generally occurs between June and December, with the dispersal of males commencing in July and August and that of females commencing between September and November. Dispersal is likely to be a social behaviour and mating systems of Koala populations provide mechanisms for young Koalas to disperse (Dique et al. 2003).

Patchy and isolated records of the Koala occur in the Narromine area. No evidence of the species was recorded in the area during targeted surveys for the BDAR and this report. An expert report was prepared for the BDAR by Dr Stephen Phillips. Analysis of contemporaneous koala records to identify areas of generational persistence identified approximately 20.3 km of the N2N alignment as currently supporting resident Koala populations, all of which was located in the Pilliga and Bohena Creek areas (Phillips 2021). Linear and riparian woodland in the Narromine area may support a very low density of Koalas at best.

a) **In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**

The factors that could potentially disrupt the life cycle of the Koala are loss of foraging habitat; introduction and spread of detrimental exotic weeds, loss of breeding habitat, and fragmentation or isolation of habitat that would pose a barrier to movement for the species.

No Koalas were recorded in the locality during surveys for the proposal or for the BDAR. Records of the species are patchy, and Koala density in the Narromine region is likely to be very low. Expert assessment of the Koala for the N2N BDAR did not identify the Narromine area as supporting a resident Koala population.

The woodland in the study area may provide habitat for the Koala. The proposal will remove 15.85 hectares of native woodland habitat with semi-intact canopy. This habitat occurs a narrow linear strips along fence lines, and patches in agricultural land with scattered trees. The small area of potential habitat to be removed represents a minor proportion of available habitat within the locality. Habitat in the locality is highly fragmented, and Koalas, if present, may use habitat in the proposal site as occasional movement habitat on a transient basis only. The proposal would result in a very minor increase in the fragmentation of woodland in the locality. In the context of the existing fragmented habitat in the local area, the proposal would comprise a minor increase in these negative effects. As the species is sufficiently mobile, the species is unlikely to be impacted by the minor increase in fragmentation.

The proposal is unlikely to remove an ecologically significant proportion of foraging habitat due to the limited quantum of direct impacts (15.85 hectares woodland vegetation) from an area that is highly fragmented. The proposal is not likely to remove, modify or fragment a significant proportion of the potential habitat for the Koala in the locality. Remnant areas of vegetation in the broader local area, including a large patch of native woodland ~15km to the east within private lands, and habitat along the

Koala (*Phascolarctos cinereus*)
Macquarie River at Narromine that would provide suitable habitat to maintain a viable local population of the species. Given the low numbers of records, fragmented nature of the habitat present, and relatively small area of clearing, the proposal is unlikely to adversely affect the lifecycle of the species such that a viable local population is placed at risk of extinction.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: **(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
N/A to an endangered community
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
N/A to an endangered community
c) In relation to the habitat of a threatened species or ecological community: **(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
The proposal will remove 15.85 hectares of native woodland habitat from the proposal site, including the potential to remove some feed trees the species prefers. This represents a small portion of the total extent of native vegetation in the locality. No Koalas were recorded during targeted surveys for the proposal or the BDAR, and the Narromine area was not identified as supporting a resident Koala population by the species expert.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
The study area has undergone previous disturbance and modification by agricultural land use, which has resulted in fragmentation of patches of woodland habitat throughout the study area. The proposal would result in further fragmentation through the removal of linear strips of vegetation and small patches of woodland within paddocks. In the context of the fragmented habitat in the study area, the proposal would comprise a minor increase in these negative effects. However narrow roadside and fence line corridors are present elsewhere in the area, and connectivity would be retained in these areas. The proposal is unlikely to affect the connectivity of habitat to the extent that any habitat for this species would be isolated.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Koala (*Phascolarctos cinereus*)

No Koalas were recorded in the locality during surveys for the proposal or for the BDAR. Records of the species are patchy, and Koala density in the Narromine region is likely to be very low. The proposal site is not in an area of generational persistence as identified by Koala expert Steve Phillips, or in an Area of Regional Koala Significance.

The proposal would result in the removal of 15.85 hectares of native woodland habitat for the Koala, containing eucalypt species known to be preferred feed trees for the species. This represents a very small portion of the total estimated extent of native woodland in the locality.

The small area of potential foraging habitat within the proposal site is unlikely to be important to the long-term survival the species in the context of the extent of potential habitat in the surrounding study area and locality.

d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The proposal would not affect any habitat of outstanding biodiversity value.

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposal would contribute to the operation of the following Key Threatening Processes (KTPs) of relevance to the Koala:

Clearing of native vegetation

The proposal would directly contribute to the operation of this KTP through the removal of around 15.85 hectares of native vegetation which may provide foraging habitat for the species as described above

As described in part c) the proposal would remove or modify a relatively minor proportion of the habitat resources for this threatened species through the operation of these KTPs.

Conclusion of the test of significance

Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the Koala if present as:

– No Koalas were recorded in the locality during surveys for the proposal or for the BDAR. Records of the species are patchy, and Koala density in the Narromine region is likely to be very low. The proposal site is not in an area of generational persistence as identified by Koala expert Steve Phillips, or in an Area of Regional Koala Significance
– The removal of 15.85 hectares of native woodlands is unlikely to significantly reduce the availability of forging habitat for the species given the wide availability of alternant foraging habitat in the study area
– Direct impacts to the species would be avoided by conducting pre-clearing surveys to locate the species on site (if present) and avoiding if it occurs

Koala (*Phascolarctos cinereus*)
– Impacts to preferred habitat (mature eucalypts and feed trees) would be avoided and minimised where possible during on-site inspections – The small area of potential foraging habitat to be removed represents a minor proportion of high-quality habitat available within the locality and is unlikely to be important for the persistence of a viable local population of the species.

Microbats (Yellow-bellied Sheathtail-bat, Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat – vulnerable species)

The Yellow-bellied Sheathtail-bat, Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat are vulnerable species listed under the BC Act. Based on suitable habitat availability, these species may occur in the study area.

The proposal would result in the following impacts on potentially occurring local populations of the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Little Pied Bat (*Chalinolobus picatus*), Northern Free-tailed Bat (*Ozimops lumsdenae*) and Corben's Long-eared Bat (*Nyctophilus corbeni*) due to the loss of potential foraging habitat for these species, including:

– Removal of around 15.85 hectares of native woodland habitat with semi-intact canopy that would provide potential foraging and roosting habitat for the Yellow-bellied Sheathtail-bat, Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat
– Removal of up to 146.30 hectares of grassland vegetation providing potential foraging habitat for the Yellow-bellied Sheathtail-bat.

Impacts to roosting habitat for these species would be minimised wherever possible. An ecologist would assess each site prior to vegetation clearance to avoid areas of biodiversity values (woody debris, mature eucalypts, hollow-bearing trees canopy trees and dense vegetation) as much as practical. There would be no removal of roosting habitat comprised of buildings, caves, drains and rock outcrops, as these do not occur in the proposal site. Hollow-bearing trees, stags and suitable roosting trees would be avoided where possible by the supervising ecologist.

There are relatively extensive areas of potential habitat for local populations of these threatened fauna in the broader local area surrounding the proposal site. This threatened species would be able to use adjacent habitat in the study area as foraging and nesting habitat.

Assessment of the significance of impacts on local populations of these threatened microbat species have been prepared and are included below. Where appropriate individual parts of the five-part test have been considered jointly for these microbat species. The outcome of these assessments is that the proposal is not likely to have a significant impact on local populations of these threatened microbat species (if present)

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	Little Pied Bat (*Chalinolobus picatus*)	Corben's Long-eared Bat (*Nyctophilus corbeni*)	Northern Free-tailed Bat *Ozimops lumsdenae*
The Yellow-bellied Sheathtail-bat is a very distinctive, large insectivorous bat that forages in most habitats across its very wide range, with and without trees. When foraging for insects, it flies high and fast over the forest canopy, but lower in more open country. The species roosts singly or in groups of up to six, in tree hollows and buildings. In treeless areas the species is known to utilise mammal burrows (DPIE 2021). As the proposal site contains potential foraging and roosting habitat it is assumed that the species may occur in the proposal site and use habitat in the study area.	The Little Pied Bat is a distinctive black and white bat that is found in inland NSW. The species occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands and roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings (DPIE 2021). As the proposal site contains potential foraging and roosting habitat it is assumed that the species may occur in the proposal site and use habitat in the study area.	The Corben's Long-eared Bat distribution coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. It inhabits a variety of vegetation types, including mallee, bulloke and box eucalypt dominated communities. It is more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW. The species roosts in tree hollows, crevices, and under loose bark. As the proposal site contains potential foraging and roosting habitat it is assumed that the species may occur in the proposal site and use habitat in the study area.	The Northern Free-tailed Bat is widely distributed across northern Australia from Western Australia to Queensland, extending south to the north-east corner of NSW. The only confirmed record in NSW is of a colony found in the roof of a house in Murwillumbah, however, calls have been detected from a few other locations in the far north east of the State. It inhabits a range of vegetation types in northern Australia, from rainforests to open forests and woodlands, and are often recorded along watercourses. Roost mainly in tree hollows but relatively large colonies have been found under house roofs in urban areas in Queensland. As the proposal site contains potential foraging and roosting habitat it is assumed that the species may occur in the proposal site and use habitat in the study area.

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	Little Pied Bat (*Chalinolobus picatus*)	Corben's Long-eared Bat (*Nyctophilus corbeni*)	Northern Free-tailed Bat *Ozimops lumsdenae*
a) **In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**			
Factors that could potentially disrupt the life cycle of the Yellow-bellied Sheathtail-bat, Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat are loss or modification of foraging habitat, loss or disturbance of breeding and roosting sites. The proposal will remove about 15.85 ha is semi-intact native vegetation that would provide foraging habitat for the Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat and up to 146.30 hectares of grassland vegetation that may provide foraging habitat for the Yellow-bellied Sheathtail-bat. These species forage over woodland and native vegetation for small insects. Given the large areas of similar habitat in the surrounding area, the species are likely to be able to continue foraging within the locality. The woodland vegetation to be removed is fragmented and occurs as small, isolated patches or linear strips along fence lines. The removal of woodland vegetation along fence lines and within small, fragmented patches in paddocks will reduce the availability of foraging and roosting habitat for these microbat species. These species are highly mobile and unlikely to be impacted by the minor increase in fragmentation of woodland habitat. These threatened microbat species are known to roost either in tree hollows, buildings, caves, rock outcrops, crevices or under loose bark. The proposal would remove a small number of hollow-bearing trees, which represents and small proportion of roosting habitat in the locality. Noise and vibration during construction activities have the potential to disturb roosting individuals. This is unlikely to impact breeding success for a small proportion of the local populations. The proposal would include fauna management protocols including careful felling of habitat trees if required and salvage and treatment of any resident fauna. This would partially mitigate impacts on the local populations of these species if any roosting individuals or their young are in the proposal site during investigations. The proposal is therefore unlikely to adversely affect the lifecycle of the Yellow-bellied Sheathtail-bat, Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat such that a viable local population would be placed at risk of extinction.			
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: **(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**			
N/A to an endangered community			

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	Little Pied Bat (*Chalinolobus picatus*)	Corben's Long-eared Bat (*Nyctophilus corbeni*)	Northern Free-tailed Bat *Ozimops lumsdenae*
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,			
N/A to an endangered community			
c) In relation to the habitat of a threatened species or ecological community: **(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**			
The proposal will remove about 15.85 hectares of native woodland vegetation that may provide foraging habitat and roosting sites for these species. This represents a small portion of the total estimated extent of potential habitat in the locality. Clearing of grassland vegetation would reduce foraging habitat for the Yellow-bellied Sheath-tail Bat, however large areas of similar agricultural land are present in the locality. The proposal may result in impacts such as noise pollution into areas of woodland during construction activities. This impact would be temporary, and sufficient alternant habitat is available for these species in the locality to allow it to move away from areas of temporary disturbance. Given the aerial nature of these species, and the high availability of alternate foraging habitat in the study area and locality, any such cumulative impacts on foraging habitat are likely to be minimal on the threatened microbat species. The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on habitat during construction activities.			
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and			
The study area has undergone previous disturbance and modification by agricultural land use, which has resulted in fragmentation of patches of woodland habitat throughout the study area. The proposal would result in further fragmentation through the removal of linear strips of vegetation and small patches of woodland within paddocks. In the context of the fragmented habitat in the study area, the proposal would comprise a minor increase in these negative effects. This minor fragmentation is unlikely to impact highly mobile microbat species. The proposal is unlikely to affect the connectivity of habitat to the extent that any habitat for these species would be isolated.			

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	Little Pied Bat (*Chalinolobus picatus*)	Corben's Long-eared Bat (*Nyctophilus corbeni*)	Northern Free-tailed Bat *Ozimops lumsdenae*
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,			
The proposal would result in the removal of 15.85 hectares of native woodland habitat for the Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat and the removal of up to 146.30 hectares of grassland vegetation which may provide foraging habitat for the Yellow-bellied Sheathtail-bat. These threatened microbat species are known to roost either in tree hollows, or under loose bark. As discussed in section (a) above, an ecologist would be present on site to supervise vegetation clearing, and to avoid nesting habitat for this species if present. The small area of potential foraging and roosting habitat within the proposal site is unlikely to be important to the long-term survival these species in the context of the extent of potential habitat in the surrounding study area and locality. The proposal will result in a minor increase in fragmentation of habitat for these species, and a minor loss in potential roost sites, if they occur in the study area. This is unlikely to pose a barrier for movement between in the study area, due to these species high mobility.			
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),			
The proposal would not affect any habitat of outstanding biodiversity value.			
e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.			
The proposal would contribute to the operation of the following KTPs of relevance to the Yellow-bellied Sheathtail-bat, Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat; – Clearing of native vegetation - The proposal would directly contribute to the operation of this KTP through the removal of around 15.85 hectares of native woodland vegetation that may provide foraging habitat areas for these species as described above. – Removal of hollow-bearing trees – The proposal site may contain hollow-bearing-trees that may comprise roost sites for these species. – Removal of dead wood and dead trees – The proposal site may contain standing dead trees that may comprise roost sites for these species.			

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	Little Pied Bat (*Chalinolobus picatus*)	Corben's Long-eared Bat (*Nyctophilus corbeni*)	Northern Free-tailed Bat *Ozimops lumsdenae*
As described in part c) the proposal would remove or modify a relatively minor proportion of the habitat resources that support potentially occurring local populations of these threatened microbat species through the operation of this KTP.			
Conclusion			
Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on a local population of the Yellow-bellied Sheathtail-bat, Little Pied Bat, Northern Free-tailed Bat and Corben's Long-eared Bat (if present) as: – Only a relatively small area (15.85 hectares) of potential native woodland habitat for these microbat species will be removed in comparison to the extent of habitat in the study area and locality – The proposal would remove a small number of hollow-bearing trees. Alternate roost habitat is present elsewhere in the locality. – The proposal is unlikely to further increase existing habitat fragmentation so as to pose a barrier to movement of these highly mobile species through the study area or locality.			

APPENDIX A

Biodiversity Assessment Report

Appendix D Assessments of significance—Environment Protection and Biodiversity Conservation Act

Appendix D – EPBC Act assessments of significance

Koala (*Phascolarctos cinereus*) – endangered species

Distribution

The Koala (*Phascolarctos cinereus*) occurs in a range of forest and woodland communities throughout NSW.

Habitat requirements

Habitat occupied by the Koala is associated with vegetation containing nutritionally desirous Myrtaceous species (ie preferred feed tree species) capable of maintaining a positive nitrogen balance of slightly above 1 percent. In this respect higher value foraging habitat is often associated with vegetation on fertile soils and reliable access to water resources for drought affected regions. Up to 120 feed tree species are known to provide suitable foliage for the Koala although the Koala is known to exhibit regional, local and seasonal preferences (TSSC, 2012).

The size of an individual Koala's home range varies in accordance with two main factors these being the abundance of preferentially utilised food trees, and gender (ie males have larger home ranges than females). Stable populations are characterised by a well-structured network of overlapping adult Koala home ranges. Landscapes exceeding 60-70 percent native vegetation cover also appear to be linked with population stability, with 150 hectares being the minimum habitat patch area supporting non-declining populations (McAlpine et al. 2006).

Males and females disperse from natal home ranges. Dispersal generally occurs between June and December, with the dispersal of males commencing in July and August and that of females commencing between September and November. Dispersal is likely to be a social behaviour and mating systems of Koala populations provide mechanisms for young Koalas to disperse (Dique et al. 2003).

Habitat in the study area

Patchy and isolated records of the Koala occur in the Narromine area. No evidence of the species was recorded in the area during targeted surveys. An expert report was prepared for the BDAR by Dr Stephen Phillips. Analysis of contemporaneous koala records to identify areas of generational persistence identified approximately 20.3 km of the N2N alignment as currently supporting resident Koala populations, all of which was located in the Pilliga and Bohena Creek areas (Phillips 2021). Linear and riparian woodland in the Narromine area may support a very low density of Koalas at best.

Assessment of significance for the Koala

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of a population	No Koalas were recorded in the locality during surveys for the proposal or for the N2N BDAR. Records of the species are patchy, and Koala density in the Narromine region is likely to be very low. Expert assessment of the Koala for the N2N BDAR did not identify the Narromine area as supporting a resident Koala population. The study area has not been identified as having generational persistence. The woodland in the study area may provide habitat for the Koala. The proposal will remove 15.85 hectares of native woodland habitat with semi-intact canopy. This habitat occurs a narrow linear strips along fence lines, and patches in agricultural land with scattered trees. The small area of potential habitat to be removed represents a minor proportion of available habitat within the locality. The proposal is unlikely to remove an ecologically significant proportion of foraging habitat due to the limited quantum of direct impacts (15.85 hectares of woodland vegetation). The proposal is not likely to remove, modify or fragment a significant proportion of the potential habitat for the Koala in the locality. Remnant areas of vegetation in the broader local area, including a large patch of native woodland ~15km to the east within private lands, and habitat along the Macquarie River at Narromine that would provide suitable habitat to maintain a viable local population of the species. Given the low numbers of records, fragmented nature of the habitat present, and relatively small area of clearing, the proposal is unlikely to adversely affect the lifecycle of the species such that a viable local population is placed at risk of extinction. The proposal is unlikely to result in a long-term decrease in the size of a population.
reduce the area of occupancy of the species	The proposal would remove 15.85 hectares of woodland vegetation occurring as small, scattered patches and linear strips along fence lines. Clearing is unlikely to fragment or reduce home ranges, and is unlikely to impact movement and dispersal of individuals in the locality. As such, the proposal is unlikely to reduce the area of occupancy of the important population.
fragment an existing population into two or more populations	Habitat in the locality is highly fragmented, and Koalas, if present, may use habitat in the proposal site as occasional movement habitat on a transient basis only. The proposal would result in a very minor increase in the fragmentation of woodland in the locality. In the context of the existing fragmented habitat in the local area, the proposal would comprise a minor increase in these negative effects. Narrow roadside and fence line corridors are present elsewhere in the area, and connectivity would be retained in these areas. As the species is sufficiently mobile, the species is unlikely to be impacted by the minor increase in fragmentation and the proposal is unlikely to fragment an existing population into two or more populations.

Criteria	Discussion
adversely affect habitat critical to the survival of a species	Habitat critical to the survival of a species is defined as the areas that the species relies on to avoid or halt decline and promote the recovery of the species. No Koalas were recorded in the locality during surveys for the proposal or for the N2N BDAR. Records of the species are patchy, and Koala density in the Narromine region is likely to be very low. The proposal site is not in an area of generational persistence as identified by Koala expert Steve Phillips, or in an Area of Regional Koala Significance. The proposal would result in the removal of 15.85 hectares of native woodland habitat for the Koala, containing eucalypt species known to be preferred feed trees for the species. This represents a very small portion of the total estimated extent of native woodland in the locality. The removal of a small area of potential foraging habitat within the proposal site is unlikely to adversely affect habitat critical to the survival of a species in the context of the extent of potential habitat in the surrounding study area and locality.
disrupt the breeding cycle of a population	Koalas live in breeding aggregations, generally comprising a dominant male, a small number of mature females, as well as juveniles of various ages (Phillips 1997). The home range of koalas varies depending on the quality of the habitat and the number of available food trees. The home range of the dominant male generally overlaps extensively with the home ranges of several females (DECC 2008). Adult koalas generally exhibit long-term fidelity to their individual home range areas (Mitchell 1990). Males and females disperse from natal home ranges, with dispersal of males commencing in July and August and that of females commencing between September and November (Dique et al. 2003). Habitat in the locality is highly fragmented, and Koalas, if present, are unlikely to use the habitat in the proposal site for breeding. Koalas may use habitat in the proposal site as occasional movement habitat on a transient basis only.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No Koalas were recorded in the locality during surveys for the proposal or for the N2N BDAR. Records of the species are patchy, and Koala density in the Narromine region is likely to be very low. The proposal site is not in an area of generational persistence as identified by Koala expert Steve Phillips, or in an Area of Regional Koala Significance. The proposal would result in the removal of 15.85 hectares of native woodland habitat for the Koala, containing eucalypt species known to be preferred feed trees for the species. This represents a very small portion of the total estimated extent of native woodland in the locality. The removal of a small area of potential foraging habitat within the proposal site is unlikely to result in the decline of the species in the context of the extent of potential habitat in the surrounding study area and locality.
result in invasive species that are harmful to a critically endangered or	Construction activities have the potential to spread weeds and pests into the study area. Introduction and spread of weeds is unlikely to substantially impact foraging habitat for this species.

Criteria	Discussion
endangered species becoming established in the endangered or critically endangered species' habitat	A fox was recorded on site during field surveys. The proposal is unlikely to result in invasive species that are harmful to this species becoming established in the area.
introduce disease that may cause the species to decline	While the proposal is unlikely to introduce disease that would cause the species to decline, threats including clearing of habitat may further affect Koala resilience. This could similarly lead to an increase in expression of symptoms of Chlamydia infection, impacting the health of the population.
interfere with the recovery of the species.	Loss, fragmentation and degradation of habitat are the most important threats to Koalas throughout their range. The disruption of home-ranging patterns as a result of habitat fragmentation and degradation, the loss of home-range trees and creation of barriers to movement may result in the disintegration of social structure, potentially contributing to the decline of the population (Phillips 2000). The removal of 15.85 hectares of native woodlands is unlikely to significantly reduce the availability of foraging habitat for the species given the wide availability of alternant foraging habitat in the study area. The proposal is unlikely to affect the connectivity of habitat to the extent that any habitat for this species would be isolated. Terefore, the proposal is unlikely to interfere with the recovery of the species.
Conclusion	Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the Koala if present as: No Koalas were recorded in the locality during surveys for the proposal or for the N2N BDAR. Records of the species are patchy, and Koala density in the Narromine region is likely to be very low. The proposal site is not in an area of generational persistence as identified by Koala expert Steve Phillips, or in an Area of Regional Koala Significance The removal of 15.85 hectares of native woodlands is unlikely to significantly reduce the availability of foraging habitat for the species given the wide availability if alternant foraging habitat in the study area Direct impacts to the species would be avoided by conducting pre-clearing surveys to locate the species on site (if present) and avoiding if it occurs Impacts to preferred habitat (mature eucalypts and feed trees) would be avoided and minimised where possible during on-site inspections

Corben's Long-eared Bat (*Nyctophilus corbeni*) – vulnerable species

Distribution

Distribution of the species coincides approximately with the Murray Darling Basin, with the Pilliga Scrub region being the distinct stronghold for this species (EES 2019b).

Habitat requirements

Corben's Long-eared Bat inhabits a variety of vegetation types, including mallee, Bulloke (*Allocasuarina leuhmanni*) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. It roosts in tree hollows, crevices, and under loose bark (EES 2019b). The species avoids roosting in commercially thinned stands and selected old regrowth (Law et al 2016) and prefers larger remnants with a well-developed understorey (Turbill and Ellis 2006).

Habitat in the study area

The proposal will remove about 15.85 ha is semi-intact native that would provide foraging and roosting habitat for the Corben's Long-eared Bat.

Assessment of significance for Corben's Long-eared Bat

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: – Key source populations either for breeding or dispersal – Populations that are necessary for maintaining genetic diversity, and/or – Populations that are near the limit of the species range Corben's Long-eared Bat has a scattered distribution mostly within the Murray-Darling Basin, with its stronghold occurring in the Pilliga Scrub (EES 2019b). Given the lack of large tracts of vegetation in the study area, an important population is unlikely to be present..
Lead to a long-term decrease in the size of an important population of a species	The proposal will result in the removal of 15.85 hectares of native woodland vegetation that would provide potential foraging habitat for the Corben's Long-eared Bat. Alternate foraging habitat would be present within the larger areas of habitat in the locality. Foraging habitat that would be impacted would comprise a small proportion of the home range of individuals, and a small proportion of foraging habitat in the locality. Given the limited impact on potential foraging habitat, the project is unlikely to lead to a long-term decrease in the size of a local population of this species. As noted above, and important population is unlikely to be present in the study area.
Reduce the area of occupancy of an important population	Corben's Long-eared Bat is known from a large area of central NSW, within the Murray-Darling Basin. The loss of 15.85 hectares of woodland habitat in an already fragmented landscape would not reduce the area of occupancy of the local population. As noted above, and important population is unlikely to be present in the study area.
Fragment an existing important population into two or more populations	The study area has undergone previous disturbance and modification by agricultural land use, which has resulted in fragmentation of patches of woodland habitat throughout the study area. The proposal would result in further fragmentation through the removal of linear strips of vegetation and small patches of woodland within paddocks. In the context of the fragmented habitat in the study area, the proposal would

Criteria	Discussion
	comprise a minor increase in these negative effects. Corben's Long-eared Bat is a slow flying agile bat, utilising the understorey to hunt non-flying prey. This species would forage along riparian corridors in the locality, including within larger areas of habitat such as the large patch of native woodland ~15km to the east within private lands, and habitat along the Macquarie River at Narromine that would provide suitable habitat to maintain a viable local population of the species. Given the mobility of the species and large area of available habitat, the proposal is unlikely to fragment an existing population into two or more populations. As noted above, and important population is unlikely to be present in the study area.
Adversely affect habitat critical to the survival of a species	The proposal would result in the removal of 15.85 hectares of native woodland habitat for the Corben's Long-eared Bat. Habitat critical to its survival comprises hollow-bearing trees, which are a limiting resource. The proposal will result in a minor increase in fragmentation of habitat for these species, and a minor loss in potential roost sites, if they occur in the study area. An ecologist would be present on site to supervise vegetation clearing to minimise the risk of injury or mortality of hollow-dwelling fauna. The proposal is unlikely to adversely affect habitat critical to the survival of the species in the context of the extent of potential habitat in the surrounding study area and locality.
Disrupt the breeding cycle of an important population	Corben's Long-eared Bat mates in autumn, and young are born in late spring to early summer. Hollow-bearing trees are required for breeding. Removal of hollow-bearing trees and stags would be avoided where possible by the supervising ecologist. Noise from construction and operation may impact breeding success in areas immediately adjacent to the project site should they be utilising the area for breeding. Given the small size of the potential roosting habitat, the project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposal would remove approximately 15.85 hectares of native woodland vegetation which provides potential foraging and roosting habitat for the Corben's Long-eared Bat. Alternate foraging and roosting habitat is available in larger remnants within the locality. Habitat that would be impacted would comprise a small proportion of the home range of individuals, and a small proportion of foraging habitat in the locality. Given the limited impact on potential habitat, the proposal is unlikely to lead to a decline of this species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Construction activities have the potential to spread weeds and pests into the study area. High levels of introduced species are already present in the study area given its location in agricultural land. Introduction and spread of weeds is unlikely to substantially impact foraging habitat for this species. A fox was recorded on site during field surveys, and this species is likely to be prevalent in the area. The proposal is unlikely to result in the

Criteria	Discussion
	increase in fox populations, or the introduction of new invasive species that are harmful to this species becoming established in the area.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	The key threats to the viability of this species are loss, fragmentation and degradation of habitat. Construction would require the removal of a relatively small area (15.85 hectares) of potential foraging and roosting habitat compared to larger areas of similar surrounding habitat. The loss of this habitat is unlikely to substantially interfere with the recovery of the species.
Conclusion	The proposal is not likely to have a significant impact on Corben's Long-eared Bat as: – Only a relatively small area (15.85 hectares) of potential native woodland foraging habitat will be removed in comparison to the extent of habitat in the study area and locality – The proposal would remove a small number of hollow-bearing trees. Alternate roost habitat is present elsewhere in the locality. – The proposal is unlikely to remove habitat or further increase existing habitat fragmentation so as to the extent that the species is likely to decline – The small area of potential foraging and roosting habitat to be removed represents a minor proportion of high-quality habitat available within the locality.

Painted Honeyeater (*Grantiella picta*) – vulnerable species

Distribution

Known to occur in the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland, however it is a nomadic species that occurs in low densities (EES 2019b).

Habitat requirements

The Painted Honeyeater is a specialist feeder of mistletoe and inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.

Habitat in the study area

The proposal will remove about 15.85 ha of semi-intact native woodland that would provide potential foraging and breeding habitat for the Painted Honeyeater. The Painted Honeyeater was not recorded in the proposal site or the Narromine to Narrabri section of Inland Rail despite targeted surveys.

Assessment of significance for Painted Honeyeater

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: – Key source populations either for breeding or dispersal – Populations that are necessary for maintaining genetic diversity, and/or – Populations that are near the limit of the species range The Painted Honeyeater is considered to have a single population given its seasonal dispersive movements from north to south driven by the fruiting of mistletoe (Garnett et al. 2011). A local population within the proposal site (if present), would thus be part of a key source population for breeding and/or dispersal and necessary for mentioning genetic diversity. Painted Honeyeater in the proposal site would not occur at the limit of the species' range. An important population is likely to be present in the proposal site.
Lead to a long-term decrease in the size of an important population of a species	The proposal will result in the removal of 15.85 hectares of native woodland vegetation that would provide potential foraging and breeding habitat for the Painted Honeyeater. Alternate foraging habitat would be present within the larger areas of habitat in the locality. The potential foraging habitat that would be impacted would comprise a negligible proportion of the home range of individuals, given that the species is largely nomadic. Woodland within the proposal site would only provide optimum foraging habitat for the species when mistletoe is present and flowering. During other times of the year, local populations of Painted honeyeater would forage on insects and nectar from woodland remnants within the proposal site on occasion. Given the limited impact on potential foraging habitat, the project is unlikely to lead to a long-term decrease in the size of a local population of this species.
Reduce the area of occupancy of an important population	The Painted Honeyeater is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The loss of 15.85 hectares of woodland habitat in an already fragmented landscape would not reduce the area of occupancy of the local population.
Fragment an existing important population into two or more populations	The landscape around the proposal site is highly modified, with large patches of vegetation comprising cropped or cleared lands. The proposal would result in further fragmentation of patchy woodland habitat. The removal of small patches of woodland within cleared land is unlikely to fragment breeding or foraging habitat, given the nomadic nature of the Painted Honeyeater. Larger areas of woodland habitat including ~15km to the east within private lands, and habitat along the Macquarie River at Narromine would provide suitable habitat to maintain a viable local population of

Criteria	Discussion
	the species. Given the mobility of the species, the large area of available habitat and the nomadic nature of the species, the proposal is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	The proposal would result in the removal of 15.85 hectares of native woodland habitat for the Painted Honeyeater. Habitat critical to its survival comprises mistletoe, which are a limiting resource. The proposal will result in a minor increase in fragmentation of woodland habitat containing insect and nectar resources for this species, and a minor loss in potential nesting habitat (if present). The proposal is unlikely to adversely affect habitat critical to the survival of the species in the context of the extent of potential habitat in the surrounding study area and locality.
Disrupt the breeding cycle of an important population	Painted Honeyeater nest from spring to autumn in a small nest of drooping eucalypts, she-oak , paperbark or mistletoe branches. The 15.85 hectares of woodland proposed for removal may include nesting habitat, however the species was not recorded and no nests were observed. The woodland vegetation proposed for removal is unlikely to be critical to the breeding cycle of the species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposal would remove approximately 15.85 hectares of native woodland vegetation which provides potential foraging and nesting habitat for the Painted Honeyeater. Alternate foraging and nesting habitat is available in larger remnants within the locality. Habitat that would be impacted would comprise a small proportion of the home range of individuals (given their nomadic life history), and a small proportion of foraging habitat in the locality. Given the limited impact on potential habitat, the proposal is unlikely to lead to a decline of this species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Construction activities have the potential to spread weeds and pests into the study area. High levels of introduced species are already present in the study area given its location in agricultural land. Introduction and spread of weeds is unlikely to substantially impact potential foraging or breeding habitat for this species. A fox was recorded on site during field surveys, and this species is likely to be prevalent in the area. The proposal is unlikely to result in the increase in fox populations, or the introduction of new invasive species that are harmful to this species becoming established in the area.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	The key threats to the viability of this species are habitat loss from clearing and degradation by livestock. The proposal would require the removal of a relatively small area (15.85 hectares) of potential foraging and nesting habitat compared to larger areas of similar surrounding

Criteria	Discussion
	habitat. The loss of this habitat is unlikely to substantially interfere with the recovery of the species.
Conclusion	The proposal is not likely to have a significant impact on Painted Honeyeater as: – The species was not recorded within the proposal site or the Narromine to Narrabri section of Inland Rail despite targeted surveys and is unlikely to rely on habitats critical to its lifecycle – The species has a nomadic life history and would be able to travel to access alternative habitat resources in the locality – Only a relatively small area (15.85 hectares) of potential foraging and breeding habitat will be removed in comparison to the extent of habitat in the study area and locality

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and derived native grasslands of South-eastern Australia – endangered ecological community

Diagnostic features

This community is a grassy woodland dominated by dominated or co-dominated by Grey Box (*Eucalyptus microcarpa*). The community also includes grassland understorey derived from the historic clearing of the woody components of the woodland. Both the grassy woodland and the derived native grassland provide vital support to a diverse range of native flora and fauna that are important to retaining regional, state and national biodiversity.

In grassy woodland occurrences, the shrub layer is variable, ranging from absent in areas of intense grazing, to moderately dense cover. In many situations, regrowth of the canopy trees may also be present in the mid layer. This community is heavily influenced by landscape factors and past land management practices. The ground layer varies in compositions, with a combination of grasses, herbs and smaller chenopods.

This community was once widespread throughout south-eastern Australia but now, across its national range, only 10 to 15 percent of the original extent remains. The community is found in wheat-sheep belt of eastern Australia and as a result has been extensively cleared since European settlement. It is estimated that the extent of the ecological community has declined from between 1.8 to 2.0 million hectares to a present extent between 300 000 and 330 000 hectares in NSW. Most of the remaining areas of this ecological community occur on private land. At present, less than one percent of what remains of the community in NSW is in formal conservation reserves (TSSC, 2001).

Occurrence in the study area

No Grey Box was recorded in the proposal site. Woodland vegetation was dominated either by Poplar Box or Pilliga Box. This TEC was recorded in the N2N construction impact zone about 3 km to the east along Dappo Road, where Grey Box occurred in combination with Poplar Box (GHD 2021).

Assessment of significance – Grey Box Woodland

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
Reduce the extent of an ecological community	The proposal would not reduce the extent of this TEC. Vegetation within the proposal site has been ground-truthed and assessed by field staff and no Grey Box was recorded. Grey Box Woodland was recorded in the N2N construction impact zone about 3 km to the east of the proposal site along Dappo Road, where Grey Box occurred in combination with Poplar Box.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The proposal will not result in further fragmentation of the Grey Box Woodland community as it is not present at the proposal site.
Adversely affect habitat critical to the survival of an ecological community	No critical habitat has been listed for the Grey Box Woodland ecological community under the EPBC Act 1999. Habitat critical to the survival of a species or ecological community also refers to areas that are necessary: For activities such as foraging, breeding, roosting or dispersal For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) To maintain genetic diversity and long term evolutionary development, or For the reintroduction of populations or recovery of the species or ecological community (DoE, 2013). As there is no Grey Box Woodland present within the proposal site, it is unlikely that the proposal will damage habitat necessary for dispersal, maintenance, genetic diversity or recovery of Grey Box Woodlands.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The proposal will involve earthworks as part of the construction of the proposal and may alter local surface drainage flows within the proposal site. As the Grey Box Woodland community does not occur within the proposal site, the proposal is unlikely to significantly modify abiotic factors critical to the long-term survival of the community.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example	The Grey Box Woodlands community does not occur within the proposal site.

Criteria	Discussion
through regular burning or flora or fauna harvesting	
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:	The Grey Box ecological community is listed as an endangered ecological community due to the significant loss of integrity throughout much of its extent. This includes both vegetative and faunal components, combined with weed invasion, fragmentation and degradation of habitat.
-assisting invasive species, that are harmful to the listed ecological community, to become established, or	The proposal will not remove any occurrence of this community, therefore there be no reduction in quality or integrity of the community.
causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants in to the ecological community which kill or inhibit the growth of species in the ecological community	Construction of the proposal has the potential to result in the mobilisation of contaminated sediments or chemical spill from vehicles or plants. However, Grey Box Woodlands will not be impacted as the community does not occur within the proposal site.
Interfere with the recovery of an ecological community	There is no national recovery plan for this ecological community. This community does not occur in the proposal site, therefore the proposal is unlikely to interfere with the recovery of the community.
Conclusion	The proposal is not likely to have a significant impact on the endangered Grey Box Woodlands ecological community given: The Grey Box Woodlands TEC is not present within the proposal site and the proposal will not remove or further fragment the community.

Poplar Box grassy woodland – endangered ecological community

Diagnostic features

The Poplar Box grassy woodland endangered ecological community is variable, ranging from grassy woodland to grassy open woodland, and can resemble an open forest structure. The canopy is dominated by Poplar Box (E*ucalyptus populnea*) with an understorey of forbs and grasses. Low density shrubs are sometimes present within this community in areas of lower nutrient and sandier soils, but taller shrubs are general lacking. The mid layer also often includes juvenile trees of canopy species and in some circumstances this layer may occur as a thicket. Small fragmented areas occur predominantly within agricultural areas.

Occurrence in the study area

Poplar Box grassy woodland (PCT 244) at the site comprises a relatively small patch. About 4.7 ha is mapped as good condition (has a canopy layer), while around 3.1 ha comprises a derives grassland form of the community (canopy lacking). Land to the north and west of the patch is cropped. Land to the north-west and east is a derived grassland form of Pilliga Box - White Cypress Pine - Buloke shrubby woodland (PCT 88). Good condition Pilliga Box - White Cypress Pine - Buloke shrubby woodland occurs to the south of the Poplar Box grassy woodland patch. Both good condition forms of PCT 88 and PCT 244 have scattered trees over a disturbed groundlayer. The patch is subject to grazing.

Taking into account the canopy cover and disturbed groundlayer, PCT 244 at the site is below the minimum patch condition for the EPBC Act TEC. This TEC was recorded about 1 km to the east of the proposal site during surveys for the N2N BDAR.

Assessment of significance – Poplar Box Grassy woodland

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
Reduce the extent of an ecological community	The proposal would not reduce the extent of this TEC. Vegetation within the proposal site has been ground-truthed and assessed by field staff and is considered to be below the area and condition thresholds for the community. Poplar Box grassy woodland was recorded in the N2N construction impact zone about 1 km to the east of the proposal site. The loss of a small patch of Poplar Box woodland in already disturbed agricultural land that does not meet the condition criteria for the community will not reduce the extent of the ecological community.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The majority of the proposal site is largely agricultural and contains cleared lands from cropping and grazing. Small patches of semi-intact native vegetation are present along existing fence lines, as scattered trees in paddocks or along adjacent road reserves. The proposal would remove a small patch of Poplar Box woodland in already disturbed agricultural land that does not meet the condition criteria for the community .
Adversely affect habitat critical to the survival of an ecological community	No critical habitat has been listed for the Poplar Box ecological community under the EPBC Act. The area's most critical to the survival of the Poplar Box ecological community are described by DAWE in their conservation advice (DoEE 2019) as being the best quality, most intact patches of the ecological community. These patches represent those parts of the ecological community that retain the highest diversity and degree of structure and ecological functions. They represent those sites closest to the original, benchmark values of the ecological community and that must retain their inherent values through protection and ongoing management (DoEE 2019). The areas of Poplar Box woodland to be removed by the proposal occurs as a small patch that is largely modified and disturbed and occur within active agricultural land. This patch does not meet the area or condition criteria for the community. As such, the proposal will not affect any habitat critical to the survival of this ecological community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The proposal will involve earthworks as part of the construction of the proposal and may alter local surface drainage flows within the proposal site. As the Poplar Box woodland community in the proposal site, the proposal does not meet the area or condition criteria, the proposal is unlikely to significantly modify abiotic factors critical to the long-term survival of the community.

Criteria	Discussion
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The areas of Poplar Box woodland to be removed by the proposal occurs as a small patch that is largely modified and disturbed and occur within active agricultural land. This patch does not meet the area or condition criteria for the community.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: -assisting invasive species, that are harmful to the listed ecological community, to become established, or	The areas of Poplar Box woodland to be removed by the proposal occurs as a small patch that is largely modified and disturbed and occur within active agricultural land. This patch does not meet the area or condition criteria for the community. No other patches occur in close proximity to the MDC that could be affected by introduction of invasive species.
causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants in to the ecological community which kill or inhibit the growth of species in the ecological community	Construction of the proposal has the potential to result in the mobilisation of contaminated sediments or chemical spill from vehicles or plants. No other patches occur in close proximity to the MDC that could be affected by mobilisation of chemicals.
Interfere with the recovery of an ecological community	There is no national recovery plan for this ecological community. Given the occurrence of this community in the proposal site as small isolated patches, the proposal is unlikely to interfere with the recovery of the community due to the patches being impacted already being fragmented and isolated from other patches. The conservation advice (DoEE 2019) outlines four key approaches to achieve their conservation objectives for Poplar Box Grassy Woodlands of which one may be relevant: – Protect the ecological community to prevent further loss of extent and condition. The areas of Poplar Box woodland to be removed by the proposal occurs as a small patch that is largely modified and disturbed and occur within active agricultural land. This patch does not meet the area or condition criteria for the community. The loss of this vegetation would therefore not interfere with the recovery of the community.
Conclusion	The proposal is not likely to have a significant impact on the endangered Poplar Box grassy woodlands ecological community given: – The areas of Poplar Box woodland to be removed by the proposal occurs as a small patch that is largely modified and disturbed and occur within active agricultural land. This patch does not meet the area or condition criteria for the community.

APPENDIX B

Heritage Impact Assessment

Narwonah Material Distribution Centre

Heritage Impact Assessment

Report to ARTC

March 2022

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EXECUTIVE SUMMARY

This Heritage Impact Assessment (HIA) has been prepared by Artefact Heritage Services (Artefact Heritage) on behalf of the Australian Rail Track Corporation (ARTC) to support the development of a new Material Distribution Centre (MDC) (hereon also referred to as the proposal). The MDC will be used for storage of rail, sleepers and ballast and will also contain a rail welding facility. ARTC proposes that under the Infrastructure State Environmental Planning Policy (Transport and Infrastructure) 2021 these works could be progressed as a Part 5.1 assessment process in a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act* 1979. The MDC is proposed to be constructed on lots:16 DP 755131, 232 DP 755131, 233 DP 755131, 1 DP 1198931.

Conclusions

This HIA has determined the following:

- No listed items of built heritage are located within the study area or within 3km of the study area.
- A search of archival text and plan records indicates that the study area has solely functioned as agricultural land since the late 19th century and has not been the location of significant built structures.
- The archaeological potential of the study area has been rated as nil-low.
- The significance of potential archaeological finds in the study area has been assessed as not reaching the level of local heritage threshold.
- One item of potential built heritage significance is present approximately 200m west of the study area. This is the Craigie Lea homestead. It has been assessed here that were the original fabric of the Craigie Lea homestead to be preserved, then this homestead would meet the threshold of local heritage significance.
- If the Craigie Lea homestead does meet the threshold of local heritage significance, then the proposal would result in minor indirect (visual) impacts to the homestead due to impacts to the homestead setting.

Recommendations

- No further formal archaeological or built heritage investigation is required for the study area.
- This report has assessed that any archaeological remains in the study area would not reach the threshold of local significance. Therefore, neither an Excavation (s140) or Exemption (s139(4) is required for works to proceed under the *Heritage Act 1977.*
- The following steps should be carried out to manage potential minor indirect (visual) impacts to Craigie Lea homestead.
    - The homestead should be inspected by a heritage specialist to determine whether the homestead retains heritage significance, or whether it has been substantially altered.

  - If the homestead is confirmed to be of local heritage significance, or a significance assessment is not completed, design of the MDC should minimise visual impacts through reduction of height adjacent to the item, or consideration of additional screening.
- Ground disturbing works may proceed under an Unexpected Finds Policy
- Staff engaged in on-site works should receive a heritage induction that will make them aware of the nature of potential heritage finds, and their obligations under the *National Parks & Wildlife Act* (NSW 1974) and the *Heritage Act* (NSW 1977).

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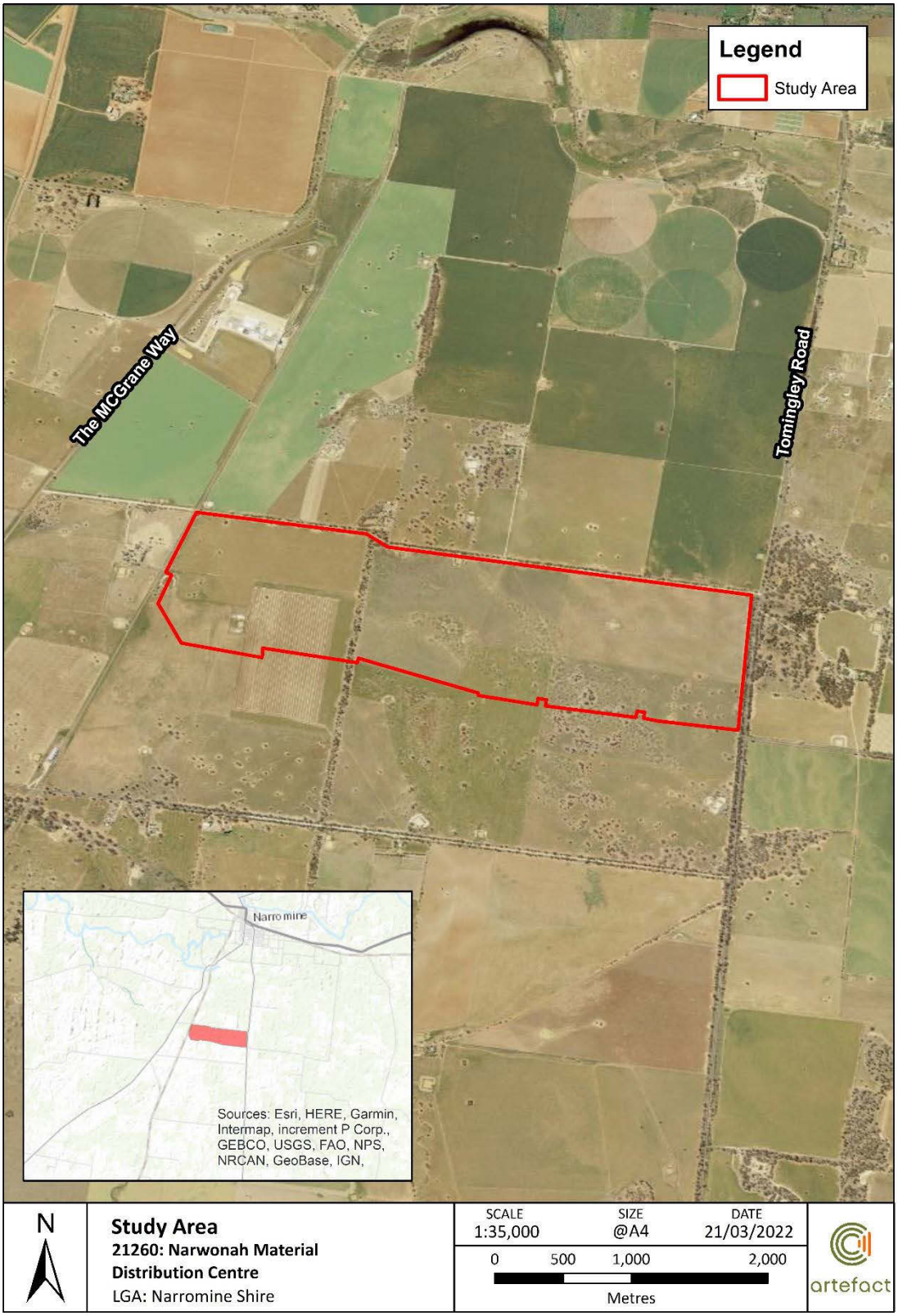
1.0 INTRODUCTION

1.1 Introduction

This Heritage Impact Assessment (HIA) has been prepared by Artefact Heritage Services (Artefact Heritage) on behalf of the Australian Rail Track Corporation (ARTC) to support the development of a new Material Distribution Centre (MDC) (hereon referred to as the proposal). The MDC will be used for storage of rail, sleepers and ballast and will also contain a rail welding facility. ARTC proposes that under the Infrastructure State Environmental Planning Policy (Transport and Infrastructure) 2021 these works could be progressed as a Part 5.1 assessment process in a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act* 1979. The MDC is proposed to be constructed on lots:16 DP 755131, 232 DP 755131, 233 DP 755131, 1 DP 1198931.

The location of the proposed MDC (the study area) is shown on Figure 1 below.

Figure 1: The study area



1.2 Methodology

This HIA has been prepared in accordance with the guidelines outlined by the NSW Heritage Office, now Heritage NSW, DPC, the Department of Planning, the Heritage Branch Department of Planning and Australia International Council on Monuments and Sites (ICOMOS), as identified in the following documents:

- NSW Heritage Office 2001. *NSW Heritage Manual: Assessing Heritage Significance*
- NSW Heritage Office 2002. *NSW Heritage Manual: Statements of Heritage Impact*
- NSW Heritage Branch, Department of Planning 2009. *Assessing Significance for Historical Archaeological Sites and 'Relics'*
- Australia ICOMOS 2013. *The Burra Charter. The Australian ICOMOS Charter for Places of Cultural Significance*.

1.3 NSW heritage significance assessment

Determining the significance of heritage items or a potential archaeological resource is undertaken by utilising a system of assessment centred on the *Burra Charter* of Australia ICOMOS.

The principles of the charter are relevant to the assessment, conservation and management of sites and relics. The assessment of heritage significance is outlined through legislation in the *NSW Heritage Act 1977* (Heritage Act) and implemented through the *NSW Heritage Manual*[1] and the *Archaeological Assessment Guidelines*.[2] The criteria specified by the guidelines encompass the four values identified in the *Burra Charter,* historical significance, aesthetic significance, scientific significance and social significance, and also consider representativeness and rarity values.

If an item meets one of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have heritage significance. The significance of an item or potential archaeological site can then be assessed as being of local or state significance. If a potential archaeological resource does not reach the local or state significance threshold, then it is not classified under the Heritage Act.

'State heritage significance' in relation to a place, building, work, relic, moveable object or precinct, means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

'Local heritage significance' in relation to a place, building, work, relic, moveable object or precinct, means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.[3]

The overall aim of assessing archaeological significance is to identify whether an archaeological resource, deposit, site or feature is of cultural value. The assessment will result in a succinct statement of heritage significance that summarises the values of the place, site, resource, deposit or feature. The heritage significance assessment criteria are described in Table 1 below.

[1] NSW Heritage Office 2001. *NSW Heritage Manual: Assessing Heritage Significance.*
[2] NSW Heritage Council 1996. "Archaeological Assessment Guidelines," in *NSW Heritage Manual.* New South Wales: Heritage Office.
[3] This section is an extract based on the NSW Heritage Branch, Department of Planning 2009. *Assessing Significance for Historical Archaeological Sites and Relics*, p. 6.

Table 1: NSW heritage significance assessment criterion

Criterion	Description
A – Historical Significance	An item is important in the course or pattern of the local area's cultural or natural history
B – Associative Significance	An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area's cultural or natural history
C – Aesthetic Significance	An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area
D – Social Significance	An item has strong or special association with a particular community or cultural group in the local area for social, cultural or spiritual reasons
E – Research Potential	An item has potential to yield information that will contribute to an understanding of the local area's cultural or natural history
F – Rarity	An item possesses uncommon, rare or endangered aspects of the local area's cultural or natural history
G – Representativeness	An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places of cultural or natural environments (or the cultural or natural history of the local area)

1.4 Assessment of heritage impact

This HIA has been prepared using the document *Statement of Heritage Impact* 2002, contained within the *NSW Heritage Manual,* as a guideline.

Impacts on heritage significance are identified as either:

- Direct (physical) impacts, resulting in the demolition or alteration of fabric of heritage significance
- Indirect (visual) impacts, resulting in changes to the setting or curtilage of heritage items or places, historic streetscapes, views or vistas.
- Potential direct impacts, resulting in impacts from factors including, but not limited to, vibration, subsidence and demolition of adjoining structures

Specific terminology and corresponding definitions are used in this assessment to consistently identify the magnitude of the proposal's direct, indirect or potentially indirect impacts on heritage items or archaeological remains. The terminology and definitions are based on those contained in guidelines produced by ICOMOS and are shown in Table 2.[4] It is assumed that all direct and potential direct impacts are a result of construction. Indirect impacts are assumed to be operational unless specified as temporary in which case they are related to construction.

[4] Including the document *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*, ICOMOS, January 2011.

Table 2: Terminology for assessing the magnitude of heritage impact

Magnitude	Definition
Major	Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource. These actions cannot be fully mitigated.
Moderate	Actions involving the modification of a heritage item, including altering the setting of a heritage item or landscape, partially removing archaeological resources, or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.
Minor	Actions that would result in the slight alteration of heritage buildings, archaeological resources, or the setting of an historical item. The impacts arising from such actions can usually be mitigated.
Negligible	Actions that would result in very minor changes to heritage items.
Neutral	Actions that would have no heritage impact.

1.5 Historical archaeological assessment

An archaeological assessment has been undertaken for this HIA. Historical archaeological potential is defined as the potential of a site to contain significant archaeological remains, including works or relics as identified in the Heritage Act. The assessment of historical archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses. Knowledge of previous archaeological investigations, understanding of the types of archaeological remains likely to be associated with various land uses, and the results of site inspection are also taken into consideration when evaluating the potential of an area to contain archaeological remains.

The potential for the survival of archaeological remains in a particular place is significantly affected by activities which may have caused ground disturbance. These processes include the physical development of the site (for example, phases of building construction) and the activities that occurred there. The likelihood for the survival of these remains (i.e. their archaeological potential) is distinct from the 'archaeological significance' and 'archaeological research potential of these remains', should any exist. These designations refer to the cultural value of potential archaeological remains and are the primary basis of the recommended management actions included in this document. For example, there may be 'low potential' for certain remains to survive, but if they do, they may be assessed as being of state significance.

The *NSW Heritage Manual* provides the framework used for the significance assessment of the potential archaeological remains within the construction footprint. These guidelines incorporate the aspects of cultural heritage value identified in the *Burra Charter*. The Heritage Council also issued the 1996 *Archaeological Assessment Guidelines*[5] and the Heritage Branch (now Heritage NSW, DPC) issued the 2009 *Assessing Significance for Historical Archaeological Sites and 'Relics*.[6] The

[5] NSW Heritage Council 2009. "Archaeological Assessment Guidelines".
[6] NSW Heritage Branch, Department of Planning 2009. *Assessing Significance for Historical Archaeological Sites and 'Relics'*.

assessment of historical archaeological sites requires a specialised framework in order to consider the range of values of an archaeological site.

The grades of archaeological potential used in this report are outlined in Table 3 below.

Table 3: Grades of archaeological potential

Grading	Justification
Nil	No evidence of historical development or use, or where previous impacts such as deep basement structures would have removed all archaeological potential
Low	Research indicates little or low intensity historical development, or where there have been substantial previous impacts, disturbance and truncation in locations where some archaeological remains such as deep subsurface features may survive
Moderate	Analysis demonstrates known historical development and some previous impacts, but it is likely that archaeological remains survive with some localised truncation and disturbance
High	Evidence of multiple phases of historical development and structures with minimal or localised twentieth century development impacts, and it is likely the archaeological resource would be largely intact.

1.6 Limitations

This HIA provides an assessment of listed and potential unlisted non-Aboriginal heritage items and potential historical archaeological resources only. This HIA does not provide an assessment for Aboriginal heritage values, which is detailed in a separate technical paper for the project. This HIA is constrained to reporting on inspection of those parts of the study area that could be accessed during field inspection on 21 February 2022. A large proportion of the study area could not be accessed for pedestrian or vehicular survey due to the dense and high vegetation then present within it. Survey took place in areas where vegetation had been slashed, however the presence of protected species in other parts of the study area restricted vegetation reduction and therefore survey there. This report is constrained to the results of direct survey of the study area and a desktop and archival survey of the study area and its surrounds. No properties other than the study area were directly inspected for potential unlisted heritage items.

1.7 Authorship

This report has been prepared by Michael Lever (Heritage Consultant, Artefact Heritage). Martina Muller (Storialines Pty Ltd) provided input regarding title and subdivision history. Sandra Wallace (Managing Director, Artefact Heritage) provided management input and technical review.

The qualifications of the heritage consultants involved in the production of the report is included in Table 4 below.

Table 4: Qualifications of report authors

Name	Qualification	Experience	Role
Michael Lever	Bachelor of Arts (Hons) (Archaeology) PhD Candidate (Archaeology)	11 years	Author

Name	Qualification	Experience	Role
Martina Muller	Master of Arts (History) PhD (History)	12 years	Author
Sandra Wallace	Bachelor of Arts (Hons) (Archaeology) PhD (Archaeology)	18 years	Reviewer

2.0 LEGISLATIVE CONTEXT

2.1 Introduction

There are no items of local, State, National or Commonwealth legislation within or near the study area that are relevant to this HIA. A summary of these Acts and the potential legislative implications follow.

Searches were carried out for heritage listings on the following registers:

- Commonwealth Heritage List (CHL)
- National Heritage List (NHL)
- State Heritage Register (SHR)
- Section 170 (s170) Heritage and Conservation Registers
- Narromine Local Environmental Plan (LEP) 2011
- NSW State Heritage Inventory (SHI) Database
- Register of the National Estate (RNE)

2.1.1 Commonwealth legislation and policy

2.1.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legislative framework for the protection and management of matters of national environmental significance such as flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the WHL or NHL.

The EPBC Act stipulates that a person who has proposed an action that will or is likely to have; a significant impact on the relevant heritage values of a World, or National heritage site must refer the action to the Minister for the Environment (hereafter the Minister). The Minister would then determine if the action requires approval under the EPBC Act. If approval is required, an environmental assessment would need to be prepared. The Minister would approve or decline the action based on this assessment.

There are no heritage items within the study area or within 3km of the study area that are listed on the WHL or NHL

2.2 State legislation and policy

2.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. This report constitutes assessment of historical (non-Aboriginal) cultural heritage values in keeping with Commonwealth and State Legislation in order that the proposal may be progressed as a Part 5.1 assessment process in a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act* 1979.

2.2.2 NSW Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) is the primary piece of legislation affording protection to heritage items (natural and cultural) in NSW. Under the Heritage Act, 'items of environmental heritage' include places, buildings, works, relics, moveable objects and precincts identified as significant. Significance is based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. State significant items can be listed on the NSW SHR and are given protection under the Heritage Act against any activities that may damage an item or affect its heritage significance. The Heritage Act also protects 'relics', which can include any deposit, artefact, object or material evidence that relates to the non-Aboriginal "settlement" of NSW and is of State or local heritage significance"

2.2.2.1 State Heritage Register

The SHR was established under Section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The SHR is administered by Heritage NSW, DPC and includes a diverse range of over 1500 items, in both private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW.

To carry out activities within the curtilage of an item listed on the SHR, approval must be gained from the Heritage Council by securing a Section 60 permit. In some circumstances, under Section 57(2) of the Heritage Act, a Section 60 permit may not be required if works are undertaken in accordance with the NSW Heritage branch document *Standard Exemptions for Works Requiring Heritage Council Approval*[7] or in accordance with agency specific exemptions. This includes works that are only minor in nature.

There are no items within the study area or within 3km of the study area that are listed on the SHR.

2.2.2.2 Section 170 Heritage and Conservation Registers

Under the Heritage Act, all government agencies are required to identify, conserve and manage heritage items in their ownership or control. Section 170 of the Act requires all government agencies to maintain a Heritage and Conservation Register that lists all heritage assets and an assessment of the significance of each asset. They must also ensure that all items inscribed on its list are maintained with due diligence in accordance with State Owned Management Principles approved by the Government on advice of the NSW Heritage Council. These principles serve to protect and conserve the heritage significance of items and are based on NSW heritage legislation and guidelines. In addition to Section 170 listings on the State Heritage Inventory, the ARTC and Transport for NSW inventories were searched.

There are no items within the study area or within 3km of the study area that are listed on Section 170 Registers.

2.2.2.3 Relics Provisions

The Heritage Act also provides protection for 'relics', which includes archaeological material or deposits. According to Section 139 (Division 9: Section 139, 140-146):

> (1) A person must not disturb or excavate any land knowingly or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being

[7] Heritage Council of New South Wales, 2009. *Standard Exemptions for Works Requiring Heritage Council Approval.*

discovered, exposed, damaged or destroyed unless the disturbance is carried out in accordance with an excavation permit.

(2) A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.

(3) This section does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Register.

(4) The Heritage Council may by order published in the Gazette create exceptions to this section, either unconditionally or subject to conditions, in respect of any of the following:

(a) Any relic of a specified kind or description

(b) Any disturbance of excavation of a specified kind or description

(c) Any disturbance or excavation of land in a specified location or having specified features or attributes,

(d) Any disturbance or excavation of land in respect of which an archaeological assessment approved by the Heritage Council indicates that there is little likelihood of there being any relics in the land.

Section 4(1) of the Heritage Act (as amended in 2009) defines a relic as:

> *…Any deposit, artefact, object or material evidence that: relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and is of State or local heritage significance.*

A relic has been further defined as:

> *Relevant case law and the general principles of statutory interpretation strongly indicate that a 'relic' is properly regarded as an object or chattel. A relic can, in some circumstances, become part of the land be regarded as a fixture (a chattel that becomes permanently affixed to land).*[8]

Excavation permits are issued by the Heritage Council of NSW, or its delegate, under Section 140 of the Heritage Act for relics outside SHR curtilages or under Section 60 for significant archaeology within SHR curtilages. An application for an excavation permit must be supported by an Archaeological Research Design (ARD) prepared in accordance with the NSW Heritage Division archaeological guidelines. Minor works that will have a minimal impact on archaeological relics or an item on the SHR may be granted an exception under Section 139 (4) or an exemption under Section 57 (2) of the Heritage Act"respectively.

2.2.2.4 Works

The Heritage Act defines 'works' as being in a separate category to archaeological 'relics'. 'Works' refer to remnants of historical structures which are not associated with artefactual material that may possess research value. 'Works' may be buried, and therefore archaeological in nature, however, exposure of a 'work' does not require approved archaeological excavation permits under the Act.

[8] NSW Heritage Branch, Department of Planning 2009. *Assessing Significance for Archaeological Sites and 'Relics'*, p. 7.

The following examples of remnant structures have been considered to be 'works' by the NSW Heritage Council:

- Former road surfaces or pavement and kerbing
- Evidence of former drainage infrastructure, where there are no historical artefacts in association with the item
- Building footings associated with former infrastructure facilities, where there are no historical artefacts in association with the item
- Evidence of former rail track, sleepers or ballast
- Evidence of former rail platforms and former platform copings.

Where buried remnants of historical structures are located in association with historical artefacts in controlled stratigraphic contexts (such as intact historic glass, ceramic or bone artefacts), which have the potential to inform research questions regarding the history of a site, the above items may not be characterised as 'works' and may be considered to be 'relics'. The classification of archaeological remains as a 'work' therefore is contingent on the predicted remains being associated with historical structures as well as there being no prediction of the recovery of intact artefactual deposits which may be of research interest.

2.3 Non-statutory heritage registers

In addition to the heritage registers established by State and Commonwealth legislation, there are a number of relevant non-statutory registers which should be considered. The following non-statutory registers was searched:

- Register of the National Estate (RNE)

The RNE lists historic, Aboriginal and natural heritage places throughout Australia. Originally established under the *Australian Heritage Commission Act 1975*, the RNE entered more than 13,000 places into the register. The RNE was frozen on 19 February 2007 following amendments to the *Australian Heritage Council Act 2003.* It ceased to be a statutory register in February 2012. The RNE is now maintained on a non-statutory basis as an archive and education resource.

There are no non-statutory heritage items within the study area or within 3km of the study area that are listed on the RNE.

3.0 HISTORICAL BACKGROUND

This section provides an overview of the historical development of the study area from first colonial reports of interaction with local Aboriginal people.

3.1 Aboriginal occupation

Historical records may provide insight to the Aboriginal past. However, it must be recognised that early documents were produced by colonial observers who interpreted and recorded events that they observed through their personal and socially conditioned biases and worldviews. It is a further feature of such early reports, that authors often focussed on events or behaviour that they perceived as unusual rather than every day and did so based on incomplete or very partial evidence.

According to mapping by the linguist and anthropologist Norman Tindale, Narromine sits at the northern boundary of Wongaibon lands, bordered by the Wiradjuri to the south and east, the Ngemba, Weilwan and Koinberi to the north, and the Barindji and Naualko to the west Figure 2.[9] The Wongaibon language is a dialect of Ngiyampaa (AIATSIS, 2022). The use of language boundaries to define Aboriginal spatial identity is not one that is universally accepted among anthropologists, including those who were contemporaries of Tindale, such as W. Stanner. [10]

Figure 2: Location of Narromine in Wongaibon land (Tindale 1940).

The earliest historical accounts of Aboriginal life in the wider surrounds of the study area derive from Thomas Mitchell's 1835 expedition in which he sought to trace the Darling River to its southern terminus. Mitchell travelled to the Darling River along the Bogan River, which passes at closest some

[9] Tindale, N. (1940). *Map Showing the Distribution of the Aboriginal Tribes of Australia*. Mitchell Library, NSW.

[10] Stanner, W. (1968). *After the Dreaming*. Canberra: ABC

30km to the south and south east of the study area.[11] Mitchell wrote of the surrounds of the Bogan River in glowing terms, as richly resourced in plant life. Mitchell relied considerably on local Aboriginal guides not only for directions but also for assistance with deriving foods including native honey and in locating waterholes when the party diverted from the course of the Bogan River. The location of waterholes was not only an issue of spatial skill, but one which required navigation of cultural values too, as Mitchell recorded:[12]

> *Another great advantage gained in the company of the natives was our being perfectly safe from the danger of sudden collision with a tribe. Their caution in approaching waterholes was more remarkable; for they always cooeyed from a great distance, and even on coming near thick scrub they would sometimes request me to halt until they could examine it.*

It is difficult to derive from Mitchells' statement whether he describes here a potential encounter between hostile local groups, or a desire by local guides to ensure that other allied groups were not taken by surprise – or indeed whether this was simply the accepted social norm of introduction.

Little subsequent historical information on 19th century Aboriginal life in the area is available. The Aboriginal Protection Board reported in 1891 that 296 Aboriginal people lived in the Dubbo area, which included Narromine. Many Aboriginal men were then employed on pastoral stations.[13]

Bulgandramine is located approximately 30km south of the study area. The Bulgandramine mission was officially opened in 1907 and was disbanded in 1956-7,[14] however, according to local Aboriginal people the location functioned as a place for segregation of Aboriginal people and the removal of children from their families from as early as 1820.[15]

3.2 Early colonial development

The first colonialists to settle in Narromine were squatters and pastoralists who laid claim to large properties along the Macquarie River in the 1830s. One such station, named 'Narramine' (as it was occasionally spelt) was taken up in 1835 and was held for many years by the prominent explorer William Charles Wentworth. M & E Maher took over this property at which time it comprised 190,000 acres or 77,000ha. By the late 19th century, almost the entirety of this property had been resumed by the government, with the exception of 20,000 acres or 8,100ha that were owned by F.M. Mack, and on which he successfully farmed sheep and wheat until 1926. [16, 17] According to one account by F.M. Mack, the catalyst which led to the increased development of Narromine, was the establishment of the Narromine Railway Station in 1883. Narromine Railway Station was positioned at the last location

[11] Mitchell, T. (1838). Three Expeditions into the Interior of Eastern Australia: with Descriptions of the Recently Explored Region on Australia Felix, and the Present Colony of New South Wales. London: T & W Boone
[12] Mitchell (1838) *Op. Cit.* Vol. 1 part 27
[13] English, A., Veale, S., Erskine, J., & Robinson, J. (1998). *Goobang National Park Cultural Heritage Assessment.* Report for NSW National Parks and Wildlife .
[14] OzArk. (2011). *Tomingley Gold Project Cultural Heritage Assessment.* Report to Alkane Resources.
[15] Pearce, M. (2016). *Former Aboriginal mission site becomes a focus for cultural education and a celebration of survival.* Retrieved from ABC News: https://www.abc.net.au/news/2016-05-05/former-aboriginal-mission-site-becomes-focus-cultural-education/7387768

[16] *The Pastoralists Review New South Wales* (1909, November 16). The Pastoral Homes of Australia. Narramine., pp. 932-935.
[17] *The Australasian* (Melbourne), (1926, October 23). Narramine Station. p. 17.

of the Great Western Railway near reliable water (the Macquarie River), before the long haul westwards to Bourke. In Mack's words

> *Until the railroad came, Narromine was just one more wayside pub, store and blacksmith shop, frequented by Cobb and Co coaches and by carriers, bullocks and horses ……. By 1886 Narromine had three pubs, a general store, a stationmaster's house, a pumping house on the river, a police barracks, a blacksmiths shop and several other shanties.*[18]

At that time, there was no built settlement south of the railway line at Narromine. Increased population of the area generally, and of the southern part of town in particular did not substantially increase until the greater enforcement by the government of selection legislation, as a result of which very large areas of squatter's holdings were resumed by the government, subdivided and sold at often reduced rates. This policy of breaking up large pastoral estates for conversion into smaller family farms was pursued by the NSW government from 1885 to 1965.[19] As a result, land around Narromine was alienated and subdivided into significantly smaller portions than was previously the case. Such alienation appears to have been behind the efforts of the first individual to build a homestead south of the Great Western Railway, in lands which once included the study area (as depicted in greater detail in the section below). Commencing in the early 20th century, citrus farming was an additional agricultural mode that could be successfully undertaken on smaller lots than required for pastoral or broadacre activities.[20] The location of citrus farms, however, were far more constrained to the immediate surrounds, or pumping distance of the Macquarie River or other permanent waterways.

3.3 Ownership and holding of the study area

The study area is located on Portions 16 and 17 of the Parish of Wentworth, County of Narromine, which originally contained 640 acres (Portion 16) and 1920 acres (Portion 17). These were alienated in 1885 and taken up by grazier and farmer, James Dempster, who made an official application for conditional purchase at the Lands Office in Dubbo on 6 August 1885. [21]This was the first day that Crown land was alienated under the new *Crown Lands Act 1884*, under which "land was available to applicants who held no other Crown land, under conditions that specified that they reside on their selection for five years and complete improvements totalling £1 per acre. The land could not be sold before those conditions were satisfied".[22]

A survey of Portions 16 and 17 was carried out on 26 January 1886, and two Crown Plans issued to James Dempster, noting the existing improvements on Portion 16 as being a 'hut-frame' and a nearby 'well (no water)' (NSW LRS, Crown Plan N.430.1884), while the value of improvements on Portion 17 was noted as 'Nil' (NSW LRS, Crown Plan N.431.1884). The hut-frame and well were located in the northern part of Portion 16, to the west of the railway line that was constructed at a much later stage. A track led from the hut-frame to Narromine. The conditional purchase of both portions was confirmed on 1 May 1886 and registered as CP 85.17 (1885 No. 17).

[18] Mack, F. M. (1949, December 22). Narromine's Early Days. *Narromine News and Trangie Advocate*, p. 4.

[19] Small, M. (2018). *The politics of land ownership in NSW: A Case Study.* Sydney: Doctoral Thesis, University of New England.

[20] Mack (1949) *Op. Cit*

[21] *Sydney Morning Herald*, 7 August 1885: 3.

[22] Terry Kass, *Unlocking Land: A Guide to Crown Land Records held at State Archives NSW*, Lidcombe: Self-published, 2019.

The 1886 Crown survey (Figure 3) shows the north western part of Portion 16 partly covered in 'Pine scrub', while the eastern side of both portions was 'light sandy soil timbered with dense pine and oak scrub intermixed with box hop-bush and budtha'. The southwestern side of Portion 17 consisted of 'box and pine timber'. The locality was noted as 'One Tree Plain' and the property was located on the eastern side of the Bogan River Road, between the 5 Mile Post and 6 Mile Post of the main road to Narromine.

In January 1887, James Dempster moved 1000 head of sheep over to Narromine from James McLaurin's Yarra Yarra Station at Ten Mile Creek (Germanton/Holbrook, NSW) where he appears to have been the overseer, before moving to his own property at Narromine. [23] In 1887, James Dempster also acquired 250 and 750 acres of land adjacent to the south, being Portions 1 and 2 in the Parish of Frost. This was registered in the name of his 17-year-old son, James Dempster junior, with the larger Portion 2 being a conditional lease. The extent of the overall property used by the Dempster family for farming and grazing is shown in Figure 4.

Dempster, who was of Scottish background, built his homestead 'Craigie Lea' on his property in the north western corner of Portion 16, as the "first house south of the line" (of the Great Western Railway). [24] At that time, there were only about 12 buildings in all of Narromine and James Dempster junior later recalled that he was about 15 when the family moved to Narromine. He noted that "where you see hundreds of people making a living to-day was then only a run for wild horses, cattle, emus, wallabies and dingoes".[25] Craigie Lea still endures as a rural homestead, located approximately 200m west of the study area,

As pioneers in the area, the family was heavily involved in the development of the town and its institutions. In August 1905, for instance, Mary Dempster, the wife of James Dempster senior, laid the foundation stone of Narromine's Presbyterian Church,[26] and James Dempster junior represented the town at cricket, while also being one of the first to play golf in the area.[27]

On 5 January 1910, James Dempster senior died at 'Craigie Lea', aged 80.[28] By then, the line for the new Peak Hill Railway line had been surveyed and the line was officially opened on 10 December 1910, when it was handed over to the Government.[29] The new railway line was known as a 'light and earth ballasted line' and contained five stations, including Narwonah which was located on Portion 17.

All stations, including Narwonah, were said to have been equipped with a 20-ton latest pattern Pooley weighbridge, ticket office and waiting room, and each station yard was stone ballasted throughout. The line and station reserve were subdivided from the overall property and sold to the Government in 1910, and Mary Dempster made an application for the residue (1904 ½ acres in Portion 17) in 1912. [30]This was registered as Additional Conditional Purchase 1912/105 (cf. NSW LRS, CT Vol 8072 fol 96; Bk 1121 No 431). Portion 16 now contained 631 acres and 20 perches (cf. NSW LRS, Bk 1121 No 431).

After the death of his father in 1910, James Dempster junior lived at 'Craigie Lea', where he raised his own family and continued to run the farm. A 'grant of land purchased by conditional sale' was issued to the Corporation of the Bank of Australasia on 23 December 1919 for Portion 16 (NSW LRS, CT Vol 3008 fol 195; Bk 1121 No 431). Eight months later, on 3 August 1920, Portion 16 was transferred to James Dempster junior, who mortgaged it with the Bank of Australasia.

[23] *Maitland Mercury*, 13 January 1887: 8; *Albury Banner*, 28 September 1872: 2.
[24] *Narromine News*, 27 June 1939: 5
[25] *Ibid*
[26] *Narromine News*, 1 September 1905: 2
[27] *Narromine News*, 27 June 1939: 5
[28] *Dubbo Dispatch*, 8 January 1910: 5
[29] *Dubbo Liberal*, 3 December 1910: 4
[30] *Dubbo Liberal*, 17 September 1912: 2

On 19 October 1936, James Dempster junior offered 'Craigie Lea' for sale as a subdivision of four blocks (

Figure 5). The property of 2535 acres was described as having "some of the best mixed farming land in the Narromine district". [31] The boundaries of Portion 16 remained unchanged, but the eastern part of Portion 17 was subdivided into two new portions: Portions 232 and 233. New surveys were undertaken in March 1936, and new plans issued for Portions 232 and 233, showing existing fencing, a hut, tank and borehole on Portion 232 (NSW LRS, Crown Plan N.1991.1884 and Crown Plan N.1992.1884, see Figure 6 and Figure 7. Apart from fencing, Portion 233 did not contain any improvements. The land was described as "nearly level country' of red loamy soil, cleared' but 'originally timbered with box pine, oak and budda.' There were several areas where gilgais had formed by 1936.

It was not until March 1938, that 'Craigie Lea' was transferred to John Andrew Hogan (NSW LRS, CT Vol 3008 fol 195).[32] Initially moving into town, James Dempster left Narromine in 1939 to live with his widowed daughter in Moree, and around 200 people, "one of the largest gatherings ever seen at the Narromine Bowling Club"[33] farewelled him at a special event in June that year. In all the Dempster family had lived in the area for half a century. Despite the mentions of their activities provided by periodical articles cited above, the Dempsters do not seem to have enjoyed local prominence. In his comprehensive *A History of Narromine and District*, the local Narromine historian Phillip King identifies 95 prominent local families and persons, dating from the founding of the town to the 1970's. The Dempsters are not mentioned in these lists. [34]

John Andrew Hogan retained ownership of 'Craigie Lea' until 20 January 1977, when the site was officially transferred to Laurence William Crook, service station proprietor from Narromine, and his wife, Gweneth Norma Crook (NSW LRS, CT Vol 7086 fol 75; Vol 8084 fols 124-125; Vol 8072 fol 96). New title certificates were issued to L. W. and G. N. Crook in 1981 (NSW LRS, Vol 14488 fols 18-20).

[31] *Narromine News*, 8 October 1936: 9
[32] *Sun*, 23 March 1938: 8; *Dubbo Liberal*, 26 March 1938: 4
[33] *Narromine News*, 23 June 1939: 2
[34] P. K. King (1979) *A History of Narromine and District*. Dubbo Printing Works, NSW

Figure 3: Crown Plan showing Portions 16 and 17 as surveyed in early 1886, with later annotations (NSW LRS, Crown Plan N.431.1884).

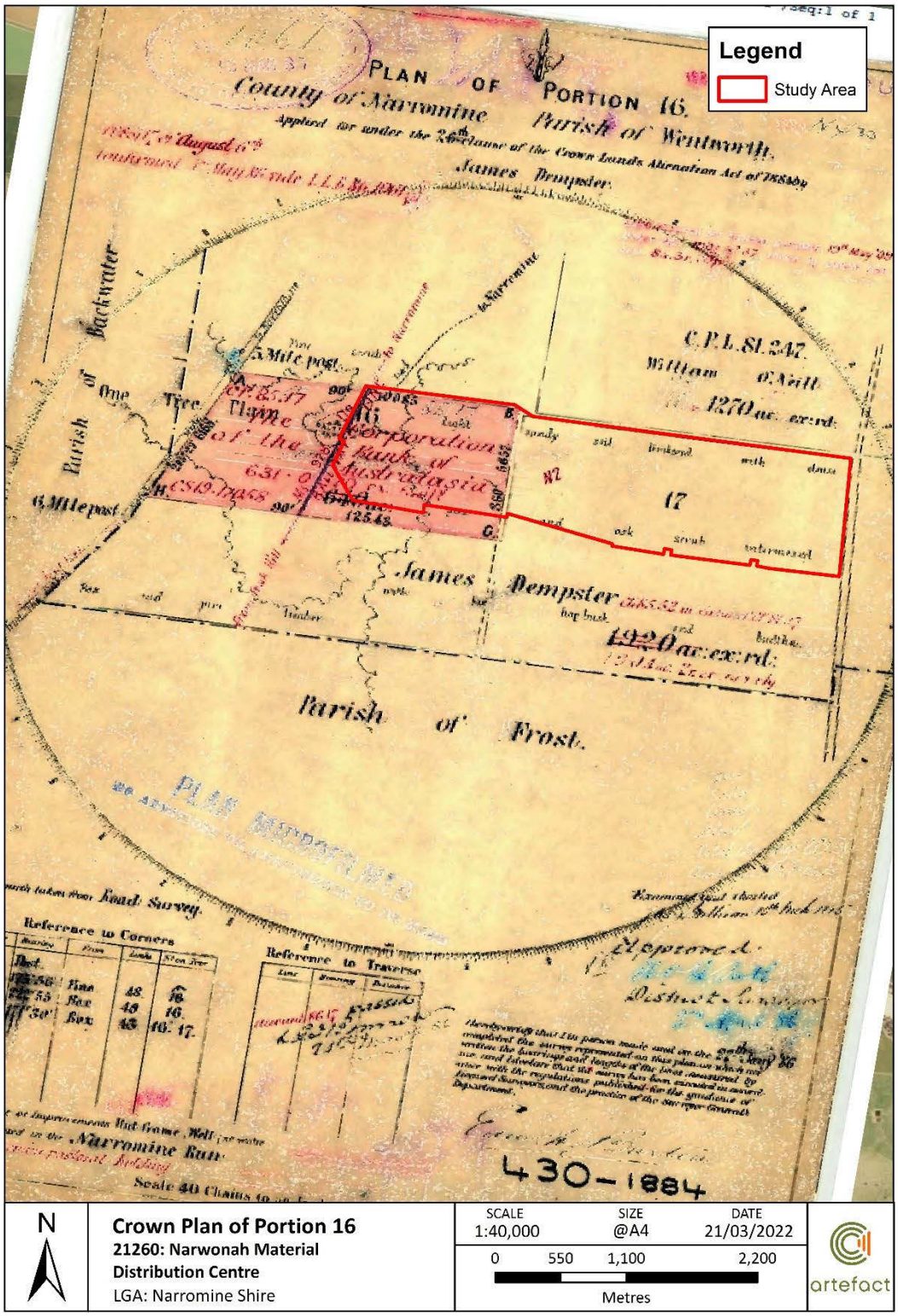


Figure 4: 1884 Parish Map showing the holdings of James Dempster senior and junior (NSW LRS, HLRV).

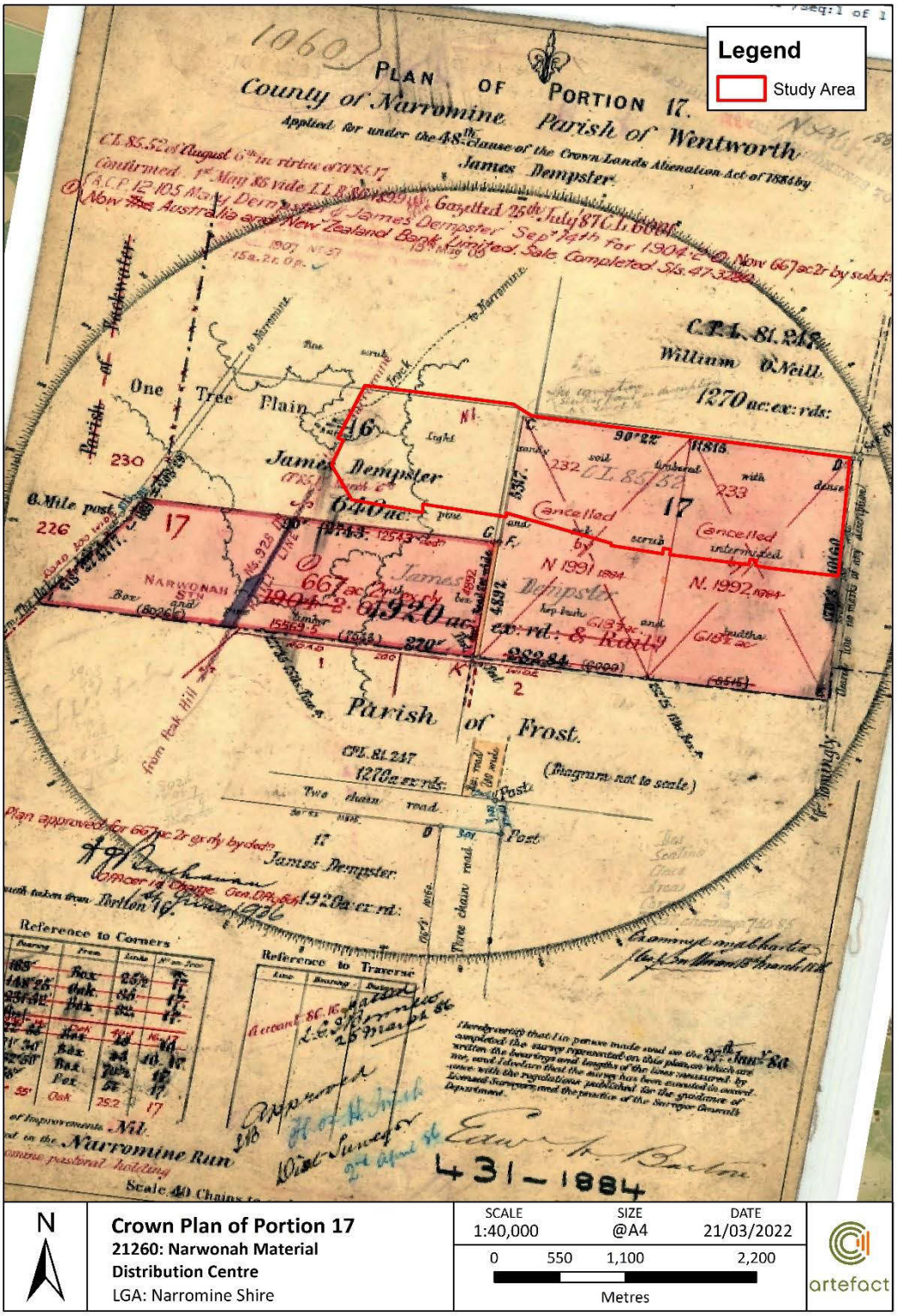


Figure 5: 1936 sales advertisement for James Dempster's 'Craigie Lea' (*Narromine News*, 8 October 1936: 9).

SUBDIVISION SALE

UNDER instructions from the Owner, Mr. JAMES DEMPSTER, we will offer at PUBLIC AUCTION his well known property

"CRAIGIE LEA"

at the Town Hall, Narromine, on

Monday, October 19, 1936

AT 3 P.M.

All Freehold and C.P. Lands—Old Title—a TOTAL of

2535 ACRES – To Be Sold in 4 Blocks – 2535 ACRES

comprising some of the best MIXED FARMING land in the Narromine district.

SITUATED 4½ miles south of NARROMINE. Narwonah Siding is situated on Block No. 3 and the furthest Block is only 2 miles from Narwonah Siding.

TO BE SOLD IN 4 BLOCKS OF 618, 618, 667 & 631 ACRES.

NOTE.—Each Block has 200 acres or more that have been cultivated.

For further details or arrangements to inspect the above, please communicate with the Selling Agents:—

BALLHAUSEN & IRVINE, **NARROMINE.**
R. H. BARNETT & CO., **NARROMINE.**
(Auctioneers in Conjunction).

Figure 6: Crown Plan surveyed in 1936, showing details of the subdivided Portion 232 (NSW LRS, Crown Plan N.1991.1884).

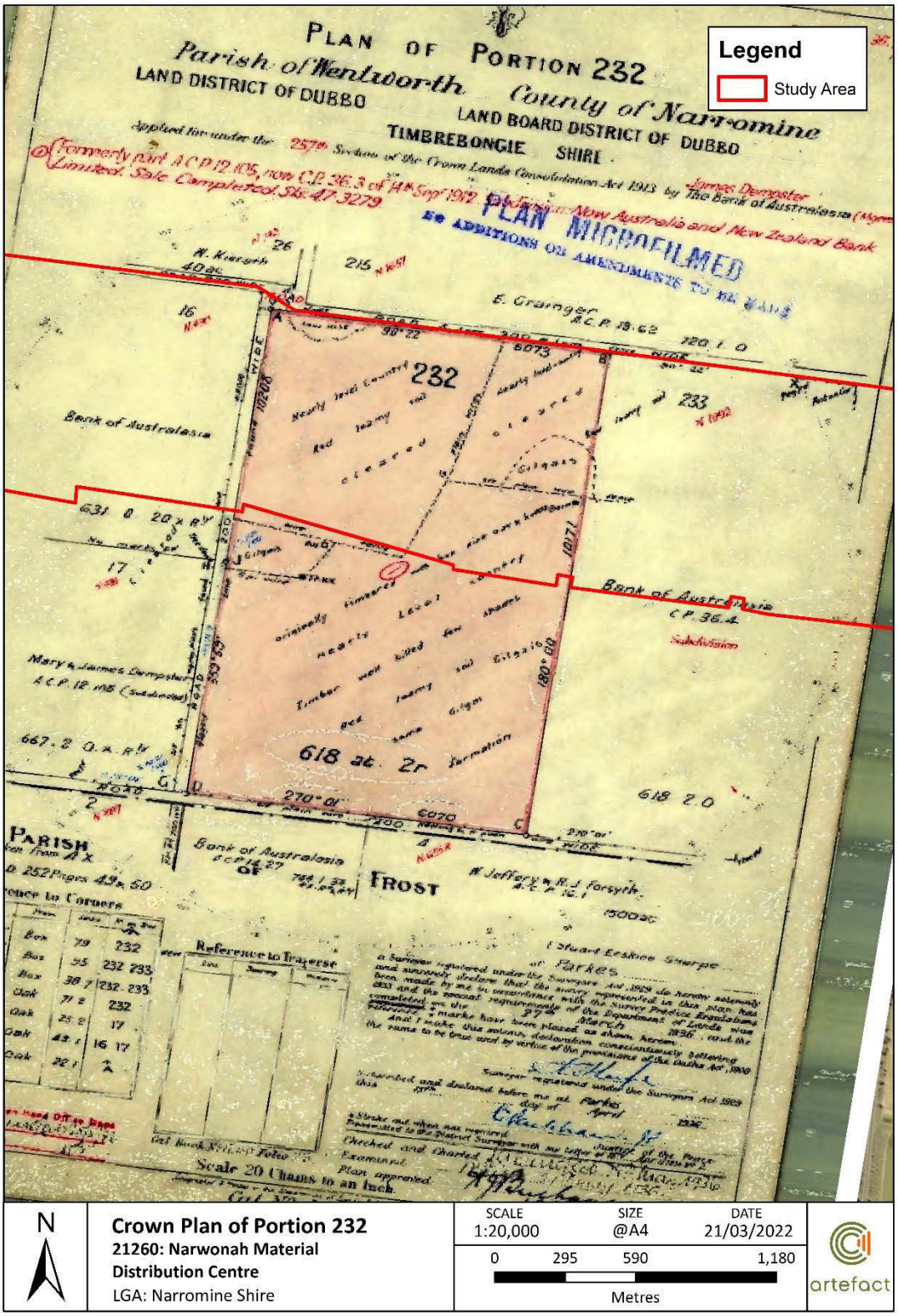
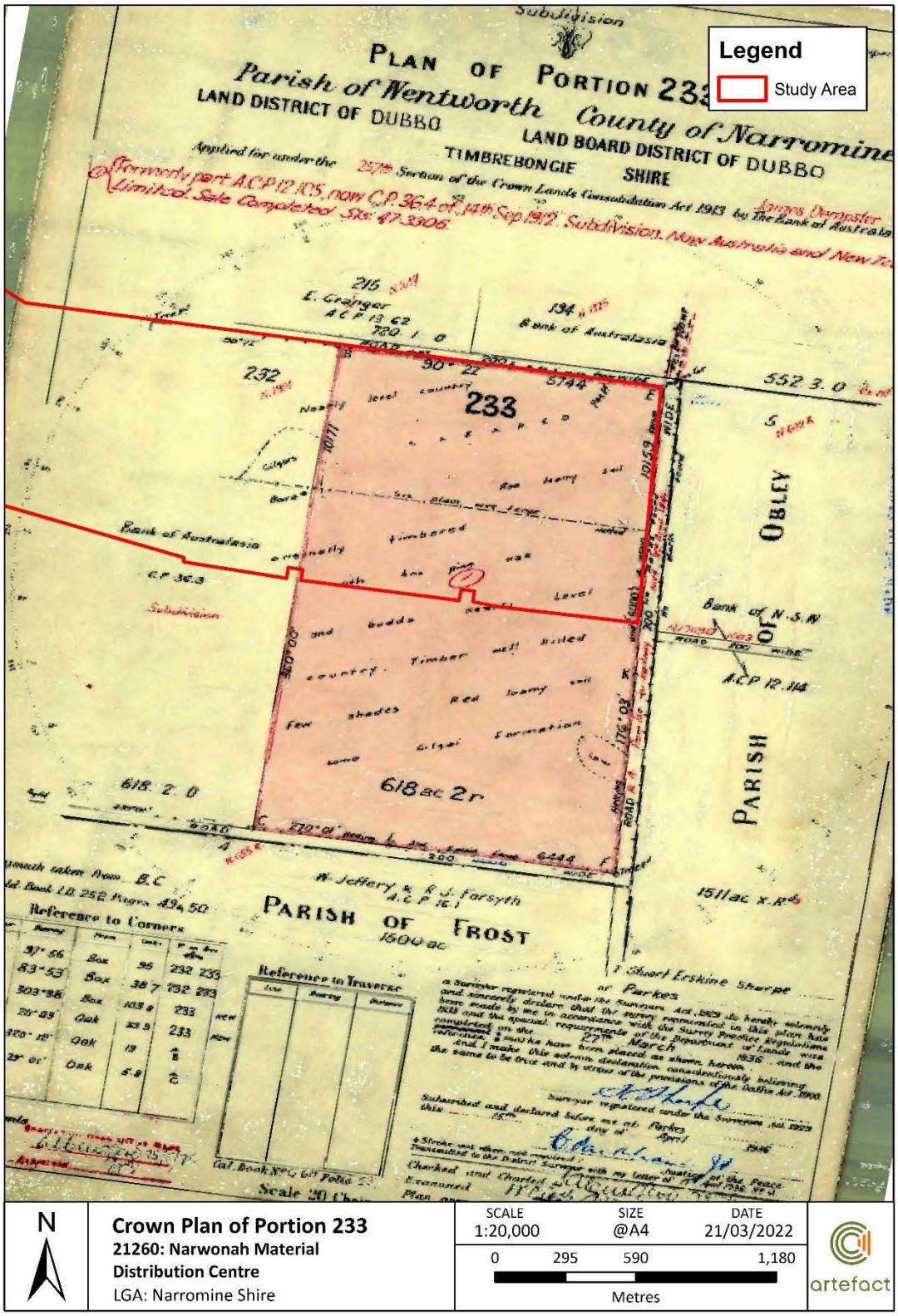


Figure 7: Crown Plan surveyed in 1936, showing details of the subdivided Portion 233 (NSW LRS, Crown Plan N.1992.1884).



4.0 BUILT HERITAGE ASSESSMENT

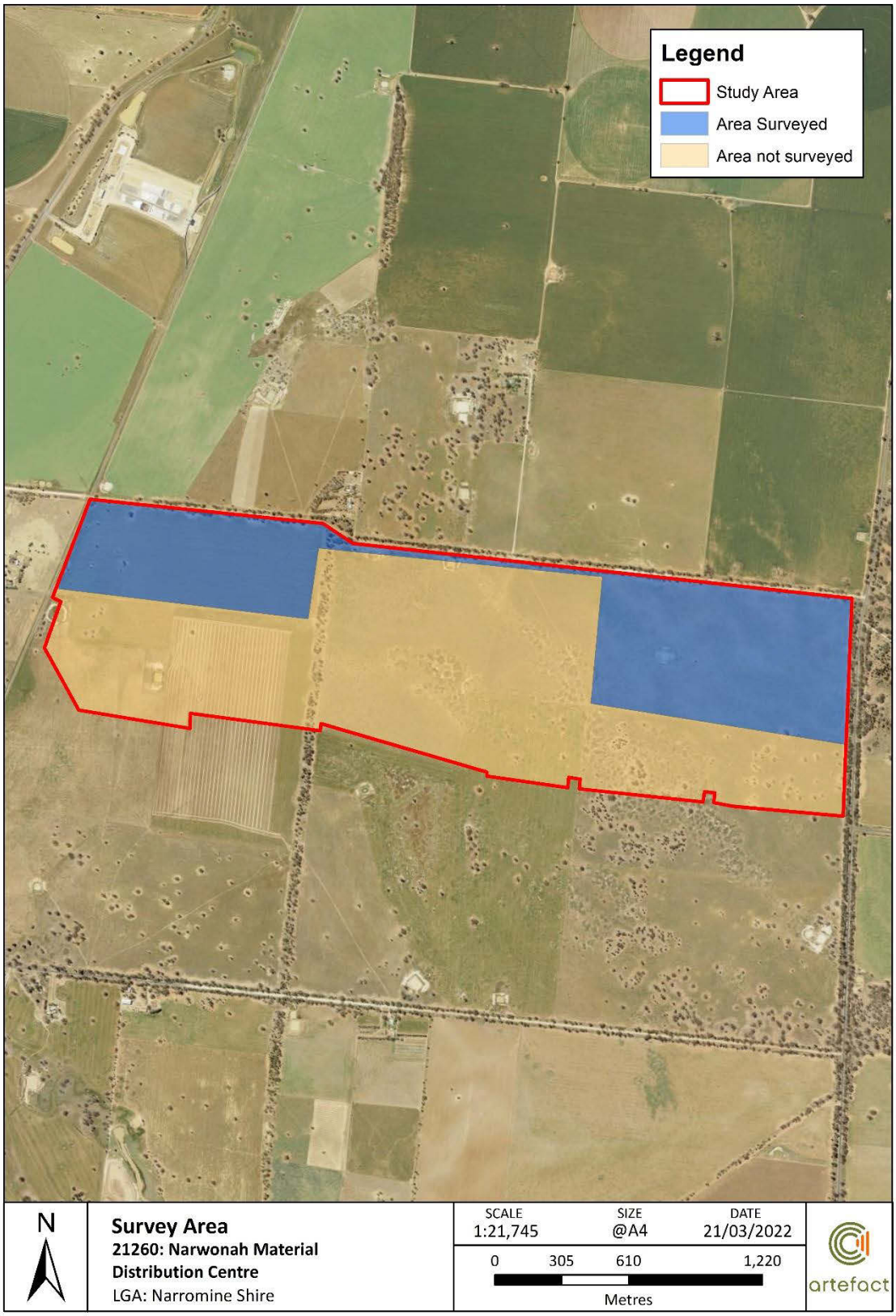
4.1 Items within the study area

As outlined in Section 2.0, and Section 3.0 no currently standing heritage listed or unlisted items have been identified within the study area.

4.1.1 Site inspection

Site inspection took place on 21 February 2022. As noted above, site inspection could not be carried out for the entirety of the study area. The parts of the study area that could be inspected are shown in Figure 7 below.

Figure 8: Parts of the study area surveyed on 21 February 2021



The inspected part of the study area has been comprehensively cleared of trees with the exception of sparsely distributed single eucalypts and bloodwoods, and a stand of introduced peppercorn trees. No built structures were observed, and fencing appeared to date from no earlier than the mid 20th century, being comprised chiefly of steel drop-posts and wire. The indications from partial site inspection, particularly when taken together with evidence from aerial image inspection, is that there are no standing structures currently in the study area. The historical examination of the study area presented above gives no reason to believe that the study area was ever subject to development beyond agricultural subdivision and excavation of water storage.

Figure 9: Study area, view south in Lot 16 DP 755131, towards peppercorns at centre

4.2 Potential heritage items near the study area

The Craigie Lea homestead is located approximately 200m to the west of the study area, in the location noted above as the site on which James Dempster built his homestead in 1887. The current report did not include inspection of private property outside the study area. It has been assessed here that were the original fabric of the Craigie Lea homestead to be preserved, then this homestead would meet the threshold of local heritage significance.. It was constructed at an early point in the development of Narromine, and may have been the first homestead in the locality south of the Great Western Railway. It is associated with early pastoral settlers of the area and may have research potential to yield information that will contribute to an understanding of the local area's cultural or natural history.

5.0 ARCHAEOLOGICAL ASSESSMENT

5.1 Introduction

The following section contains a preliminary assessment of archaeological potential within the study area. This assessment is based on an analysis of available historical plans, secondary sources and an understanding of previous impacts within the study area. The aim of this assessment is to identify portions of the study area with potential to contain significant archaeological resources which will require further management as part of the project.

Historical archaeological potential is defined here as the potential of a site to contain historical archaeological remains. The assessment of historical archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses.

This section does not address archaeological potential or significance in locations outside the study area as it is assumed that no ground disturbing works associated with the proposal will occur outside the study area footprint.

5.2 Summary of historical land use phases

As evidenced in Section 4.0 above, the only evidence for historical activity to the ground surface within the study area is that of clearing the timber and scrub that was once mapped as present there, followed by ongoing mixed agriculture – chiefly raising sheep and ploughing for broadacre cropping. The hut and well which likely later became the site of Craigie Lea Homestead were situated outside and to the west of the study area.

5.3 Assessment of archaeological potential

The archaeological potential of the study area is presented in terms of the likelihood for archaeological remains to be present considering the land use history and previous impacts. This is presented using the following grades:

- **Nil-Low** – research does not indicate any historical built development, or only ephemeral development.
- **Low** – research indicates very little historical development and/or there have been substantial previous impacts and it is unlikely that archaeological remains survive.
- **Moderate** – analysis demonstrates known historical development and some previous impacts but it is possible or likely that some archaeological remains but have been subject to some disturbance.
- **High** – evidence of historical development and structures with minimal subsequent development impacts and it is likely archaeological remains survive intact.

Once potential archaeological features have been identified, the value or significance of the remains is considered. Archaeological research potential and historical significance are often good criteria to provide a preliminary significance assessment and determine if the potential remains could be defined as a ‘relic’ under the Heritage Act.

The archaeological potential of the overall study area is summarised in Table 5 below. This table outlines the type of potential archaeological features associated with each development phase and the likelihood of their presence.

Table 5: Assessment of archaeological potential

Phase	Potential Remains	Archaeological Potential
1887- ~1900 Land clearance and early settlement	Evidence of land clearance and delineation such as tree boles, burnt soils, fence postholes. Evidence of informal camps such as postholes and artefact scatters.	Nil-low
1900-1936 Ongoing sheep and wheat farming	Evidence of land clearance and delineation such as tree boles, burnt soils, fence postholes. Evidence of unrecorded farm buildings such as postholes and artefact scatters.	Nil-low
1936-Current Subdivision, ongoing sheep and wheat farming	Evidence of subdivision such as changes to fence lines and fencing methods. Evidence of land clearance and delineation such as tree boles, burnt soils, fence postholes. Evidence of unrecorded farm buildings such as postholes and artefact scatters.	Nil-Low

5.4 Assessment of archaeological significance

An assessment of archaeological significance for potential remains is provided in Table 6 below. This weighs the information known about the study area, its development and owners and residents against the criterion listed in Table 1 at the outset of this report.

Table 6: Assessment of archaeological significance

Phase	Potential Remains	Significance
1887- ~1900 Land clearance and early settlement	**Nil-low potential for:** Evidence of land clearance and delineation such as tree boles, burnt soils, fence postholes. Evidence of informal camps such as postholes and artefact scatters.	These remains would be associated with early settlement in the area, reflecting a significant historical period. However, the potential remains – notably postholes and tree boles, would not hold research potential nor demonstrate rarity, aesthetic significance and would not likely be representative or of social significance to the community. **Remains would not reach the threshold of local significance**
1900-1936 Ongoing sheep and wheat farming	**Nil-low potential for:** Evidence of land clearance and delineation such as tree boles, burnt soils, fence postholes. Evidence of unrecorded farm buildings such as postholes and artefact scatters.	These remains would be associated with ongoing development of the area. However, the potential remains – notably postholes and tree boles, would not hold research potential nor demonstrate rarity, aesthetic significance and would not likely be representative or of social significance to the community. **Remains would not reach the threshold of local significance**

Phase	Potential Remains	Significance
1936-Current Subdivision, ongoing sheep and wheat farming	**Nil-Low potential for:** Evidence of subdivision such as changes to fence lines and fencing methods. Evidence of land clearance and delineation such as tree boles, burnt soils, fence postholes. Evidence of unrecorded farm buildings such as postholes and artefact scatters.	These remains are likely to have only resulted in ephemeral archaeological record, and even where preserved would not hold research potential nor demonstrate rarity, aesthetic significance and would not likely be representative or of social significance to the community. **Remains would not meet the threshold of local significance**

6.0 HERITAGE IMPACT ASSESSMENT

6.1 Proposal

Final design for the proposal is not yet to hand. It is assumed for the purpose of this report that impacts to ground surfaces may occur at any point in the study area.

6.2 Built heritage impacts

6.2.1 Built heritage in the study area

There are no items of built heritage listed on heritage registers in the study area.

Despite the inability to survey the entirety of the study area, a combination of historical and aerial imaging evidence firmly indicates that there are no unlisted items of built heritage in the study area.

Impacts to built heritage in the study area are therefore neutral (nil).

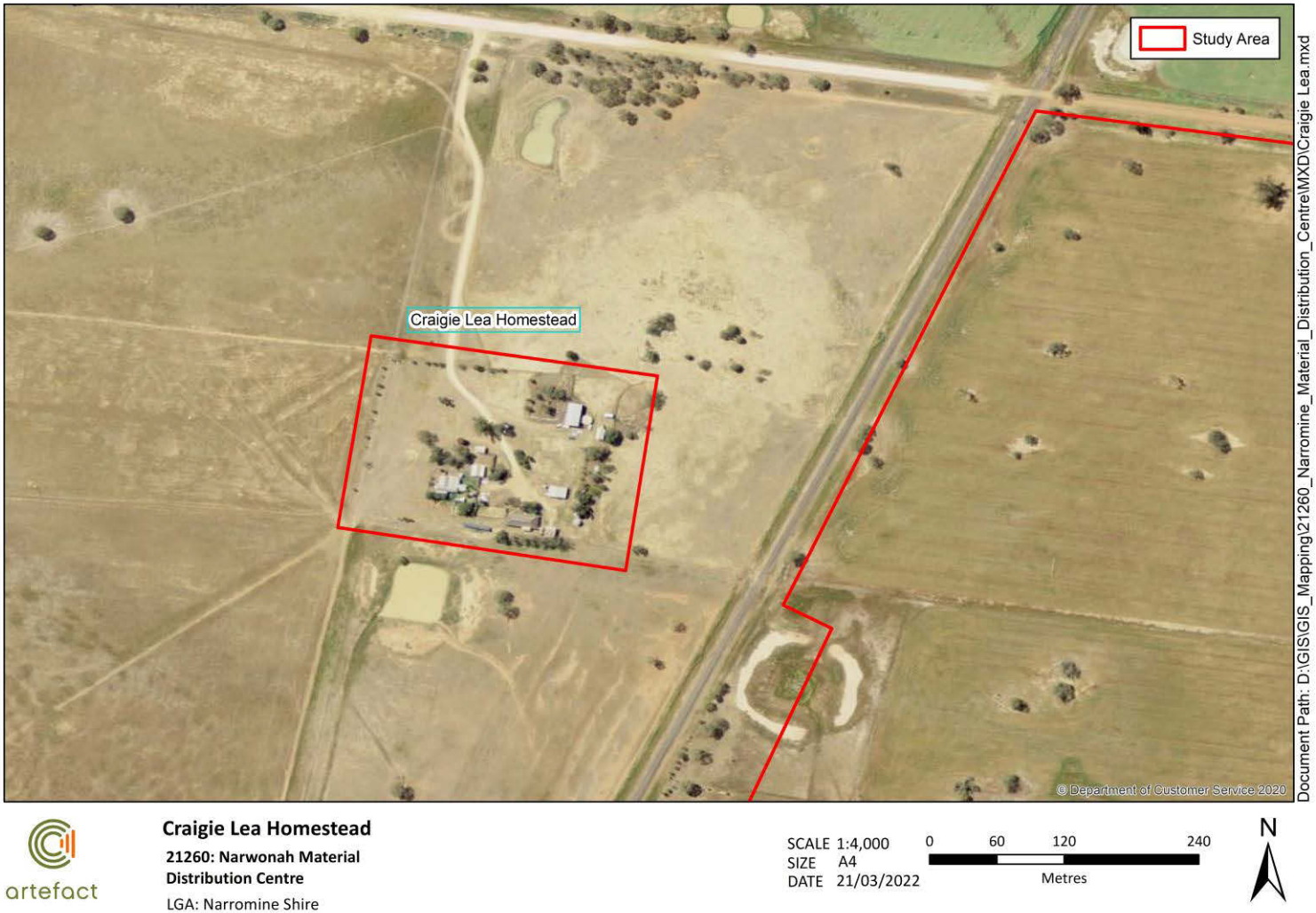
6.2.2 Built heritage near the study area

Craigie Lea homestead is located approximately 200m west of the study area as shown in Figure 10 below. The homestead is screened from the study area by mature trees, and the Parkes-Narromine railway line. It is an early local homestead that has not yet been inspected for heritage significance.

The proposal will have neutral (nil) direct impacts on the heritage values of Craigie Lea homestead, as no physical impacts to the homestead or property are proposed.

If Craigie Lea homestead is of heritage significance, the proposal will have a minor indirect (visual) impacts to Craigie Lea homestead, resulting from visual changes to the setting of the item.

Figure 10: Craigie Lea Homestead relative to the study area



6.3 Archaeological impacts

The archaeological potential of the study area has been assessed as nil-low. The archaeological significance of any archaeological remains in the study area has been assessed as not reaching the threshold of local significance.

6.4 Statement of heritage impact - Built heritage

The statement of heritage impact summarised in Table 7 has been developed from the Heritage Division's (now Heritage NSW, DPC) guidelines for *Statements of Heritage Impact* (2002).

Table 7: Statement of heritage impact for the proposal - archaeological values

Heritage consideration	Discussion
What aspects of the proposal respect or enhance the heritage significance of the study area and nearby heritage items?	No items of built heritage listed on heritage registers have been identified in the study area. The proposal will have a neutral (nil) effect on built heritage.
What aspects of the proposal could have a detrimental impact on the heritage significance of the study area and nearby heritage items?	The evaluation here of the significance of Craigie Lea homestead as of local heritage significance is conditional on direct inspection of the homestead to determine the degree to which its historical fabric has been preserved. The proposal may have a minor indirect (visual) impacts to the potential heritage values of Craigie Lea homestead through effects on the homesteads setting. These impacts are already partially mitigated by existing mature tree screening between the proposal and Craigie Lea homestead, and the Parkes-Narromine railway line which separates the proposal from the homestead.
Is the proposal sited on any known, or potentially significant archaeological deposits? If so, have alternative positions for additions been considered?	The archaeological potential of the study area has been evaluated as nil-low. The significance of any archaeological deposits in the study area has also been evaluated as nil-low.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

This HIA has determined the following:

- No listed items of built heritage are located within the study area or within 3km of the study area.
- A search of archival text and plan records indicates that the study area has solely functioned as agricultural land since the late 19th century and has not been the location of significant built structures.
- The archaeological potential of the study area has been rated as nil-low.
- The significance of potential archaeological finds in the study area has been assessed as not reaching the level of local heritage threshold.
- One item of potential built heritage significance is present approximately 200m west of the study area. This is the Craigie Lea homestead. It has been assessed here that were the original fabric of the Craigie Lea homestead to be preserved, then this homestead would meet the threshold of local heritage significance.
- If the Craigie Lea homestead does meet the threshold of local heritage significance, then the proposal would result in minor indirect (visual) impacts to the homestead due to impacts to the homestead setting.

7.2 Recommendations

- No further formal archaeological or built heritage investigation is required for the study area.
- This report has assessed that any archaeological remains in the study area would not reach the threshold of local significance. Therefore, neither an Excavation (s140) or Exemption (s139(4) is required for works to proceed under the *Heritage Act 1977.*
- The following steps should be carried out to manage potential minor indirect (visual) impacts to Craigie Lea homestead.
    - The homestead should be inspected by a heritage specialist to determine whether the homestead retains heritage significance, or whether it has been substantially altered.
    - If the homestead is confirmed to be of local heritage significance, or a significance assessment is not completed, design of the MDC should minimise visual impacts through reduction of height adjacent to the item, or consideration of additional screening.
- Ground disturbing works may proceed under an Unexpected Finds Policy
- Staff engaged in on-site works should receive a heritage induction that will make them aware of the nature of potential heritage finds, and their obligations under the *National Parks & Wildlife Act* (NSW 1974) and the *Heritage Act* (NSW 1977).

8.0 REFERENCES

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APPENDIX C

Aboriginal Archaeological Survey Report

NARWONAH MATERIAL DISTRIBUTION CENTRE REVIEW OF ENVIRONMENTAL FACTORS

Narwonah Material Distribution Centre

Aboriginal Archaeological Survey Report

Report to Australian Rail Track Corporation

Narromine Local Government Area

April 2022

artefact

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EXECUTIVE SUMMARY

This Archaeological Survey Report (ASR) has been prepared by Artefact Heritage Services (Artefact Heritage) on behalf of the Australian Rail Track Corporation (ARTC), as part of an Aboriginal Cultural Heritage Assessment Report (ACHAR) to support the development of a new Material Distribution Centre (MDC). The MDC will be used for storage of rail, sleepers and ballast and will also contain a rail welding facility. ARTC proposes that under the State Environmental Planning Policy (Transport and Infrastructure) 2021 these works could be progressed as a Part 5.1 assessment process in a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act* 1979. The MDC is proposed to be constructed on lots:16 DP 755131 , 232 DP 755131, 233 DP 755131, 1 DP 1198931.

This report meets the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010), the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010a), the *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010b), and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011). This report provides recommendations as to whether further archaeological investigation may be required in relation to the current proposal.

Overview of Findings

Archaeological survey of the study area was carried out by Artefact Heritage with Registered Aboriginal Parties (RAPs) on 21 February 2022. Ground surface visibility during survey was effectively nil, even in areas where vegetation had been slashed to an extent that allowed a combination of pedestrian and vehicular survey. A large proportion of the study area (64%) had not been subject to vegetation reduction prior to survey and vegetation density in these locations was such that even vehicular survey was deemed unsafe. Based on local modelling, the study area is unlikely to be of greater than low-moderate archaeological potential. The identification of Site MDC-AS01 in a localised area of heightened soil visibility likely results from this location not having been subject to previous farming activity due to its proximity to mature trees.

There have been several sites identified to the immediate south of the study area on gilgai formations. These gilgais appear to continue into parts of the study area that could not be inspected during survey. As recommended by Jacobs previous survey of the proposal (2021, p.12), archaeological sub-surface testing of gilgais and immediate surrounds should be carried out.

The results of test excavation would inform recommendations for salvage during the construction phase. If artefacts are located during test excavation an AHIP would be required to permit salvage excavation if required, or further impacts to the location of identified sites.

Recommendations:

The following recommendations are made for the management of potential Aboriginal archaeological values in the study area and mitigation of potential impacts to them.

Site MDC-AS01

- If possible, design should be formulated to avoid impacts to Site MDC-AS01, in which case:
    - The location of Site MDC-AS01 should be protected with a ten-metre fenced No-Go zone through the period of ground disturbing construction works
    - The location of Site MDC-AS01 must be marked on site mapping and

    - The location of Site MDC-AS01 and restrictions regarding it must be discussed at site inductions and tool box meetings for works in the site vicinity.
- If impacts to Site MDC-AS01 cannot be avoided:
    - Surface salvage of artefacts in Site MDC-AS01 must be carried out
    - Salvage of artefacts in Site MDC-AS01 must be carried out in consultation with Registered Aboriginal Parties.
    - Artefacts collected from Site MDC-AS01 must be subject to repatriation in accordance with consultation with Registered Aboriginal Parties.
    - An AHIP is required to permit any impacts including surface collection salvage to Site MDC-AS01
    - An Aboriginal Cultural Heritage Assessment Report (ACHAR) will be required in support of the AHIP application

Areas outside Site MDC-AS01

- Mature trees in Lot 1 DP 1198931 could not be inspected during site survey on 21 February 2022, due to dense and high surrounding vegetation. Lot 1 DP 1198931 comprises an area of approximately 1km x 40m.
- Areas outside of Site MDC-AS01 where no gilgais are present have been assessed here as of low archaeological potential. Following survey of any mature trees in these locations, works may proceed without further archaeological assessment
- Areas where gilgais are evident have been assessed here as of moderate archaeological potential and a program of archaeological sub-surface testing must be completed for these parts of the study area in accordance with the *Code of Practice for archaeological investigation of Aboriginal objects in NSW* (DECCW, 2010)

CONTENTS

FIGURES

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ABBREVIATIONS

ACHAR	Aboriginal Cultural Heritage Assessment Report
AHC	Australian Heritage Council
AHIP	Aboriginal Heritage Impact Permit
AHIMS	Aboriginal Heritage Information Management System
ALR Act	*Aboriginal Land Rights Act 1983*
Artefact Heritage	Artefact Heritage Services Pty Ltd
AS	Artefact Scatter
ASR	Aboriginal Archaeological Survey Report
ATSIHP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
BP	Before Present (that is 1950)
Consultation Requirements	Aboriginal cultural heritage consultation requirements for proponents 2010
CHL	Commonwealth Heritage List
DECCW	Department of Environment, Climate Change and Water
EIS	Environmental Impact Statement
EPA Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and biodiversity Conservation Act 1999*
ha	hectares
ICOMOS	International Council on Monuments and Sites
km	kilometres
LALC	Local Aboriginal Land Council
LGA	Local Government Area
m	metres
NHL	National Heritage List
NPW Act	*National Parks and Wildlife Act 1974*
OEH 2010	Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (Office of Environment and Heritage - now Heritage NSW)
OEH 2011	Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (Office of Environment and Heritage -now Heritage NSW)

RAP	Registered Aboriginal Party
RNE	Register of the National Estate

1.0 INTRODUCTION

This Archaeological Survey Report (ASR) has been prepared by Artefact Heritage Services (Artefact Heritage) on behalf of the Australian Rail Track Corporation (ARTC), as part of an Aboriginal Cultural Heritage Assessment Report (ACHAR) to support the development of a new Material Distribution Centre (MDC).

The MDC will be used for storage of rail, sleepers and ballast and will also contain a rail welding facility. ARTC proposes that under the State Environmental Planning Policy (Transport and Infrastructure) 2021 these works could be progressed as a Part 5.1 assessment process in a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act* 1979. The MDC is proposed to be constructed on lots:16 DP 755131, 232 DP 755131, 233 DP 755131, 1 DP 1198931 (the study area).

This report meets the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010), the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010a), the *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010b), and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011). This report provides recommendations as to whether further archaeological investigation may be required in relation to the current proposal.

1.1 Proposal

1.1.1 Location

The location of the study area is shown in Figure 1 below. It comprises 340 hectares (ha) of open land situated between Tomingley Road to the east, Craigie Lea Lane to the north, and cadastral or arbitrary boundaries to the south and west. The town of Narromine is approximately 6 kilometres (km) north of the study area.

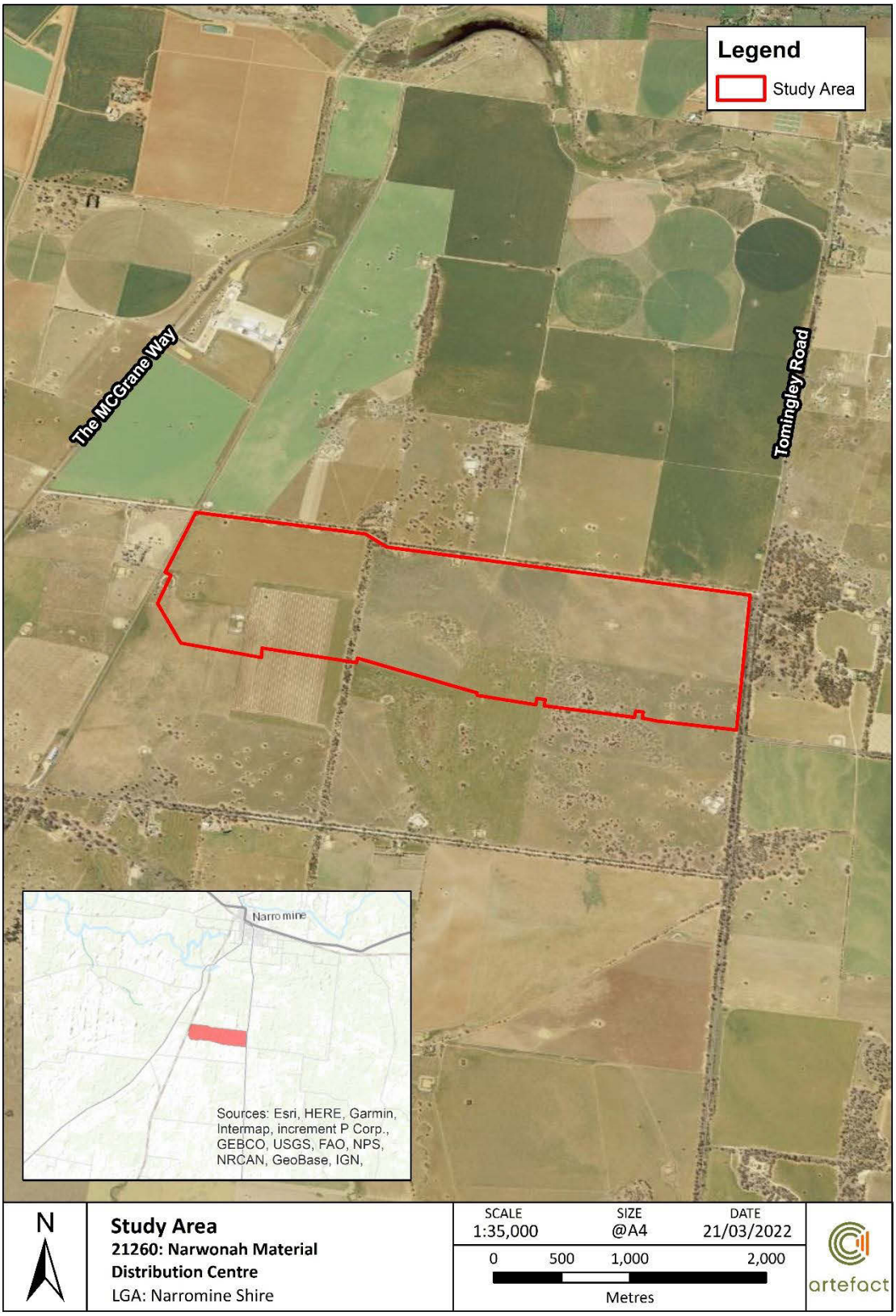
1.1.2 Proposed scope

The proposed works could include the following:

- Ballast laydown area
- Connections to existing and proposed new rail track
- Hardstand and facilities for ARTC and third party parking, offices and amenities
- Indicative three sediment basins
- Unloading, stabling and maintenance rail roads
- Locomotive maintenance facility
- Rail and sleeper storage
- Workshops and amenities
- Vehicular wheel wash areas
- Earthwork noise management bunds
- Rail welding facilities
- Gantry handling of both rail and sleepers

Detail design of the MDC is not complete. For the purposes of this assessment, it is assumed that works may take place at any location in the study area.

Figure 1: The study area



Objectives of Assessment

The objectives of this report include:

- An overview of the Aboriginal history of the study area
- Identification of Aboriginal sites and areas of archaeological potential within the study area
- Identification of potential historical disturbance to ground within the study area
- An archaeological survey
- Assessment of the significance of identified Aboriginal sites
- Conclusions and recommendations

1.2 Authorship and Acknowledgements

This report was written by Michael Lever (Heritage Consultant). Dr Sandra Wallace (Director) reviewed this report and provided management input.

2.0 LEGISLATIVE CONTEXT

2.1 Commonwealth Legislation

2.1.1 Native Title Act 1994

The *Native Title Act 1994* was introduced to work in conjunction with the *Commonwealth Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

A search of Native Title records was lodged on 30 November 2021 with the Geospatial Searches service of the National Native Title Tribunal (ref SR21/1885).

No Native Title applications, claims, determinations or Indigenous Land Use Agreements were present in the study area at the time of this search.

2.1.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legislative framework for the protection and management of matters of national environmental significance, such as, flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the WHL or NHL.

The EPBC Act stipulates that a person who has proposed an action that will or is likely to have; a significant impact on the relevant heritage values of a World or National heritage site must refer the action to the Minister for the Environment (hereafter the Minister). The Minister would then determine if the action requires approval under the EPBC Act. If approval is required, an environmental assessment would need to be prepared. The Minister would approve or decline the action based on this assessment.

There are no heritage items within the study area or within 3km of the study area that are listed on the WHL, NHL or CHL.

2.1.3 The Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (ATSHIP Act)

The ATSHIP Act is legislation passed by the parliament of the Commonwealth of Australia to enable the Commonwealth to intervene and, where necessary, preserve and protect areas and objects of particular significance to Australia's Aboriginal or Torres Strait Islander peoples from being desecrated or injured. The ATSHIP Act is invoked when items of particular heritage significance to Aboriginal or Torres Strait Islander are subject to potential impacts. Register searches for this report have not identified any items of material cultural heritage within the study area that would trigger the ATSHIP Act.

2.2 State Legislation

2.2.1 National Parks & Wildlife Act 1974

The NPW Act provides statutory protection for all Aboriginal 'objects' as defined under Section 83 of the Act, (consisting of any material evidence of the Aboriginal occupation of NSW) and for 'Aboriginal Places' as defined under Section 84 (areas of cultural significance to the Aboriginal community).

Under Section 86 of the NPW Act. Aboriginal objects are afforded automatic statutory protection in NSW whereby it is an offence to harm or desecrate an Aboriginal object.

The NPW Act defines an Aboriginal 'object' as:

> *…any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises New South Wales, being habitation before or concurrent with the occupation of that area by persons of non-Aboriginal European extraction, and includes Aboriginal remains.*

An Aboriginal Place is declared by the Minister, in recognition of its special significance with respect to Aboriginal culture. Under Section 86 of the NPW Act Aboriginal objects and places are protected. Section 86 provides for two offences relating to Aboriginal objects and one offence concerning Aboriginal places and establishes penalties and fines for the harm or desecration of an Aboriginal object or place. All Aboriginal objects, whether recorded or not are protected under the NPW Act. Section 90 of the NPW Act makes provision for Aboriginal Heritage Impact Permits (AHIPs), which authorise actions that would otherwise constitute an offence.

This ASR complies with the guidelines and regulations associated with the NPW Act, by assisting the proponent in meeting their obligations under the NPW Act.

As detailed in section 3.2 below, a search of the Aboriginal Heritage Information Management System (AHIMS) was carried out on 12 January 2022. No Aboriginal sites or places were listed in the study area.

2.2.2 Native Title Act 1994

The *Native Title Act 1994* was introduced to work in conjunction with the *Commonwealth Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

A search of Native Title records was lodged on 30 November 2021 with the Geospatial Searches service of the National Native Title Tribunal (ref SR21/1885). No Native Title applications, claims, determinations or Indigenous Land Use Agreements were present in the study area.

2.2.3 Aboriginal Land Right Act 1983

The *Aboriginal Land Rights Act 1983* (ALR Act) established Aboriginal Land Councils (at State and Local levels). These bodies have a statutory obligation under the ALR Act to:

> *(a) take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law, and*
>
> *(b) promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.*

The study area is within the boundary of the Narromine LALC. On 30 November 2011, as part of project consultation, written enquiry was addressed to the Office of the Registrar Aboriginal Land Rights Act 1983 to enquire whether any places had been registered under the ALR Act in the study area. No response was received to this enquiry.

2.2.4 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. This report constitutes assessment of Aboriginal cultural heritage values in keeping with Commonwealth and State Legislation in order that the proposal may be progressed as a Part 5.1 assessment process in a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act* 1979.

3.0 ABORIGINAL HISTORICAL AND ARCHAEOLOGICAL CONTEXT

3.1 Ethnographic and historical evidence

Historical records may provide insight to the Aboriginal past. However, it must be recognised that early documents were produced by colonial observers who interpreted and recorded events that they observed through their personal and socially conditioned biases and worldviews. It is a further feature of such early reports, that authors often focussed on events or behaviour that they perceived as unusual rather than every day, and did so based on incomplete or very partial evidence.

According to mapping by the linguist and anthropologist Norman Tindale, Narromine sits at the northern boundary of Wongaibon lands, bordered by the Wiradjuri to the south and east, the Ngemba, Weilwan and Koinberi to the north, and the Barindji and Naualko to the west (Tindale, 1940) Figure 2. The Wongaibon language is a dialect of Ngiyampaa (AIATSIS, 2022). The use of language boundaries to define Aboriginal spatial identity is not one that is universally accepted among anthropologists, including those who were contemporaries of Tindale (e.g. (Stanner, 1968)).

Figure 2: Location of Narromine in Wongaibon land (Tindale 1940).

The earliest historical accounts of Aboriginal life in the wider surrounds of the study area derive from Thomas Mitchell's 1835 expedition in which he sought to trace the Darling River to its southern terminus. Mitchell travelled to the Darling River along the Bogan River, which passes at closest some 30km to the south and south east of the study area. Mitchell wrote of the surrounds of the Bogan River in glowing terms, as richly resourced in plant life (Mitchell, 1838). Mitchell relied considerably on local Aboriginal guides not only for directions but also for assistance with deriving foods including native honey and in locating waterholes when the party diverted from the course of the Bogan River (Mitchell, 1838). The location of waterholes was not only an issue of spatial skill, but one which required navigation of cultural values too, as Mitchell recorded (Mitchell 1838):

> *Another great advantage gained in the company of the natives was our being perfectly safe from the danger of sudden collision with a tribe. Their caution in approaching waterholes was more remarkable; for they always cooeyed from a great distance, and even on coming near thick scrub they would sometimes request me to halt until they could examine it.*

It is difficult to derive from Mitchells' statement whether he describes here a potential encounter between hostile local groups, or a desire by local guides to ensure that other allied groups were not taken by surprise – or indeed whether this was simply the accepted social norm of introduction.

Little subsequent historical information is available. The Aboriginal Protection Board reported in 1891 that 296 Aboriginal people lived in the Dubbo area, which included Narromine. Many Aboriginal men were then employed on pastoral stations (English, Veale, Erskine, & Robinson, 1998, p. 50).

Bulgandramine is located approximately 30km south of the study area. The Bulgandramine mission was officially opened in 1907 and was disbanded in 1956-7 (OzArk, 2011), however, according to local Aboriginal people the location functioned as a place for segregation of Aboriginal people and the removal of children from their families from as early as 1820 (Pearce, 2016).

3.2 Aboriginal Heritage Information Management System

3.2.1 Registered Aboriginal sites in the search area

The locations and details of Aboriginal sites are considered culturally sensitive information. It is recommended that this information, including the AHIMS data and GIS imagery, is removed from this report if it is to enter the public domain.

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken on 12 January 2022 (Client ID 650850) for the following area, with no buffer.

GDA Zone 55	
From Easting: 607247	**To Easting: 620562**
From Northing: 6414587	**To Northing: 6435355**

This represents a search area of approximately 311km^2 centred on the study area. A total of 37 Aboriginal sites are registered on the AHIMS site register in the extensive search area as shown in Figure 3.

Heritage NSW lists 20 standard site features that can be used to describe a site registered with AHIMS, and more than one feature can be used for each site. The frequency of recorded site types in the search area for this report is summarised in Table 1 below and shown on Figure 3. The distribution and nature of recorded archaeological sites in the search area most likely reflects locations where development has required archaeological survey, rather than reflecting inherent archaeological patterning. This can be demonstrated through the proportions of recorded modified tree sites relative to surface artefact sites. It is certain that far more lithic artefacts exist in the search area than modified trees. Nevertheless, the majority of sites in the search area are modified trees (49%). If modified trees and burials are added to this number, then these comprise 57% of all registered sites.

This is likely a function of the high level of visibility of modified trees and their potential preferential preservation. It is notable, that a large proportion of the modified trees that have been identified in the study area are contained in road reserves and areas where visibility and preservation is enhanced,

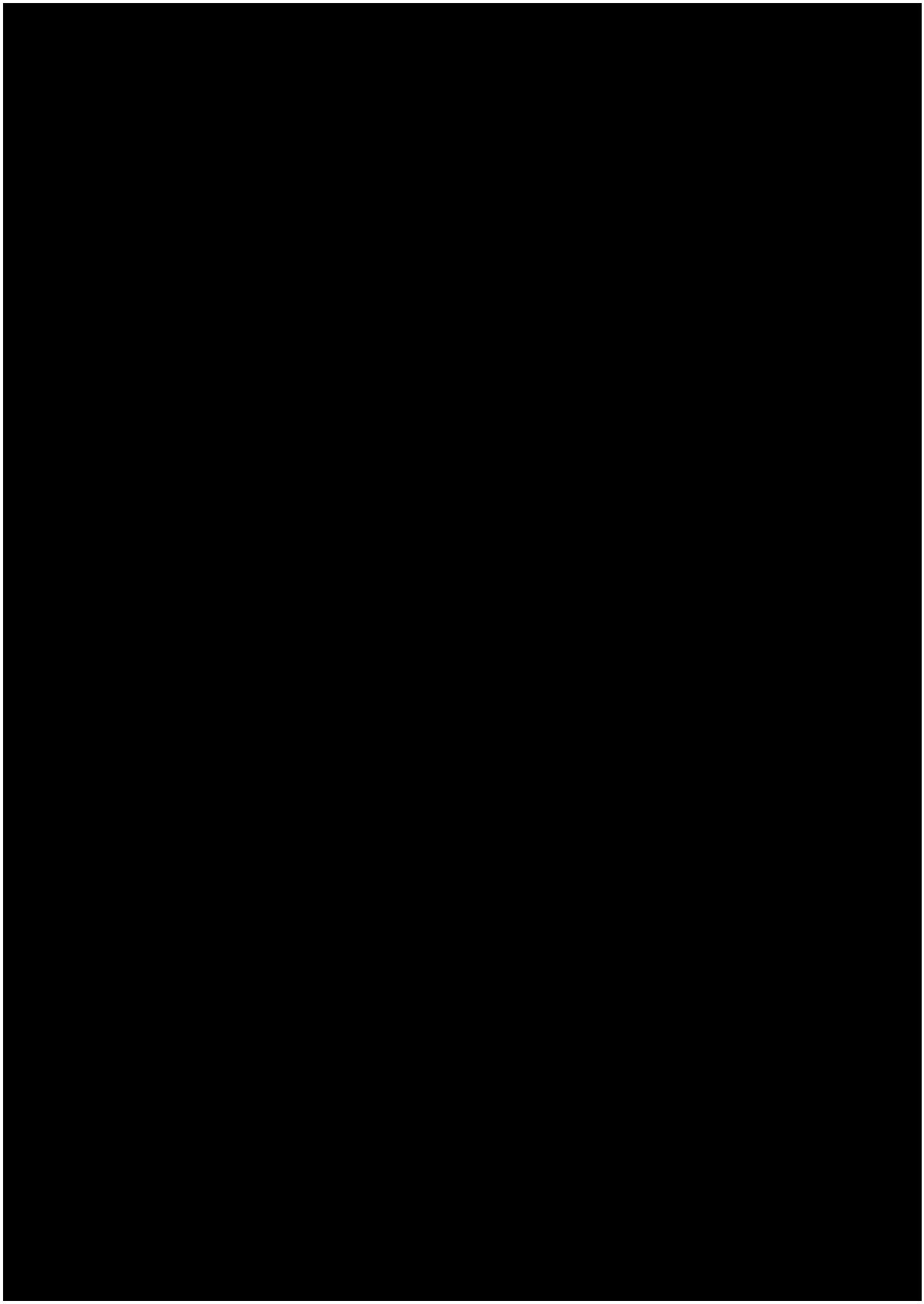
particularly along Tomingley Road, Pinedean Road and along the Backwater Cowal Creek. Recording of such sites most likely results from a combination of incidental observation and archaeological inspection initiated by proposed development.

Open artefact (lithic) sites only comprise 38% of all registered sites in the search area, and this relatively low proportion of total sites is most likely to result from a general lack of local development activities that would trigger archaeological investigation under the NPW Act.

Table 1: Frequency of recorded site types within the search area

Site Feature	Frequency	Percentage
Artefact (open site)	14	38
Grinding Groove	1	2.5
Modified tree (carved or scarred)	18	49
Modified tree & Burial	3	8
Ochre Quarry	1	2.5
Total	**37**	**100**

The majority of sites in the search area are modified trees (49%). If modified trees and burials are added to this number, then these comprise 57% of all registered sites. This is likely a function of the high level of visibility of modified trees and their potential preferential preservation. Open artefact sites comprise 38% of all registered sites. Recorded modified trees have been notably recorded in locations that provide enhanced visibility and preservation, such as road reserves (particularly Tomingley Road) and along the Backwater Cowal Creek.



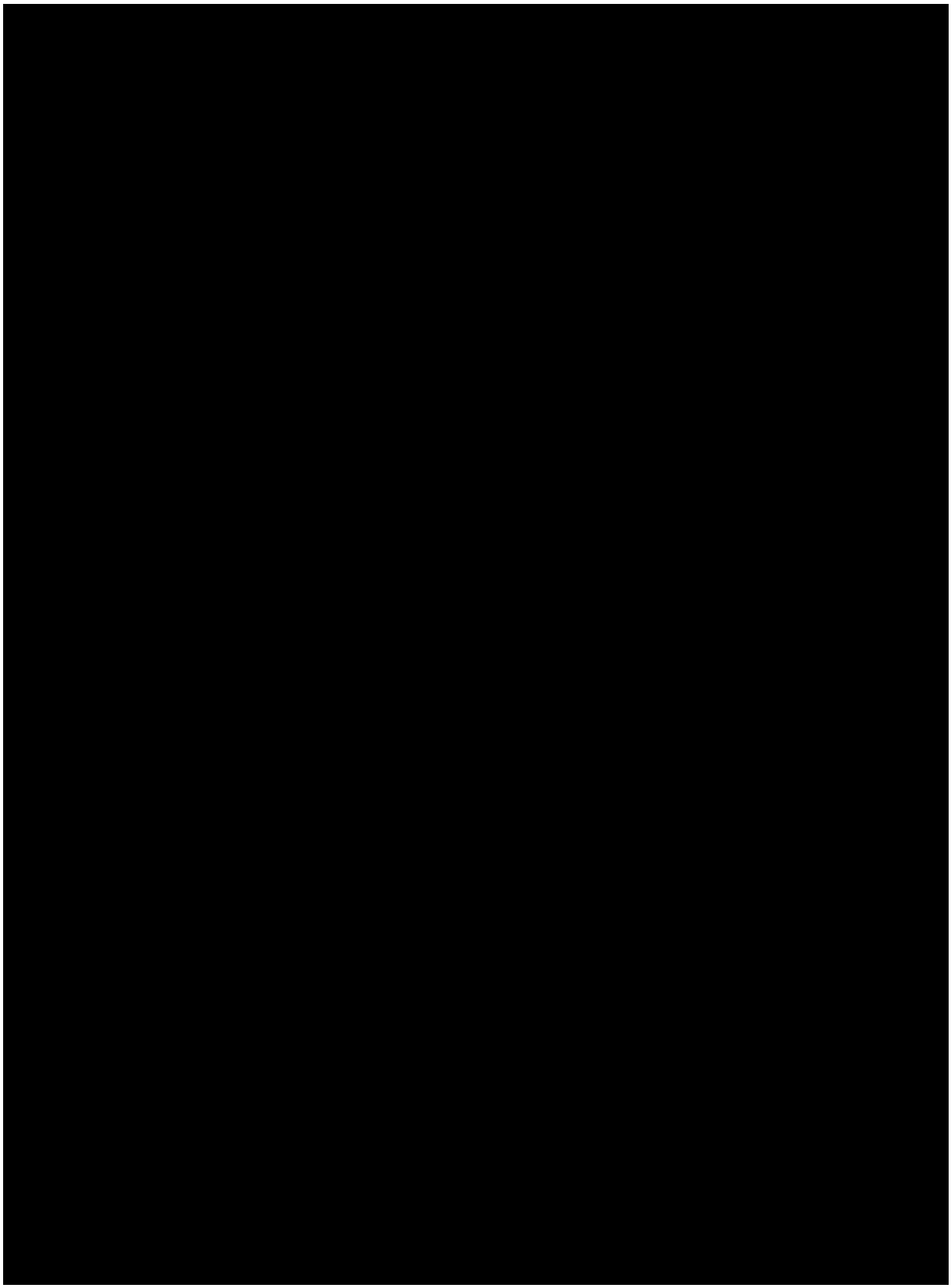
3.2.2 Registered Aboriginal sites within 500m of the study area

A preliminary Aboriginal Cultural Heritage Advice letter report for the MDC was issued by Jacobs (Jacobs, 2021). This included results of field survey by Jacobs for both the current study area, and locations outside and immediately south of the current study area. Jacobs (2021) identified a number of isolated or low density artefact scatters outside the current study area. These are listed below and are shown in Figure 4. All of the sites registered by Jacobs (2021) were identified immediately adjacent to gilgais. This may be due to the possible past function of gilgais as water resources utilised by Aboriginal people, to lower rates of past agricultural impact to the location of gilgais, to a higher degree of ground surface visibility around gilgais, or a combination of all three factors. There is a predominance of quartz at these sites with quartz artefacts comprising 60% of finds (n=6), mudstone comprising 20% (n=2) and silcrete 20% (n=2).

Table 2: AHIMS sites near the study area

AHIMS #	Site type	Landform	~Distance to study area (m)	Relation to study area landform
35-3-0292	Isolated silcrete artefact	Adjacent to gilgai on floodplain	<200	Contiguous floodplain
35-3-0293	Mudstone isolated artefact	Adjacent to gilgai on floodplain	<500	Contiguous floodplain
35-3-0294	Mudstone isolated artefact	Adjacent to gilgai on floodplain	<200	Contiguous floodplain
35-3-0295	Quartz isolated artefact	Adjacent to gilgai on floodplain	<500	Contiguous floodplain
35-3-0296	Silcrete isolated artefact	Adjacent to gilgai on floodplain	<500	Contiguous floodplain
35-3-0297	Two quartz flakes	Adjacent to gilgai on floodplain	<400	Contiguous floodplain
35-3-0298	Three quartz artefacts	Adjacent to gilgai on floodplain	<500	Contiguous floodplain

Figure 4: AHIMS Sites near to the study area



3.2.3 Discussion of AHIMS search results

The AHIMS search results indicate a considerable preponderance of culturally modified trees and isolated or low density artefact scatters in the search area. The artefact sites recorded by Jacobs (2021) are unusual in that they represent the densest cluster of artefact sites in the search area, that does not include modified trees, and are not associated with permanent waterbodies.

3.3 Previous archaeological assessments

3.3.1 Relevant reports

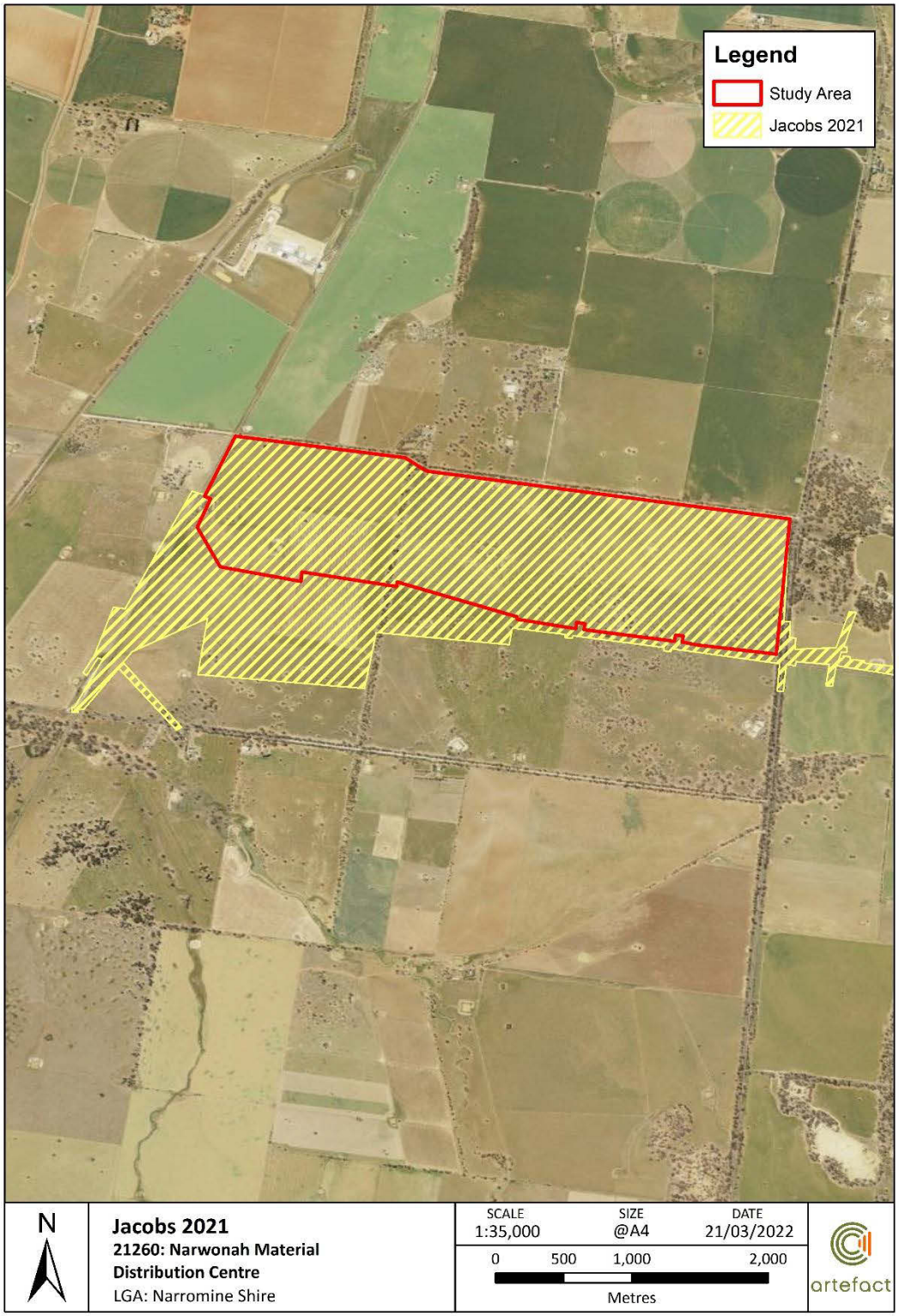
Little reporting is to hand for the study area and its immediate surrounds. Previous reporting for phases of the Inland Rail frequently nominally include the study area. In reality however, they encompass very large spatial extents which limits the degree to which they can be relied upon for modelling specifically relevant to the study area. An exception to this is the archaeological survey carried out by Jacobs (2021), the results of which are summarised below.

Further, this section is restricted to analysis of reports that deal with similar landforms and local landforms to the study area. For this reason the report on the Goobang National Park by English et al (English, Veale, Erskine, & Robinson, 1998) has been omitted. The steeply relieved landform that is characteristic of the Goobang National Park does not provide equal comparison to the unrelieved flat landform of the study area.

Jacobs 2021. Narromine to Narrabri Inland Rail Project. Preliminary Aboriginal Cultural Heritage Advice for the Proposed Narromine South multi-project compound. Report to ARTC.

Jacobs (2021) carried out archaeological survey of the current study area and adjoining areas to the south, east and west during June 2021 in ground surface visibility conditions of between 10% - 30%. A total of seven Aboriginal archaeological sites were identified, all of which are outside of the current study area (Figure 4). All of these sites were isolated or low density artefacts, with a predominance of quartz. All of these sites were described as located in proximity to gilgais. Jacobs (2021) stated that the western third of the current study area had been ploughed and disturbed and was therefore of lower archaeological potential. Jacobs noted evidence of gilgais in the central portion of the current study area, but did not identify any sites at these locations. Survey by Jacobs (2021) focussed on the surrounds of gilgais and inspection of mature trees for cultural scarring. No culturally scarred trees were identified in the study area. Jacobs (2021) recommendations included that archaeological sub-surface testing be carried out, concentrated on the surrounds of gilgais. The location of Jacobs (2021) and findings relative to the current study area are shown in Figure 5 below.

Figure 5: Study area of Jacobs 2021 relative to current study area



OzArk Environmental and Heritage Management Pty Ltd (OzArk) 2011. Tomingley Gold Project. Cultural Heritage Assessment. Report to Alkane Resources Ltd.

OzArk (2011) carried out assessment over a large study area that included the location of a mine at Tomingley situated 30km south east of the study area, but which also included the footprint of extensive connected water pipeline which extended to Narromine.

OzArk (2011) applied a stream-ordering model in predicting site occurrence, in which sites nearer to permanent water were more probable to represent locations of more frequently and perhaps permanently utilised Aboriginal settlement locations. Archaeological evidence for this may be present in abundance and range of variety of artefact types and materials. Locations near ephemeral water sources would be more likely to contain archaeological evidence of single phase or transit utilisation. This would be represented by lower abundance of sites, artefacts, types and materials.

Of most relevance to the current report is the predictive statement by OzArk (2011, p. 47) that

> *On flat plains over 200m from water, archaeological evidence is likely to be sporadic if present at all*

By far the most numerous site type recorded by OzArk (2011) were culturally modified trees, with a total of 43 trees identified as certainly of Aboriginal manufacture (OzArk, 2011, p. 85). One abundant artefact site and PAD (TNWP-OS1) was recorded on a terrace within 50m of a paleochannel of the Macquarie River at Narromine, described as having "dozens of artefacts visible at surface, including quartz, indurated mudstone, chert and granite" (OzArk, 2011, pp. 66-67). At Tomingley a second artefact site was recorded (TGP-0S-1), located within 100m of an ephemeral spring within a flat plain. This site comprised 18 surface artefacts in a large exposure, dominated by quartz and quartzite (44% of total) (OzArk, 2011, p. 54). Also at Tomingley, site TGP-0S-2 was identified, consisting of two quartz and one silcrete flake located near an unnamed drainage line on a low flat plain.

Recommendations made by OzArk (2011) with relation to artefact sites were that soils had already considerably deflated at TGP-0S-1 and TGP-0S-2, and given this and the nature of landform they were in, little potential existed for additional information to be gained through test excavation. At TNWP-OS1 however, the authors considered substantial archaeological potential to be present (OzArk, 2011, p. 54). No recommendations were made for archaeological test excavation in locations away from waterbodies and deemed of lower potential.

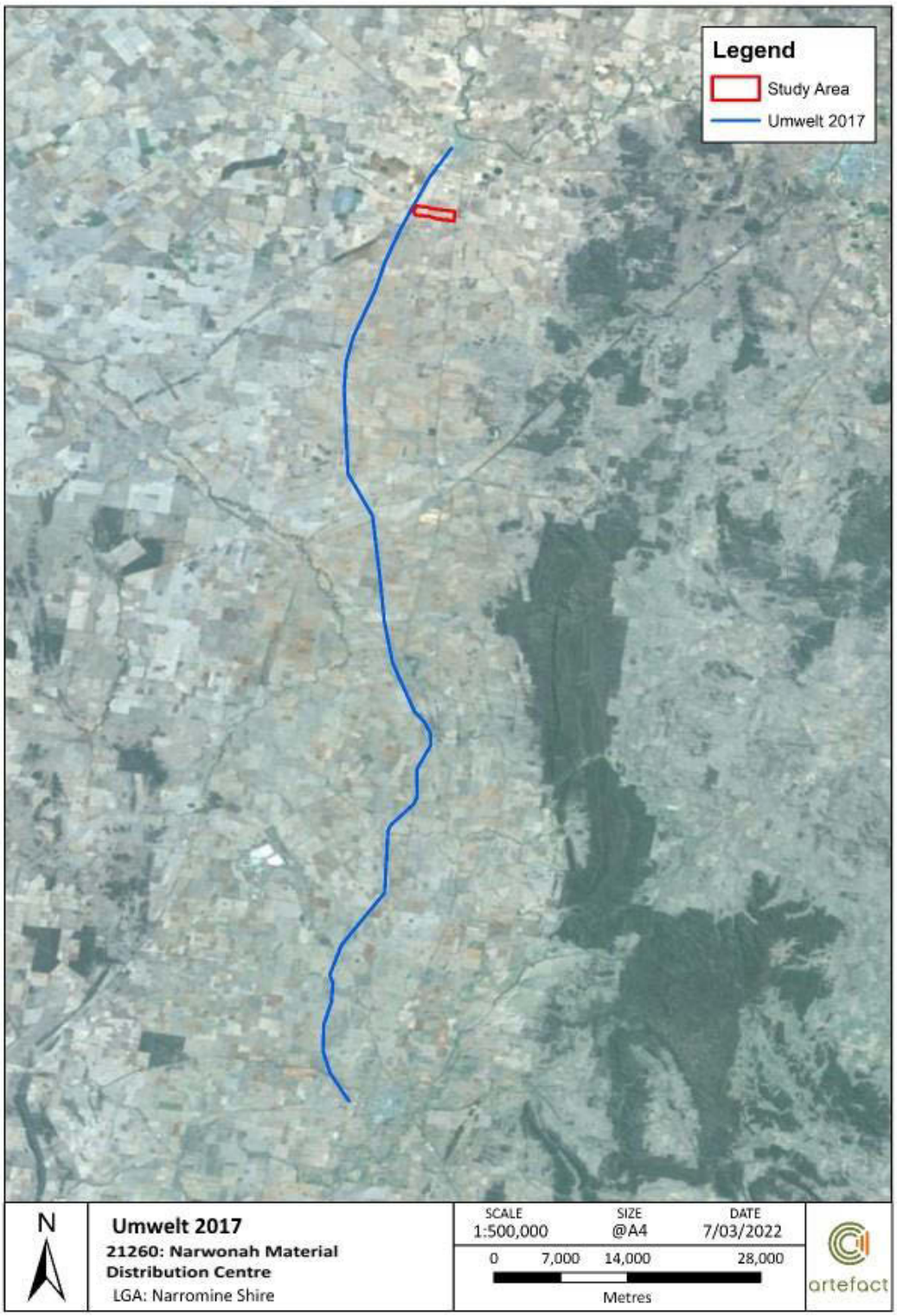
Umwelt 2017. Inland Rail – Parkes to Narromine. Aboriginal Cultural Heritage and Archaeological Assessment. Report to ARTC.

Umwelt (2017) carried out archaeological survey of the construction footprint for the Inland Rail between Parkes and Narromine. The extent of the Umwelt (2017) study area relative to the current study area is shown in Figure 6 below. Predictive modelling, based on previously registered sites in the vicinity, stated that most sites would be comprised of modified trees or lithic artefacts, and that unless near permanent waterways, these lithic sites would characteristically only contain small numbers (less than five) artefacts.

Archaeological survey was carried out during winter and comprised a combination of vehicle inspection and pedestrian survey. Ground surface visibility varied widely, from 5% to 90%. Considerable existing ground disturbance was identified resulting from both agricultural and pre-existing rail activities. Two new surface sites were recorded, both within 100m of the Backwater Cowal Creek. Site 35-3-0206 comprised 20 lithic artefacts of which 75% (n=15) were quartz. Site 35-3-0208 comprised 29 lithic artefacts of which 97% (n=28) were quartz. This predominance of quartz was considered characteristic of the region (Umwelt, 2017, pp. 60-61). Recommendations were

made for the surface collection & / archaeological salvage of locations that were to be impacted by the proposal and which had been rated as of moderate or higher archaeological potential. The rating of archaeological potential by Umwelt (2017) rested on a combination of proximity to water and lack of soil disturbance. The locations proposed for collection or salvage by Umwelt (2017) all occurred far closer to waterbodies than is the case for any location in the current study area.

Figure 6: Umwelt study area relative to current study area

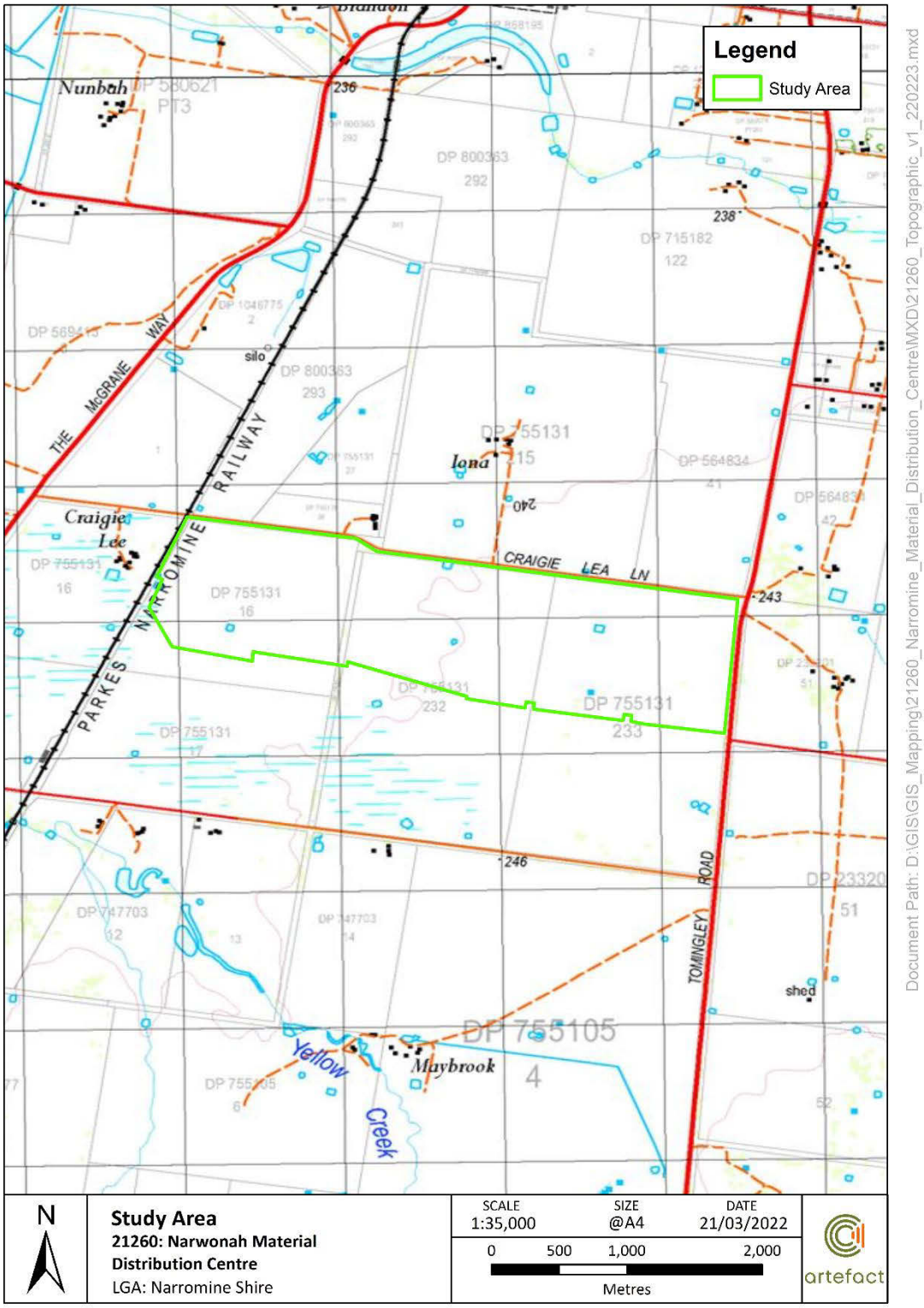


4.0 ENVIRONMENTAL CONTEXT

4.1 Geology, soils and hydrology

The study area is located on effectively level plain, with at times very slight slope downwards to the south and east. It is within a network of permanent tributaries of the Macquarie River, which flows at nearest some 6km to the north. The nearest of these tributaries to the study area are the Backwater Cowal located 3km to the north, and Yellow Creek, located 1.5km to the south (Figure 7). The study area does not therefore enjoy a position that would likely have seen it preferentially utilised by Aboriginal people in the past as an important resource centre. The study area is currently subject to regular flooding when either or both of the Backwater Cowal and Yellow Creek are in flood (Mark Smith, Narromine LALC). Geological and sedimentological evidence indicates that the study area has long been subject to at least periodic inundation. The substrate in the study area comprises a combination of Tertiary alluvium (cz) and Quaternary alluvium (cza) of mainly red silt with some pebble bands and quartz (Sherwin, 1997). The study area is modelled as containing a combination of Red Vertosols and Chromosols (E-Spade, 2022). The shrink-swell and cracking nature of clay rich vertosols would contribute to the presence of gilgais identified by Jacobs (2021), while the Chromosols lend themselves well to agriculture.

Figure 7: Topography and hydrology of the study area



4.1.1 Geotechnical evidence

A program of geotechnical test pitting was carried out in the study area by D & N Geotechnical Pty Ltd (D & N Geotechnical Pty Ltd, 2022). Indications of this included that the study area as a whole contained significant areas that were potentially prone to waterlogging, and to shrink-swell gilgai soils. Topsoils were recorded as shallow, comprising sandy silts above sandy or silty clay to average maximum depths of 300mm. Archaeological definitions of culturally sensitive topsoils would likely exclude these lower clay units, leaving a potential archaeologically sensitive deposit of generally between 100mm to 200mm.

4.2 Previous land use

A search of archival, documentary and aerial photographic evidence indicates that the study area has been subject only to ground disturbances characteristic of agricultural activity including comprehensive clearing of trees, grading of tracks around the study area perimeter, and repeat ploughing.

4.3 Predictive model

Drawing on the information provided above, the following predictive model for the presence of Aboriginal artefacts in the study area takes into consideration the following factors:

There is agreement between the three reports examined above (OzArk, 2011; Umwelt, 2017; Jacobs, 2021) that the primary predictive factor in archaeological lithic site occurrence, and artefact density within sites near the study area, is proximity to permanent water. The study area is situated on open plain with clay-based soils, and is therefore in some respects comparable to the Cumberland Plain surrounding Sydney. English et al (English, Veale, Erskine, & Robinson, 1998) explicitly cite early stream ordering work done by J. McDonald on the Cumberland Plain in discussing predictive modelling for their study area at the Goobang National Park, some 30km south east of the current study area. This work by McDonald was subsequently substantially expanded in collaboration with B. White (White & McDonald, 2010). White and McDonald have contributed to the debate over site prediction by discussing the nature of Aboriginal site distribution, interpreted through lithic analysis of excavated sites in the Rouse Hill Development Area. Their predictive model firmly ties artefact density and site occurrence to proximity to higher order waterways, while with distance from permanent water, in particular distances over 100m on unrelieved plain, artefact densities may be expected to represent a ‘background scatter’ (White & McDonald, 2010).

Jacobs (2021) recorded a number of low density artefact sites in the vicinity of gilgais to the south of the current study area. In the relatively dry surrounds of the study area these gilgai waterbodies may have a greater degree of archaeological potential than would otherwise be anticipated.

4.3.1 The following predictive statements are made:

- Culturally modified trees are the most frequently identified site type in the area and may be encountered at any point in the landscape
- Flat land locations at greater than 200m from permanent water are unlikely to contain artefact densities of greater than background scatter nature (less than 1 artefact per m^2)
- Flat land locations containing localised water bodies including gilgais have potential to contain low density artefact scatters

- Agricultural activities including ploughing, clearing and grading are likely to have disturbed the integrity of archaeological deposits in upper soil units.
- Quartz will be the predominant artefact material

5.0 FIELD METHODS

5.1 Limitations

It was understood prior to field survey that a large proportion of the study area (216ha = 64%) was under dense vegetation following higher than average summer rains. Further, that vegetation in this area could not be slashed due to protective measures in place for an endangered local species. Survey was carried out in February, and it was not deemed safe to enter un-slashed areas in which vegetation was dense and frequently over 1m tall (Figure 8). Vegetation was slashed in an area of 124ha, representing 36% of the study area. On attending site on 21 February 2022, and after attempting several pedestrian transects of the slashed area it became evident that ground surface visibility even in slashed areas was effectively zero (Figure 9, Figure 10, Figure 11).

Figure 8: Example of unslashed vegetation levels at perimeter of unslashed area

Figure 9: Characteristic ground surface visibility in slashed area

Figure 10: Ground surface visibility in slashed area - view south

Figure 11: Characteristic height & density of slashed vegetation – view south

5.2 Survey methodology

Survey commenced on the morning of 21 February 2022 with the following participants:

Individual	Role	Organisation
Michael Lever	Heritage Consultant	Artefact Heritage
Brye Marshall	Heritage Consultant	Artefact Heritage
Selina Nalatu	Cultural Heritage Advisor	ARTC
[redacted]	RAP	[redacted]

Individual	Role	Organisation
[redacted]	RAP	[redacted]
[redacted]	RAP	[redacted]
[redacted]	RAP	[redacted]

Survey commenced on foot with individuals walking in line, spaced 10m apart, proceeding in north-south transects (Figure 12). Following several pedestrian transects it became apparent that conditions of effectively zero ground visibility were likely to be present throughout the survey area. Survey methodology then changed to one of closely spaced vehicular transects (Figure 14). The added height afforded by vehicular approach aided in the identification of those few areas of exposed soil that were present. All such identified areas of exposed soil were subject to close examination on foot (Figure 13).

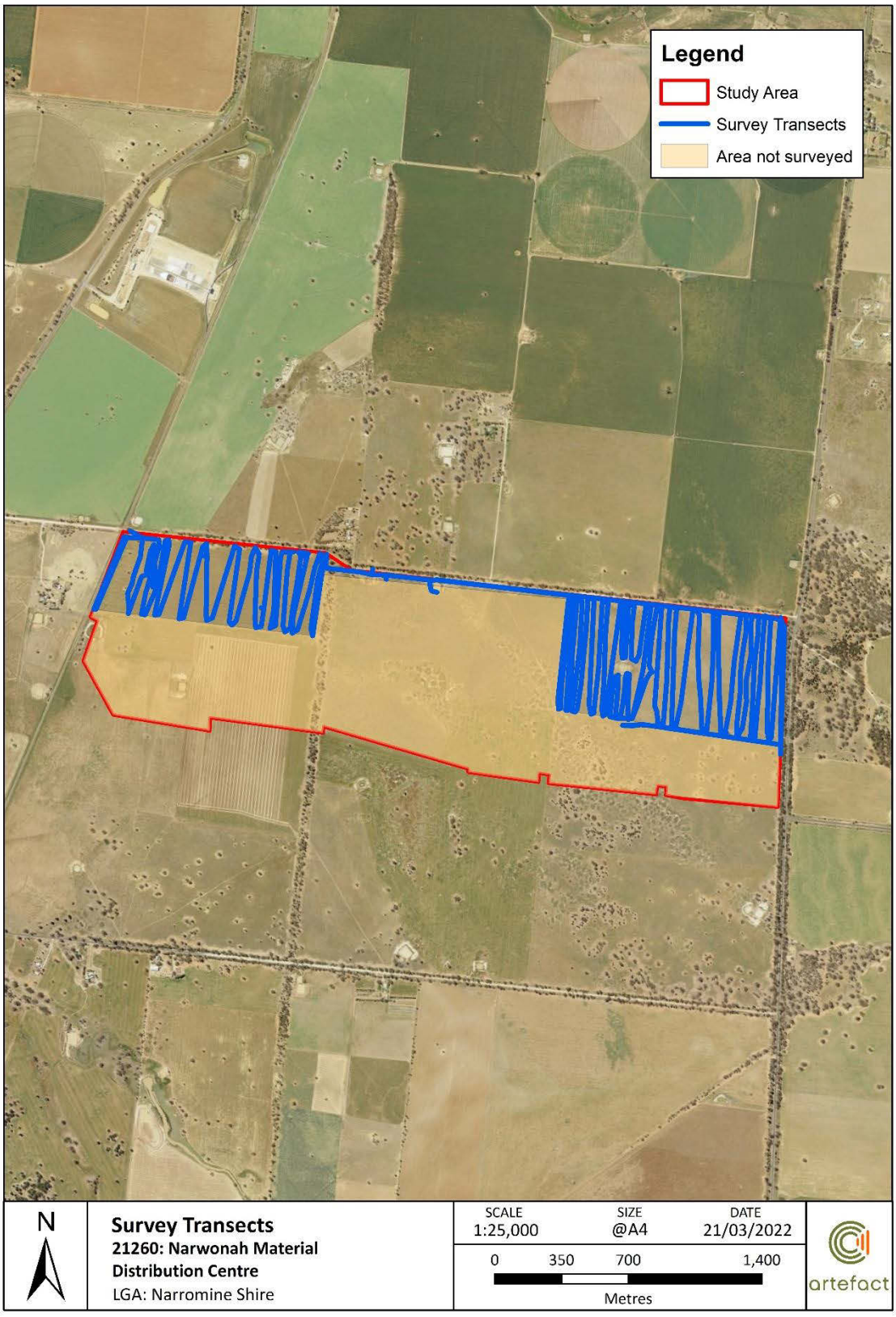
Figure 12: Pedestrian survey in progress, view south east

Figure 13: Pedestrian inspection of visible soils identified through vehicular survey

5.2.1 Survey Units

The study area comprises an effectively level plain of 340ha all of which is defined here as one survey unit – Survey Unit One. A total 124ha of Survey Unit One was subject to a combination of vehicular and pedestrian survey, while the remaining 216ha of Survey Unit One could not be accessed. The extent of Survey Unit One that was surveyed is represented on Figure 14 below, in which the gps-tracked transects of vehicular and pedestrian survey are shown.

Figure 14: Survey Unit One showing survey transects



6.0 SURVEY RESULTS

6.1 Survey Unit One

At the time of survey, all those parts of Survey Unit One that could be accessed had been ploughed east-west, with furrows obscured beneath the dense grasses shown in Figure 9 to Figure 11 above. Although such ploughing may have disturbed the archaeological integrity of artefact deposits, it is unlikely to have removed such deposits altogether.

Isolated trees, at times in small clusters were present in the western extreme of the Survey Unit. These included eucalypts, casuarina, and several peppercorn trees. Other than these, the property had been comprehensively cleared. Soil visibility was almost wholly limited to remnant graded tracks along the perimeter of the Survey Unit as shown in Figure 13 above and Figure 15 below. These tracks almost invariably contained abundant mechanically fractured quartz, shale, and at times ironstone (Figure 16). High levels of shale and quartz were also evident on the surface of backfilled geotechnical pits (Figure 17). Whether due to repeat ploughing or natural factors, no gilgais were observed in the parts of the study area that could be accessed.

All trees in the parts of Survey Unit One that could be accessed were examined. No evidence of cultural modification was identified.

One new Aboriginal site was identified in the portion of Survey Unit One that could be accessed. This is site MDC-AS01 (AHIMS ID pending), an artefact scatter described in Section 6.3.2 below.

Figure 15: Inspection of remnant perimeter track

Figure 16: Mechanically fractured quartz and ironstone on remnant track

Figure 17: High levels of quartz and shale in geotechnical test pit soils

6.1.1 RAP discussions and consultation

[redacted]

6.2 Effective survey coverage

A summary of survey coverage is outline in Table 3 and

Table 4 below.

Table 3: Effective survey coverage

Survey unit	Landform	Survey unit area (m2)	Visibility (%)	Exposure (%)	Effective survey coverage (m2)	Effective coverage (%)
1	Level Plain	3,400,000	.5	0	17,000	.5

Table 4: Landform survey coverage

Landform	Landform area (m2)	Area effectively surveyed	% of landform surveyed	Number of sites	Number of artefacts/ features
Level Plain	3,400,000	17,000	.5	1	5

6.3 Summary of results

6.3.1 Previously recorded Aboriginal sites

There are no previously recorded Aboriginal sites in the study area. As shown in Figure 3 and listed in Table 2 there are seven previously recorded Aboriginal sites to the immediate south of the study area. These are all listed on their site cards as occurring adjacent to gilgais.

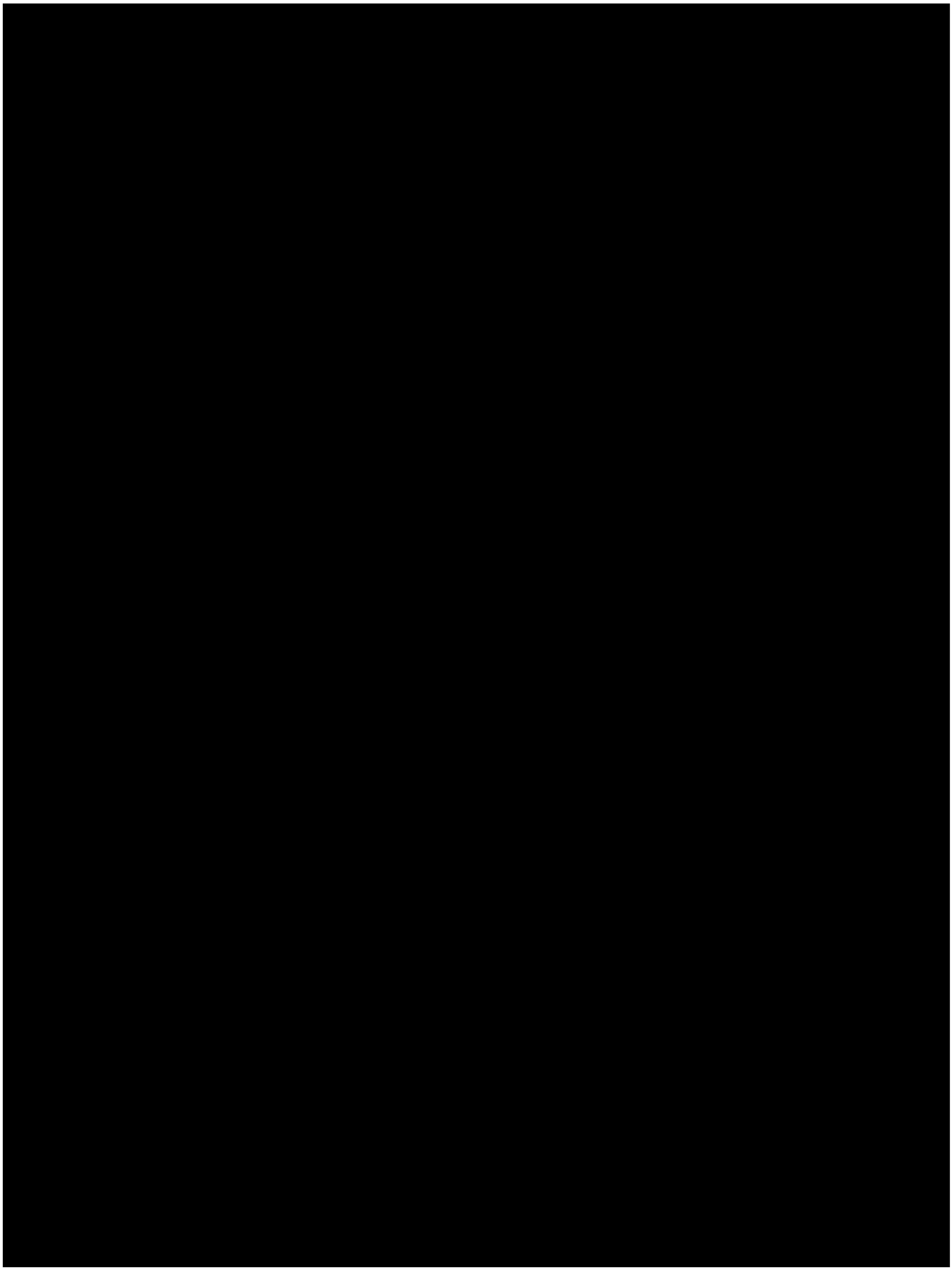
6.3.2 Newly recorded Aboriginal sites

One newly recorded Aboriginal site has been registered as a result of survey. This is site MDC-AS01 (AHIMS ID pending) which is a low density artefact scatter located on an active bull-ant nest surrounding two peppercorn trees (Figure 18). De-vegetation by bull-ants has resulted in a high level of surface visibility surrounding these trees (Figure 19). It is likely that proximity to these peppercorn trees has protected the site from the levels of agricultural impact such as ploughing that was evident through the rest of the study area. Artefacts identified were one complete quartz flake, two fragmentary quartz flakes, one quartz core and one silcrete core. The visible extent of the artefact scatter measured 10m x 10m, equivalent to one surface artefact per 20m^2. The location of site MDC-AS01 is shown on Figure 21 below.

Figure 18: Location of MDC-AS01. View south

Figure 19: Surface visibility at bull-ant nest, site MDC-AS01. View south

Figure 20: Quartz flake and silcrete core. Site MDC-AS01



7.0 ANALYSIS AND DISCUSSION

7.1 Discussion

The findings of the present survey require the balance of four factors:

- The findings of previous archaeological assessments in the area
- The effective nil ground surface visibility during survey in areas that could be accessed
- The inability to access heavily vegetated parts of the study area situated near gilgais and the sites south of the study area previously identified by Jacobs (2021)
- The identification of site MDC-AS01

Previous archaeological assessments carried out in the surrounds of the study area have emphasised the low archaeological potential of local floodplain locations situated at greater than 200m distance from permanent water (OzArk, 2011; Umwelt, 2017; Jacobs, 2021). These studies have indicated that at distances greater than 200m from permanent water, archaeological artefact deposits may occur at a low densities characteristic of background artefact scatters. These studies only made recommendations for archaeological testing in locations of heightened archaeological potential – not on level plains. Jacobs (2021) identified isolated or low density deposits of artefacts near gilgais which may have functioned as water resources in the past. Quartz is the dominant material identified by these three reports (OzArk, 2011; Umwelt, 2017; Jacobs, 2021).

Nil ground surface visibility in areas that could be accessed: This has constrained capacity to evaluate the potential for surface artefact finds in the study area. Modelling for such areas indicated the likely presence of only very low density artefact scatters, (such as Site MDC-AS01).

Inability to access heavily vegetated areas: These heavily vegetated areas have been mapped by survey under more favourable conditions (Jacobs 2021), as containing gilgais cojoining the extent of gilgais in which artefact sites were identified by Jacobs (2021). As shown in Figure 14, a line of varied vegetation is evident diagonally through the study area from the north west to the south east, and this almost certainly represents the gilgais to which Jacobs (2021) refer. The effective totality of this band of gilgai was in areas that could not be accessed during survey due to unslashed vegetation.

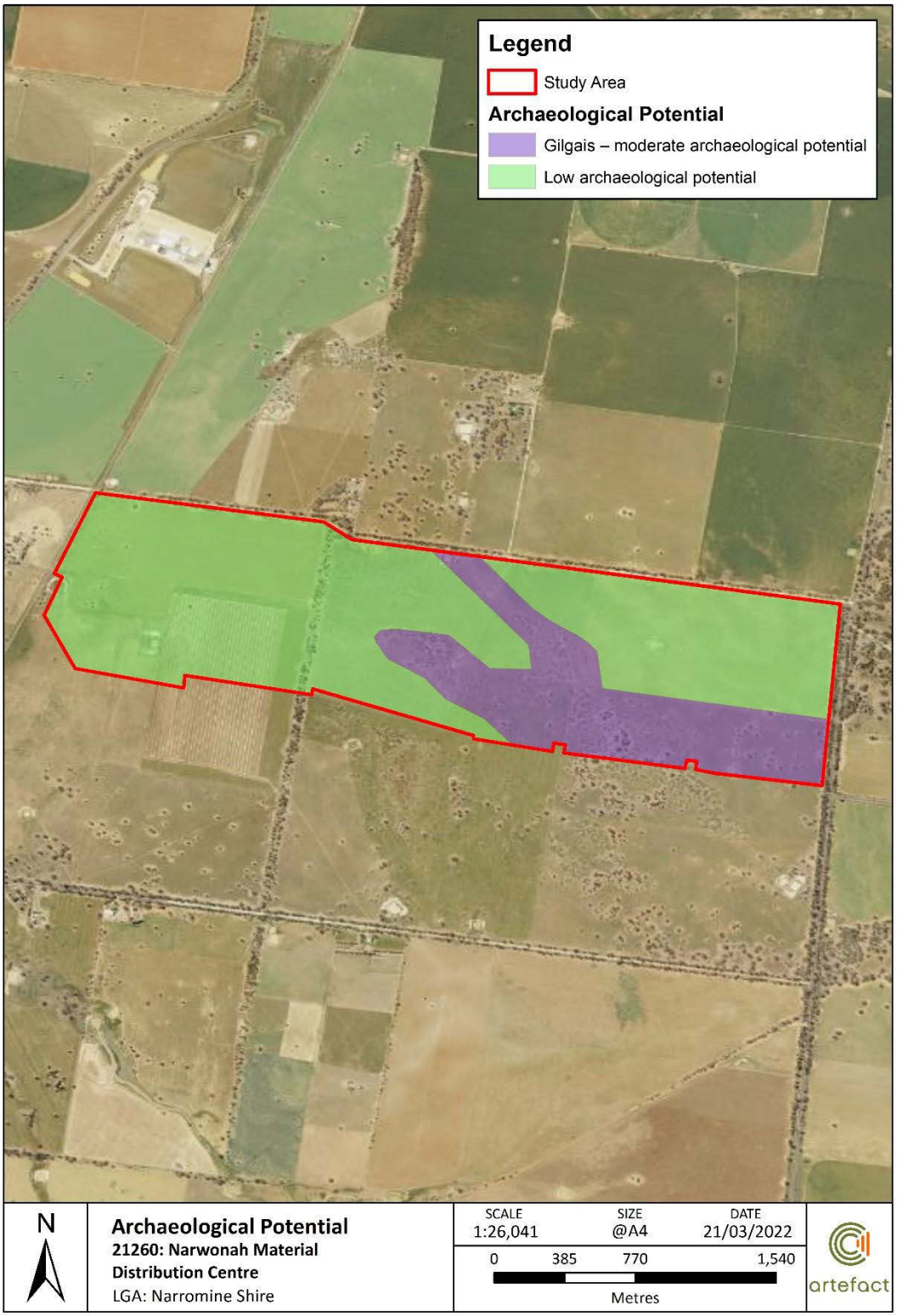
Site MDC-AS01 is a low density artefact scatter in soils that have been subject to bioturbation and at which soil visibility was 90%-100%. The site is located in the immediate surrounds of two peppercorn trees which have almost certainly protected its soils to some extent from the effects of impacts such as ploughing.

7.2 Summary

It has not been possible to satisfactorily inspect ground surface conditions through archaeological site survey. Based on local modelling, the study area is unlikely to be of greater than low-moderate archaeological potential. Nevertheless, there have been several sites identified to the immediate south, on gilgai formations. These gilgais appear to continue into uninspected parts of the study area. Aerial imaging further indicates that the extent of these gilgais continues into parts of the study area that was subject to survey by Artefact Heritage in February 2022. These gilgais were not evident – possibly due to the recent slashing of the vegetative cover that often distinguishes gilgais from their surrounds. The identification of Site MDC-AS01 in a localised area of heightened soil visibility further illustrates the potential presence of artefactual sites in the study area. As recommended by Jacobs (2021, p.12), archaeological sub-surface testing should be carried out, with particular focus on the

locations of gilgais. The location of gilgais as identified from aerial imaging is shown on Figure 22 below.

Figure 22: Location of Gilgai-associated moderate archaeological potential



8.0 ARCHAEOLOGICAL SIGNIFICANCE ASSESSMENT

8.1 Assessment criteria

Archaeological significance refers to the scientific importance of a landscape or area. This is characterised using criteria such as: archaeological research potential; representativeness and rarity of the archaeological resource; and potential for educational values. These are explained below:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the study area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

8.2 Archaeological significance assessment

The archaeological significance of the site recorded within the study area (MDC-AS01) has been assessed by observations made during the site survey, previous investigations in the region as well as the landscape and archaeological context of the study area. The significance values are summarised in the table below. It is noted that any anticipated sub surface expression of this site would constitute a low density artefact deposit. Characteristically such low density artefact deposits would not rate higher than "low" on any of the rating scales for scientific significance below. However cultural significance values may significantly vary from scientific values (see 8.3 below).

Table 5: Archaeological significance assessment of identified site

Site name	Research potential	Scientific value	Representative value	Rarity value	Overall significance
MDC-AS01 (AHIMS ID pending)	Low	Low	High	Low	Low

8.3 Cultural significance

[Note: information on the cultural significance of site MDC-AS01 and the study area as a whole will be updated following discussions by the Aboriginal community in their response to the current investigation]

9.0 IMPACT ASSESSMENT

9.1 Proposed works

The MDC will be used for storage of rail, sleepers and ballast and will also contain a rail welding facility. ARTC proposes that under the Infrastructure State Environment Planning Policy (2007) these works could be progressed as a Part 5.1 assessment process in a Review of Environmental Factors (REF) under the *Environmental Planning and Assessment Act* 1979. The MDC is proposed to be constructed on lots:16 DP 755131, 232 DP 755131, 233 DP 755131, 1 DP 1198931 (the study area).

Detail design of the MDC is not complete. For the purposes of this assessment, it is assumed that works may take place at any location in the study area.

The proposed works could include the following:

- Ballast laydown area
- Connections to existing and proposed new rail track
- Hardstand and facilities for ARTC and third party parking, offices and amenities
- Indicative three sediment basins
- Unloading, stabling and maintenance rail roads
- Locomotive maintenance facility
- Rail and sleeper storage
- Workshops and amenities
- Vehicular wheel wash areas
- Earthwork noise management bunds
- Rail welding facilities
- Gantry handling of both rail and sleepers

9.2 Impact assessment

Accurate assessment of potential impacts by the proposed development to Site MDC-AS01 cannot be made at the concept design stage. Avoidance of impacts to Site MDC-AS01 is a preferred option. It is assumed for the purposes of assessment that impacts resulting from the proposal may occur to ground surfaces at any location in the study area. The proposed program of archaeological testing is required in order to more precisely establish the archaeological potential of the study area. The results of this test excavation program may inform design and will inform application and assessment pathways, including whether an ACHAR and AHIP are required for proposed works.

Changes to the spatial dimensions of the study area from those indicated in current concept design plans may require further assessment of potential impacts to Aboriginal cultural heritage values in the study area.

Management and mitigation measures for currently identified potential impacts are provided in the following section.

10.0 MANAGEMENT AND MITIGATION MEASURES

10.1 Guiding principles

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites should be conserved. If conservation is not practicable, measures should be taken to mitigate against impacts to Aboriginal sites.

The nature of the mitigation measures recommended is based on the assessed significance of the site or sites and the impact assessment.

[Note: the final recommendations would also be informed by cultural significance, which will be discussed by the Aboriginal community in their responses to the current investigation]

10.2 Mitigation and management measures – Site MDC-AS01

10.2.1 Aboriginal Heritage Impact Permit (AHIP) & Surface Salvage

Site MDC-AS01

- As first preference, impacts to Site MDC-AS01 should be avoided
- If impacts to Site MDC-AS01 cannot be avoided, surface collection salvage should be carried out in consultation with RAPs
- An AHIP is required to permit any impacts including surface collection salvage to Site MDC-AS01
- An Aboriginal Cultural Heritage Assessment Report (ACHAR) will be required in support of the AHIP application

10.3 Mitigation and management measures – areas outside Site MDC-AS01

- Areas outside of Site MDC-AS01 where no gilgais are present, have been assessed here as of low archaeological potential. Works may proceed without further archaeological assessment in such areas.
- Areas where gilgais are evident have been assessed here as of moderate archaeological potential and a program of archaeological sub-surface testing must be completed for these parts of the study area in accordance with the *Code of Practice for archaeological investigation of Aboriginal objects in NSW* (DECCW, 2010).

11.0 CONCLUSIONS AND RECOMMENDATIONS

Overview of Findings

Archaeological survey of the study area was carried out by Artefact Heritage with Registered Aboriginal Parties (RAPs) on 21 February 2022. Ground surface visibility during survey was effectively nil, even in areas where vegetation had been slashed to an extent that allowed a combination of pedestrian and vehicular survey. A large proportion of the study area (64%) had not been subject to vegetation reduction prior to survey and vegetation density in these locations was such that even vehicular survey was deemed unsafe. Based on local modelling, the study area is unlikely to be of greater than low-moderate archaeological potential. The identification of Site MDC-AS01 in a localised area of heightened soil visibility likely results from this location not having been subject to previous farming activity due to its proximity to mature trees.

There have been several sites identified to the immediate south of the study area on gilgai formations. These gilgais appear to continue into parts of the study area that could not be inspected during survey. As recommended by Jacobs previous survey of the proposal (2021, p.12), archaeological sub-surface testing of gilgais and immediate surrounds should be carried out.

The results of test excavation would inform recommendations for salvage during the construction phase. If artefacts are located during test excavation an AHIP would be required to permit salvage excavation if required, or further impacts to the location of identified sites.

The following recommendations are made:

Recommendations:

The following recommendations are made for the management of potential Aboriginal archaeological values in the study area and mitigation of potential impacts to them.

Site MDC-AS01

- If possible, design should be formulated to avoid impacts to Site MDC-AS01, in which case:
    - The location of Site MDC-AS01 should be protected with a ten-metre fenced No-Go zone through the period of ground disturbing construction works
    - The location of Site MDC-AS01 must be marked on site mapping and
    - The location of Site MDC-AS01 and restrictions regarding it must be discussed at site inductions and tool box meetings for works in the site vicinity.
- If impacts to Site MDC-AS01 cannot be avoided:
    - Surface salvage of artefacts in Site MDC-AS01 must be carried out
    - Salvage of artefacts in Site MDC-AS01 must be carried out in consultation with Registered Aboriginal Parties.
    - Artefacts collected from Site MDC-AS01 must be subject to repatriation in accordance with consultation with Registered Aboriginal Parties.
    - An AHIP is required to permit any impacts including surface collection salvage to Site MDC-AS01
    - An Aboriginal Cultural Heritage Assessment Report (ACHAR) will be required in support of the AHIP application

Areas outside Site MDC-AS01

- Mature trees in Lot 1 DP 1198931 could not be inspected during site survey on 21 February 2022, due to dense and high surrounding vegetation. Lot 1 DP 1198931 comprises an area of approximately 1km x 40m.
- Areas outside of Site MDC-AS01 where no gilgais are present have been assessed here as of low archaeological potential. Following survey of any mature trees in these locations, works may proceed without further archaeological assessment
- Areas where gilgais are evident have been assessed here as of moderate archaeological potential and a program of archaeological sub-surface testing must be completed for these parts of the study area in accordance with the *Code of Practice for archaeological investigation of Aboriginal objects in NSW* (DECCW, 2010)

12.0 REFERENCES

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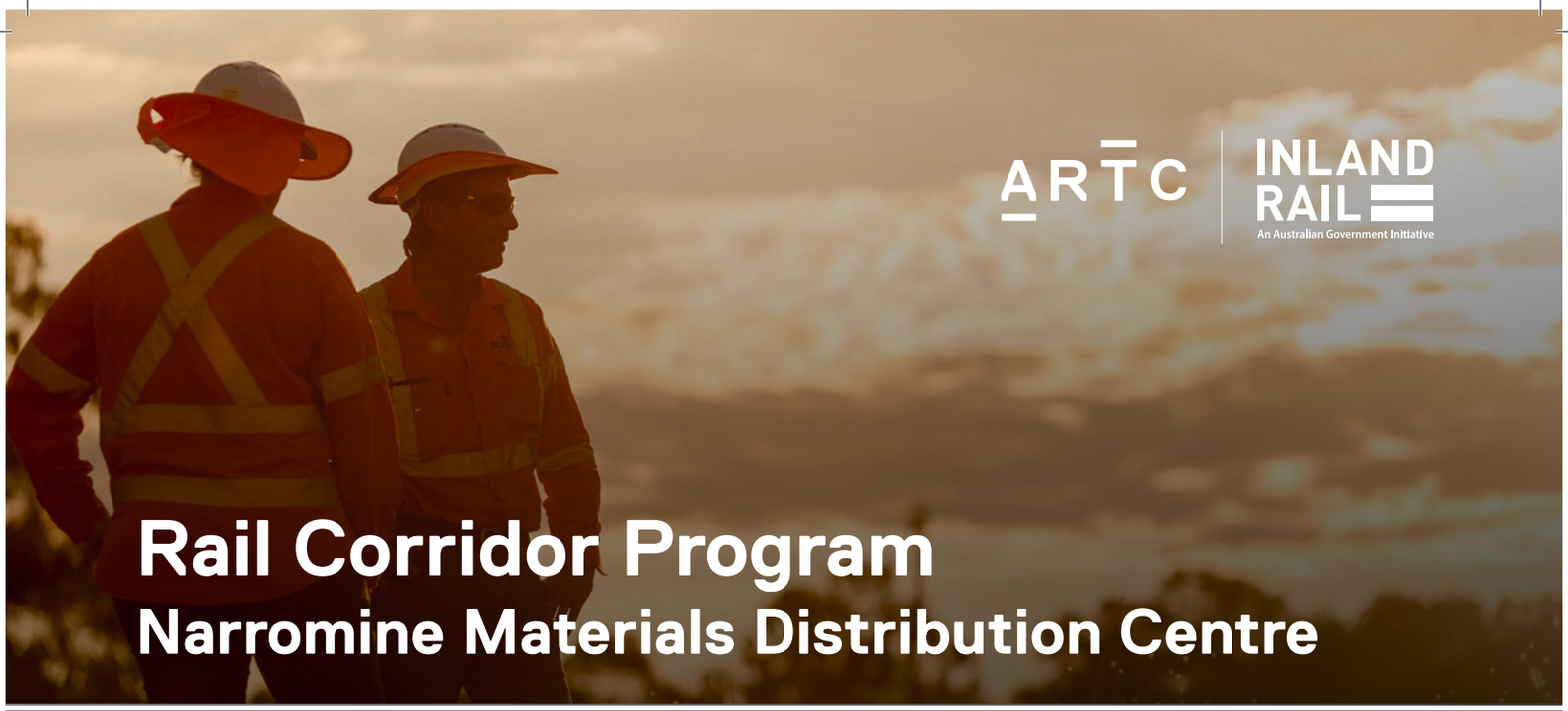
APPENDIX D

Consultation Materials



Rail Corridor Program
Narromine Materials Distribution Centre

SUPPLIER BRIEFING

Learn more about local employment and supply opportunities

Australian-owned company Martinus has been awarded a contract to deliver the Rail Corridor Program for ARTC Inland Rail, which includes two materials distribution centres to service the future installation of ballast, sleepers, rail and turnouts along approximately 570km of the Inland Rail alignment between Narromine and Gowrie, in Queensland. Narromine has been selected as the preferred location for the southern materials distribution centre.

The Rail Corridor Program will provide opportunities for local people and businesses to get involved in Inland Rail, a once-in-a-generation project. Job seekers and prospective suppliers are invited to attend our 'Meet the Contractor' briefing to learn more about how to get involved with the project.

About the information session

Prospective job seekers and suppliers can find out more information about how to apply for a position. Prospective subcontractors, suppliers, and equipment providers will receive a high-level overview of work packages, timing of works, contractual requirements and the procurement process.

Job seeker opportunities

The project team is looking to fill a number of local construction, operation, project support and maintenance roles including, but not limited to:

- Various engineering roles, including project, site, signalling, electrical, plant/rollingstock, testing and commissioning graduate and apprentices (rail and non-rail roles)
- Civil construction roles
- Fitters
- Surveyors
- Environmental specialists
- Electrician
- Boilermakers
- Rail specialists, including welders, grinders and certifiers
- Track supervisors and rail superintendents
- WHS specialists
- Various plant operators
- Train drivers
- Cost engineers
- Community engagement officers
- Procurement and accounting roles
- Project controls and planner
- Administration
- Various other project support roles.

Supply chain opportunities

The project team will be sourcing local plant, equipment, materials and people to support rail works, roadworks, earthworks and drainage construction. Services required include, but are not limited to:

- Quarry supplies
- Water supply and storage
- Waste management
- Fuel supply and distribution
- Construction consumables including small tools
- Office buildings and power distribution
- Geotechnical testing laboratory
- Earthmoving plant
- Supply and install of fencing
- Compaction equipment
- Water carts
- Traffic control
- Concreting
- Steelfixing
- Heavy haulage.

Event details

Date and time	Venue	Audience
Thursday 3 February 2022 4.00–7.00pm	Soul Food Depot and Gallery 1–7 Dandaloo Street Narromine NSW 2821	Job seekers and prospective suppliers

Register your interest

Registration is essential to comply with COVID-safe requirements. Register online at **inlandrail.com.au/rcp-supplier-briefing** or by contacting us on the details below by **Tuesday 1 February 2022.**

Want to know more?

ARTC is committed to working with landowners, communities, local businesses, state and local governments as a vital part of our planning and consultation work, and we value your input. If you have any questions or comments, please let us know.

1800 732 761

inlandrailnsw@artc.com.au

ARTC Inland Rail, 37 Burroway Street, Narromine NSW 2821

inlandrail.com.au

CURRENT AS AT JANUARY 2022

IR_2997

Rail Corridor Program
Narromine Materials Distribution Centre

PROJECT FACT SHEET NSW

ARTC Inland Rail has identified a requirement for two materials distribution centres to service the future installation of ballast, sleepers, rail and turnouts along approximately 570km of the Inland Rail alignment between Narromine and Gowrie, in Queensland. Narromine has been selected as the preferred location for the southern materials distribution centre.

The 400ha Narromine facility is proposed to be located on ARTC-owned land adjacent to the existing Narwonah siding, off Narwonah Siding Road, approximately 8km south of the Narromine township (see map over page). Australian-owned company Martinus has been awarded a contract to deliver the Rail Corridor Program.

Key features

Key features of the proposed temporary facility include:

- Ballast stockpile
- Ballast loading conveyors
- Sleeper and other precast concrete product stockpile
- Rail stockpile
- Sleeper and rail handling gantries
- Area to prepare and weld rail
- Locomotive provisioning and maintenance facilities
- General construction laydown and container storage.

Environmental investigations

Development of the Narromine Materials Distribution Centre, including environmental approvals, is being progressed separately to the Narromine to Narrabri section of Inland Rail.

We are carrying out environmental investigations at the site, including cultural heritage, air quality, noise and vibration, and flooding to assess the potential impacts and inform the development of mitigation measures. These studies will be detailed in a Review of Environmental Factors report (REF). The REF will be placed on public exhibition and open for public submissions in mid-2022.

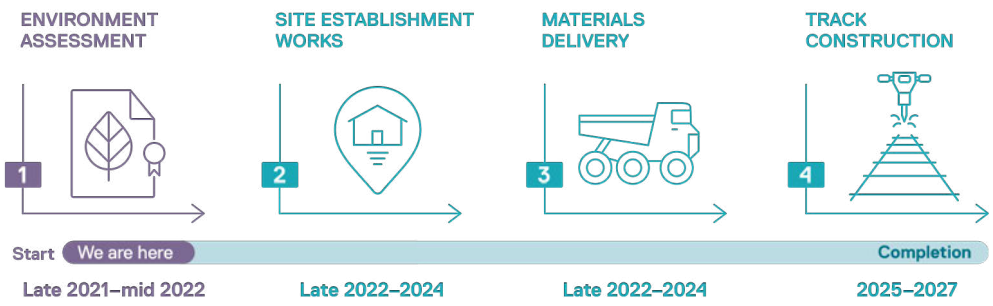
Hours of operation

During site establishment and the materials delivery phase, work will be carried out between 6am and 6pm, up to seven days per week.

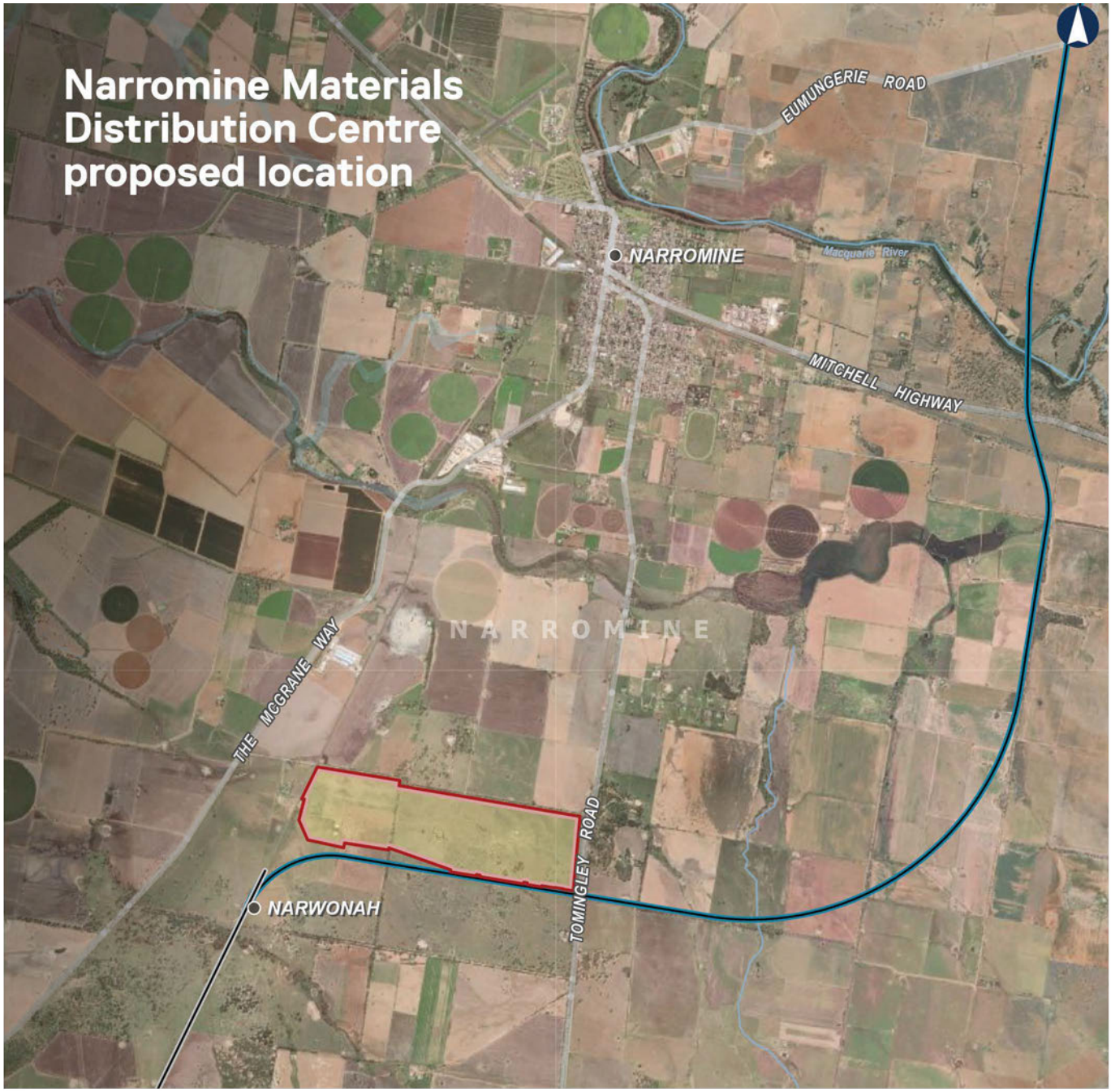
During the track construction phase, activities at the facility may also take place out of hours. If out-of-hours work is required, prior notification will be provided to nearby residents.

Activities to be undertaken at site include, but are not limited to: unloading, loading and movement of materials, including ballast, rail and sleepers; welding and grinding of rail; locomotive provisioning and maintenance; and other general construction activities.

Project timeline



**Timeframes are indicative and are subject to change. Please note major construction will not start until statutory approvals have been received.*



Have your say

Please contact the stakeholder engagement team on **1800 732 761** or email **inlandrailnsw@artc.com.au** if you have any questions or feedback about the Narromine Materials Distribution Centre.

LEGEND

Proposed Narromine Materials Distribution Centre

Inland Rail Alignment

N2N – Narromine to Narrabri

P2N – Parkes to Narromine

Want to know more?

ARTC is committed to working with landowners, communities, state and local governments as a vital part of our planning and consultation work, and we value your input. If you have any questions or comments, please let us know.

1800 732 761

inlandrailnsw@artc.com.au

ARTC Inland Rail, GPO Box 14, Sydney NSW 2001

inlandrail.com.au

CURRENT AS AT FEBRUARY 2022

IR_3017

Community information pop-up

Rail Corridor Program
Narromine Materials Distribution Centre
Review of Environmental Factors

NARROMINE

Friday 4 February 2022

9:00am–1:00pm AEDT

Outside Kierath's Shopping Square
76–82 Dandaloo Street, Narromine NSW 2821

ARTC Inland Rail has selected Narromine as the preferred location for a materials distribution centre to service the future installation of ballast, sleepers, rail and turnouts on a section of the Inland Rail alignment.

Development of the Narromine Materials Distribution Centre, including environmental approvals, is being progressed separately to the Narromine to Narrabri section of Inland Rail.

We are carrying out environmental investigations at the site to inform a Review of Environmental Factors report (REF). These studies will allow us to examine any potential impacts and determine what mitigations may be necessary.

In addition, we are seeking comments from the community on any issues that may be relevant to inform the REF, including mitigation measures during construction and operation of the Narromine Materials Distribution Centre.

Please come along to speak with our team about any feedback or questions regarding the Narromine Materials Distribution Centre.

1800 732 761 **inlandrailnsw@artc.com.au**
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IR_2998

APPENDIX E

Lighting Assessment

INLAND RAIL - NARWONAH MATERIAL DISTRIBUTION CENTRE

Lighting Assessment

Prepared for:

Australian Rail Track Corporation
Level 16, 180 Ann Street
BRISBANE QLD 4000

SLR Ref: 0-0033-906-EMN-R1-RP-0001_C
Version No: Rev C
March 2022

EXECUTIVE SUMMARY

Objectives

SLR Consulting Australia has been engaged by the Australian Rail Track Corporation to assess the lighting environment around assess the light spill from the proposed Narwonah Material Distribution Centre (MDC) approximately seven kilometres to the south of Narromine.

The purpose of this study is as follows:

- Review policies and guidelines relevant to the MDC.
- Determine the limiting criteria from the Australian Standards.
- Identify all future and existing sensitive receivers that may be impacted upon.
- Develop a 3D Lighting model of the site and surrounding sensitive receives.
- Undertake a qualitative review of the site and surrounding receivers and a quantitative light spill model to determine the extent of any light spill.
- Provide recommendations to reduce or eliminate any light spill.

Requirements

Obtrusive light and light spill are covered by AS 4282:2019 and the site is classified as Zone A2 (Sparsely inhabited rural and semi-rural areas) requiring a curfew vertical illuminance limit of 1 lux, the limit also applies to the surrounding sensitive receivers which fall into Zone R1 (dwellings well setback from boundaries). The vertical illuminance limits for *curfew hours* apply at the glazing line of habitable rooms or dwellings on nearby residential properties when they are less than 10 metres from the property boundary.

The site falls into the 200-kilometre radius dark sky region surrounding the Siding Spring Observatory which is 140 kilometres to the northeast of the MDC. Recommendations in accordance with the Dark Sky Planning Guideline are incorporated while meeting the lighting requirements of the site.

The State Environmental Planning Policy (Infrastructure) is also applicable and generally refers to the Australian Standards given is Section 1.3.

Methodology

A future 3D lighting simulation model of the site was developed using lighting fixtures of the type likely to be used on the site. The resulting light spill was modelled using dedicated lighting software AGi32.

Findings and Conclusions

The following conclusions can be deduced from the light spill study:

- In the absence of the existing site vegetation, the resulting illuminance levels on the facades of surrounding buildings from the MDC Development were seen to meet the requirements of AS 4282-2019.
- Neither the surrounding dwellings or calculation lines 10 metres from the boundary would receive light above the required limit of 1 lux

EXECUTIVE SUMMARY

- The surrounding terrain and vegetation provide opportunities for additional shielding of surrounding dwellings.
- The light fittings and design of the site used in the modelling exercise meet the recommendations of the Dark Sky Planning Guideline.

Recommendations

While no exceedances of the required light limits are expected the following recommendations have been provided as general guidance to minimise any effects of the light installations for the proposed development. They also aim to minimise skyglow so as not to affect the Siding Spring Observatory . Recommendations include:

- Direct lights downward as much as possible.
- Use luminaires that are aimed to minimise light spill, e.g. full cut off luminaires where no light is emitted above the horizontal plane to eliminate upward spill light.
- Use shielded fittings.
- Do not waste energy and increase light pollution by over-lighting. E.g. use LED fittings, timer switches etc.
- Keep glare to a minimum by keeping the main beam angle less than 70°.
- Wherever possible use floodlights with asymmetric beams that permit the front glazing to be kept at or near parallel to the surface being lit.
- Direct the site lighting away from the sensitive receivers.
- Where possible position site lighting as far away from site boundaries as practicable; and
- Use warm white colours. Light used on site will have a colour temperature below 3500 K.
- Buildings to be painted with dark matt colours as recommended in the Dark Sky Planning Guideline to reduce upward reflected light.

The modelled site assumed a worst-case scenario with all lighting installations switched on. At times when the site is not in high use and there is only safety and security lighting in use the impact on the surrounding areas would be reduced.

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DOCUMENT REFERENCES

TABLES

FIGURES

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1 Introduction

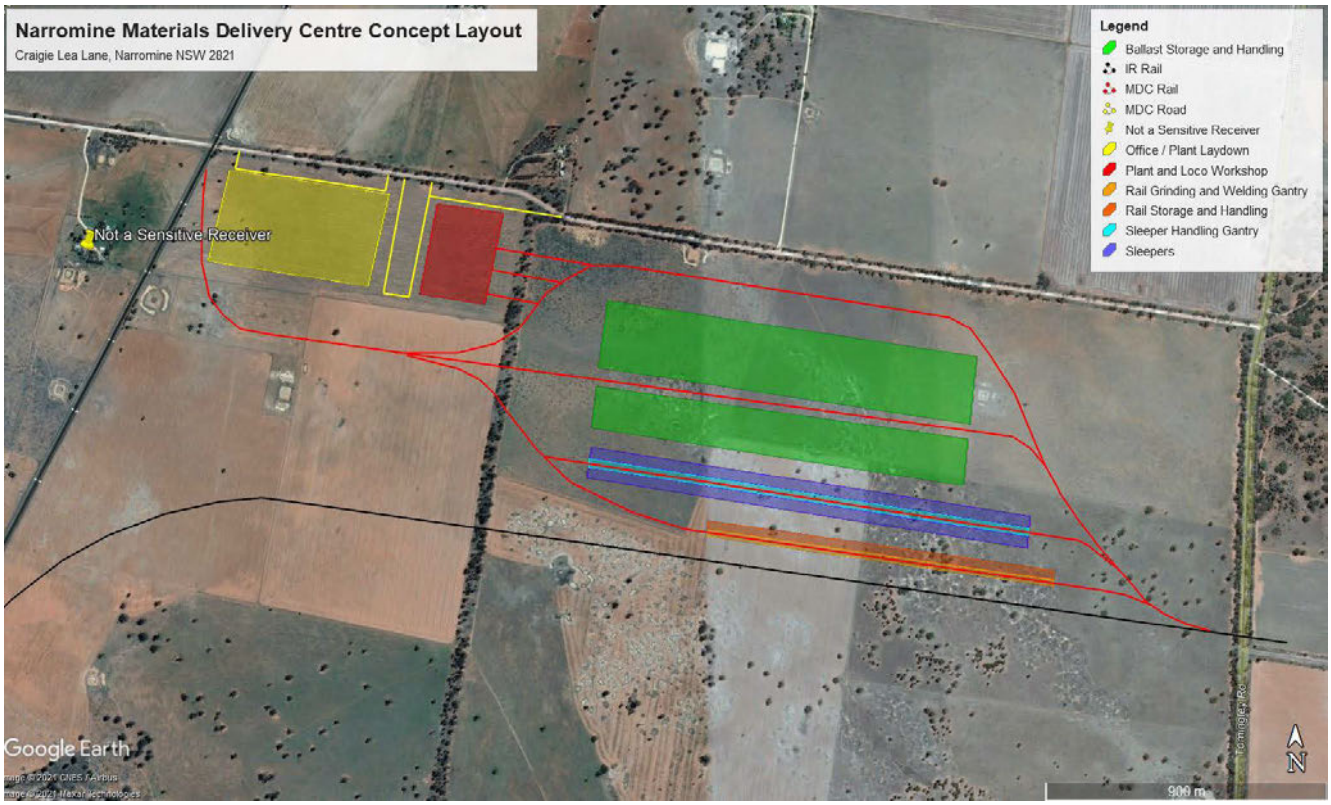
SLR Consulting Australia Pty Ltd had been engaged by the Australian Rail Track Corporation to assess the light spill from the planned Narwonah Material Distribution Centre (MDC).

The purpose of this study is as follows:

- Review policies and guidelines relevant to the MDC.
- Determine the limiting criteria from the Australian Standards.
- Identify all future and existing sensitive receivers that may be impacted upon.
- Develop a 3D Lighting model of the site and surrounding sensitive receives.
- Undertake a qualitative review of the site and surrounding receivers and a quantitative light spill model to determine the extent of any light spill.
- Provide recommendations to reduce or eliminate any light spill.

1.1 Site and Surrounds

Figure 1 Aerial Image of Site Location



Note: Preliminary Layout provided by ARTC (Aconex reference: IR2500-RTRFI-000180)

The proposed site is approximately seven kilometres to the south of Narromine between the McGrane Way and Tomingley Road with Craigie Lea Lane to the north.

1.2 Proposed Development Description

The site, located at the south end of the N2N section of Inland Rail, is proposed to be used for material storage and distribution to assist with the construction of the Inland Rail. The key activities in the site are proposed to include:

- Storage and distribution of ballasts, sleepers and rails,
- Welding and grinding of rails,
- Temporary train movements (connecting the Parkes-Narromine line and the proposed N2N section) within the site for distribution of materials,
- A locomotive workshop to maintain machinery, vehicles and locomotives that are used at the centre for construction purposes,
- Truck movements to and from site,
- General site office activities for site and materials management.
- Construction of the site itself will occur between March 2022 until August 2022, with operation to support construction during the Inland Rail project from August 2022 to July 2027. The activities are currently proposed to occur 24 hours a day, 7 days a week subject to further review as construction plans progress.

1.3 Referenced Documents

The following documents and information were referenced in preparation of this report:

- AS 4282:2019 Control of the Obtrusive Effects of Outdoor Lighting
- AS 1158 Series
- AS 1680 Series
- Dark Sky Planning Guideline – NSW Department of Planning & Environment
- SEPP (Infrastructure) 2007

2 Light Background

2.1 Lighting Terminology

A description of the common terminology used for the lighting study, taken from *AS 4282:2019 Control of the Obtrusive Effects of Outdoor Lighting,* is shown in **Table 1**

Table 1 Lighting Terminology (Consistent with AS4282)

Obtrusive light	Spill light which, because of quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction or a reduction in the ability to see essential information, eg: traffic lights.
Spill light	Light emitted by a lighting installation which falls outside the boundaries of the property on which the installation is sited.
Residential property	Land upon which a dwelling exist or may be developed, eg: land zoned for residential development.
Dwelling	A building in which people normally reside, especially during the hours of darkness, eg house, hotel, motel, hospital.
Illuminance	The luminous flux arriving at a surface divided by the area of the illuminated surface. Unit: lux(lx); 1 lx = 1 lm/m^2
Luminous intensity	The concentration of luminous flux emitted in a specific direction. Unit: candela (cd).
Luminous flux	The measure of the quantity of light. For a lamp or luminaire it normally refers to the total light emitted irrespective of the directions in which it is distributed. Unit: lumen (lm).
Luminaire	Apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except for the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary circuit auxiliaries together with the means for connecting them to the electrical supply.
Glare	Condition of vision in which there is a discomfort or a reduction in the ability to see, or both, caused by an unsuitable distribution or range of luminance, or to extreme contrast in the field of vision (a) Disability Glare – Glare that impairs the visibility of objects without necessarily causing discomfort. (b) Discomfort Glare – Glare that causes discomfort without necessarily impairing the visibility of objects.

2.2 Light Spill Effects

The effect of light spill from outdoor lighting impacting on residents, transport users, transport signalling systems and astronomical observations is governed by the Australian Standard: *AS 4282-2019 Control of the Obtrusive Effect of Outdoor Lighting.*

The obtrusive effects of light spill are due both to an increase in general illuminance that can lead to sleep deprivation, and from the direct view of the light source that can cause glare issues.

The adverse effects of light spill from outdoor lighting are influenced by a number of factors:

- The topology of the area. Light spill is more likely to be perceived as obtrusive if the lighting installation is located higher up than the observer. Lighting installations are usually directed towards the ground and an observer would hence have a direct view of the luminaire.

- The surrounding area. Hills, trees, buildings, fences and general vegetation have a positive effect by shielding the observer from the light installation.
- Pre-existing lighting in the area. Light from a particular light source is seen as less obtrusive if it is located in an area where the lighting levels are already high, eg in cities. The same lighting installation would be seen as far more bothersome in a dark residential area.
- The zoning of the area. A residential area is seen as more sensitive compared to commercial areas where high lighting levels are seen as more acceptable. Following this logic it is expected that rural areas would be more sensitive again to light increases

Typical illuminance levels for a variety of circumstances are given in **Table 2** for comparison.

Table 2 Typical Illuminance Levels for Various Scenarios

Lighting Scenario	Horizontal Illuminance (lux)
Moonless overcast night	0.0001
Quarter Moon	0.01
Full Moon	0.1
Twilight	10
Indoor office	300
Overcast day	1,000
Indirect sunlight clear day	10,000-20,000
Direct sunlight	100,000-130,000

2.3 Skyglow

Skyglow is the general brightness of the night sky and can be separated into natural and artificial skyglow. In this case the concern is regarding artificial skyglow which is caused by light from human-made sources being scattered by molecules, aerosols and particulates in the atmosphere. This can affect the operation of optical telescopes because if artificial skyglow becomes to high, observations of faint astronomical objects can nolonger be made.

2.4 State Environmental Planning Policy (Infrastructure) 2007

The SEPP 2007 is also applicable to this site however each instance of lighting controls refer to the standards already mentioned above.

3 Site Lighting

The ARTC has provided SLR with the lighting plan from a similar project. This will be used as a reference to build the model with sufficient lighting for the purpose of the site before checking the extent of any light spill. For a site such as this, the required lighting levels are generally determined by the tasks to be performed in a particular area. The minimum lux levels to be provided are covered in the AS 1680 series and AS 1158 series which refer to workplace, pedestrian and road lighting. In this case the recommended values from the standards and previous example are as follows.

- Office/Plant Laydown – 350 lux around buildings, general walkways 30-40 lux
- Parking areas – 14-21 lux
- Plant and Workshop – 400 lux
- Ballast Pits – 40-60 lux
- Sleeper Stockpile – General 30-70 lux, Ends 330-690 lux
- Rail loading and LWR area – Gantries 110-230, General work area 160 lux, welding stations 340 lux
- Other road and track areas – 40 lux

These lighting levels will be used to provide enough light within the model. This will be achieved with a mix of light towers as well as building and equipment attached lighting.

4 Light Spill

4.1 Time of Operation

The applicable limits for adverse spill light depend on the time of operation for the lighting installation. Operation taking place during *pre-curfew hours,* between 6am and 11pm (AS 4282), is less likely to give cause to complaints from adjacent residential properties, while a more restrictive limit is applicable to *curfew hours*.

The facility is expected to be used 24 hours a day, therefore the limits for curfew hours will apply, which are given in the following section.

4.2 Requirements

To determine the limiting values the environmental zone of the area needs to be defined. These can be found in Table 3.1 of AS 4282:2019.

Due to its location outside of Narromine the area can probably best classed as Zone A2 which covers sparsely inhabited rural and semi-rural areas. Surrounding residential dwellings will fall into Zone R1 as they are generally well setback for the nearest roads.

The curfew limits for these zones are given in Table 3.2 of the standard and are 1 lux for Zone A2 and 1 lux for Zone R1. As per Table 3.3 of the standard the allowable luminous intensity per luminaire for Zone A2 is 1,000 candela. A Candela is the measure of emittance from a light source while Lux or Lumen per square metre is a measure of the luminous flux on a given area. Lux is also adjusted for the spectral range of the human eye.

Table 3 Recommended Maximum Values of Light Technical Parameters (AS4282-2019)

Light Technical Parameter	Time of Operation	Zone "A2"	Zone "R1"
Illuminance in vertical plane (E_v)	Pre-curfew hours	**5 lx**	N/A
	Curfew hours	**1 lx**	1 lx
Luminous Intensity emitted by luminaires (I)	Pre-curfew hours	**7,500 Cd**	N/A
	Curfew hours	**1,000 Cd**	N/A

The vertical illuminance limits for *curfew hours* apply in the plane of the windows of habitable rooms or dwellings on nearby residential properties when they are less than 10 metres from the property boundary. This refers to windows looking out toward the site as opposed to a horizontal measurement which would be parallel to the ground looking up. If the facades more than 10 metres from the boundary the vertical illuminance limits will apply at that 10 metre line, facing toward the site. The vertical illuminance criteria for *pre-curfew hours* apply at the boundary of nearby residential properties in a vertical plane parallel to the boundary. Values given are for the direct component of illuminance, ie: no reflected light is taken into account.

5 Qualitative Assessment

5.1 Sensitive Receivers

Initially the site and surrounds will be assessed qualitatively to look for general factors affecting obtrusive light in the local area.

The following addresses have been identified as the nearest sensitive receivers to the site:

- 256 Craigie Lea Lane
- 162 Craigie Lea Lane
- 725 Tomingley Road
- 743 Tomingley Road
- 207 Narwonah Road
- 317 Narwonah Road
- 377 Narwonah Road
- 381 Narwonah Road
- Property to the northwest of the site on The McGrane Way

The closest of these is 256 Craigie Lea Lane which is approximately 190 metres from the edge of the site while some are up to a kilometre away. In general, the land is relatively flat although there are some small rises to the east of the site on the east side of Tomingley Road which may provide some shielding to the dwellings behind. Almost all the dwellings also have some vegetation between them and the site which will provide further shielding. The large distances to these receivers will also work in the favour of the site as the lux level is inversely proportional to the square of the distance from the light source.

5.2 Skyglow

SLR has been made aware of the Siding Spring Observatory which is 140 kilometres to the northeast of the MDC site. As such the site falls into the 200-kilometre radius dark sky region surrounding the observatory.

Artificial Skyglow is caused by light from human development interacting and scattering from particles in the atmosphere. If the cumulative light levels become too great faint astronomical objects are no longer able to be observed hence the need for this to be considered in the vicinity of Siding Spring

There are a number of general recommendations given in the Dark Sky Planning Guideline with the aim of minimising artificial skyglow:

- Eliminate upward light spill
- Avoid over lighting
- Switch off lights when not required
- Use warm white colours below 3500 K

These recommendations were taken into account when selecting luminaires for the modelling exercise.

6 Modelling Assessment

6.1 Model Setup

Using the lighting software AGi 32 the site outline and sensitive receivers were imported into the geometry space, shown below in **Figure 2**. From this a workshop was added with one open wall facing the incoming rail lines. Indicative office buildings were also added. Simple blocks were also extruded for the surrounding dwelling. A ground plane was added and coloured roughly to match the general area. The site buildings were coloured to match the area with a mid-green and in practice buildings should have a matte finish to reduce sharp reflections.

Next luminaires were chosen to provide light where required.

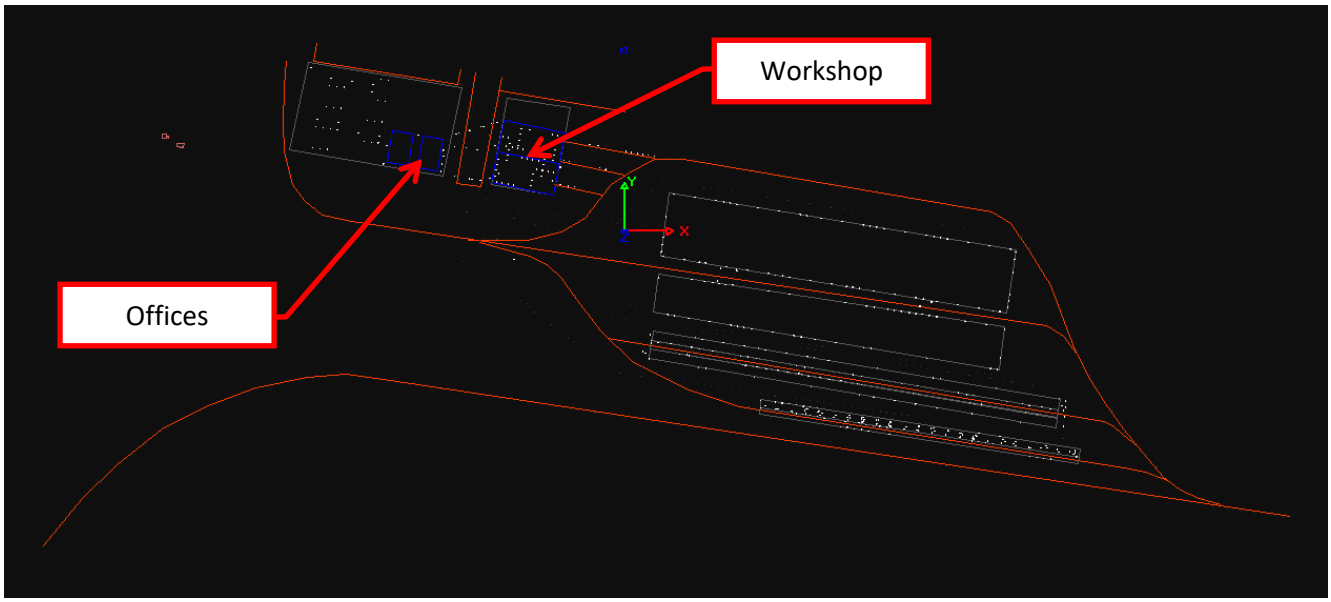
- For the outdoor areas roadway and area lights were chosen from Hubbell lighting Inc. The ASL-8L-3K-210-3 model was chosen as they were full cutoff luminaires with an upward waste light ratio (UWLR) of zero. Each luminaire used 8 LED's with a colour temperature of 3000K meeting the recommendations of the Dark Sky Planning Guideline.
- For the workshop highbay LED lights were chosen from Cooper Lighting Solutions, Model FHL-7L-56. While these also had zero UWLR they are shielded from the surrounding area by the walls and roof of the workshop.

The luminaires were then placed into the model to generate the desired lux level on the ground as specified in Section 3. This involved lighting the tracks, possible roadways, ballast area, sleeper area and rail welding area.

Area and roadway light were generally orientated toward the middle of the site or toward the south as the closest dwelling were to the north.

Next calculation points were added to the walls of the dwellings and 10 metres from the boundary of each property. Calculation points were also added across the whole area 1.5 metres above the ground. These points were generally aimed toward the middle of the site to effectively capture the extent of any light spill off the site

Figure 2 Model Base



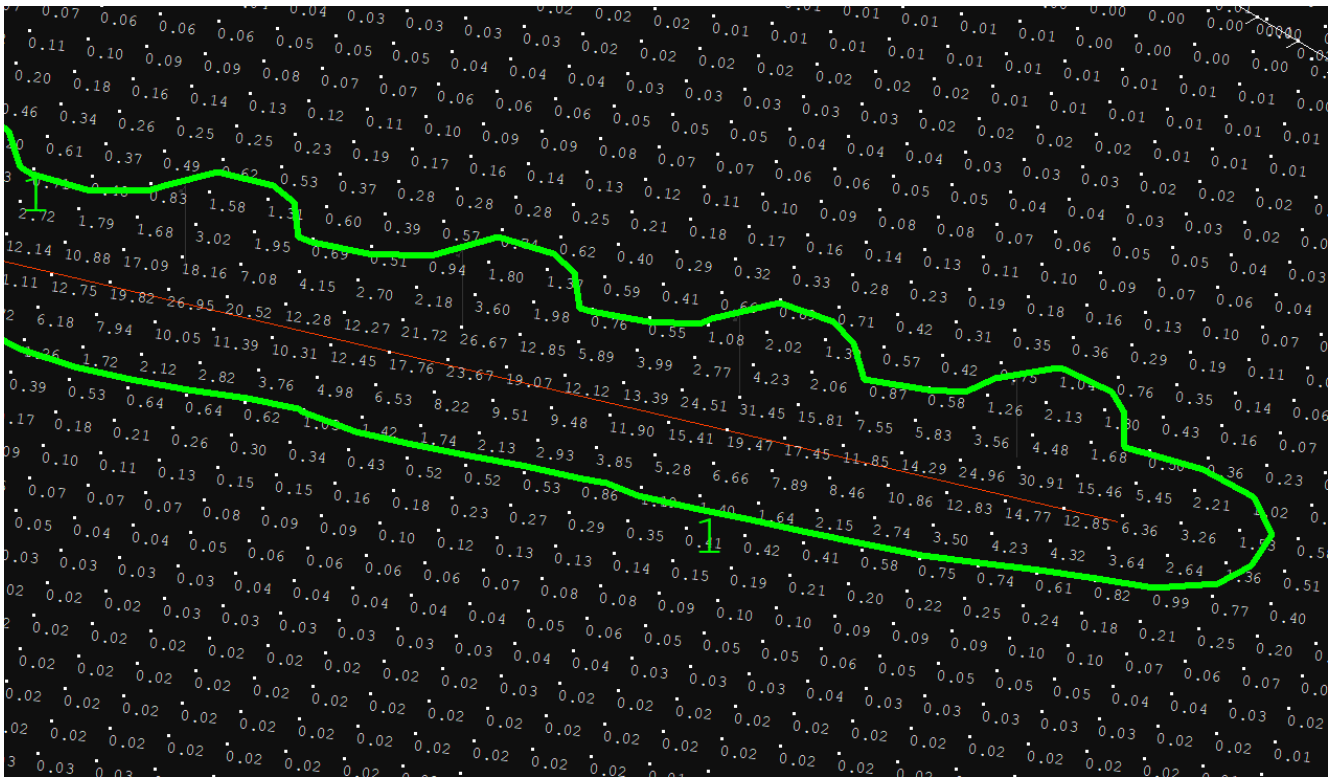
In general, conservative assumptions were made to check the light spill from the site. This is because a detailed lighting design is unavailable at the time of modelling, so SLR has assumed lighting for a number of conservative options to assess the light spill. For instance, lighting has been added for the roadways even though this is usually ignored in light spill calculations as it is necessary for the safe function of the road. It is there expected that the final detailed lighting design would perform better than this case.

6.2 Results

The developed lighting model did not include vegetation meaning the results should be conservative. Using the direct calculation method, the model was run and the following results were obtained:

At the facades of all the above-mentioned sensitive receivers there was found to be zero lux. It should be noted that although there will be no light spill above the requirements it is likely that residents will still be able to “see” the site at night time

Figure 3 1 Lux Contour



A typical 1 lux contour is shown above for the site entrance to the north of the workshop. The chosen luminaires provide light where needed but the levels reduce relatively quickly when moving away from the site.

Figure 4 Facades of 256 Craigie Lea Lane

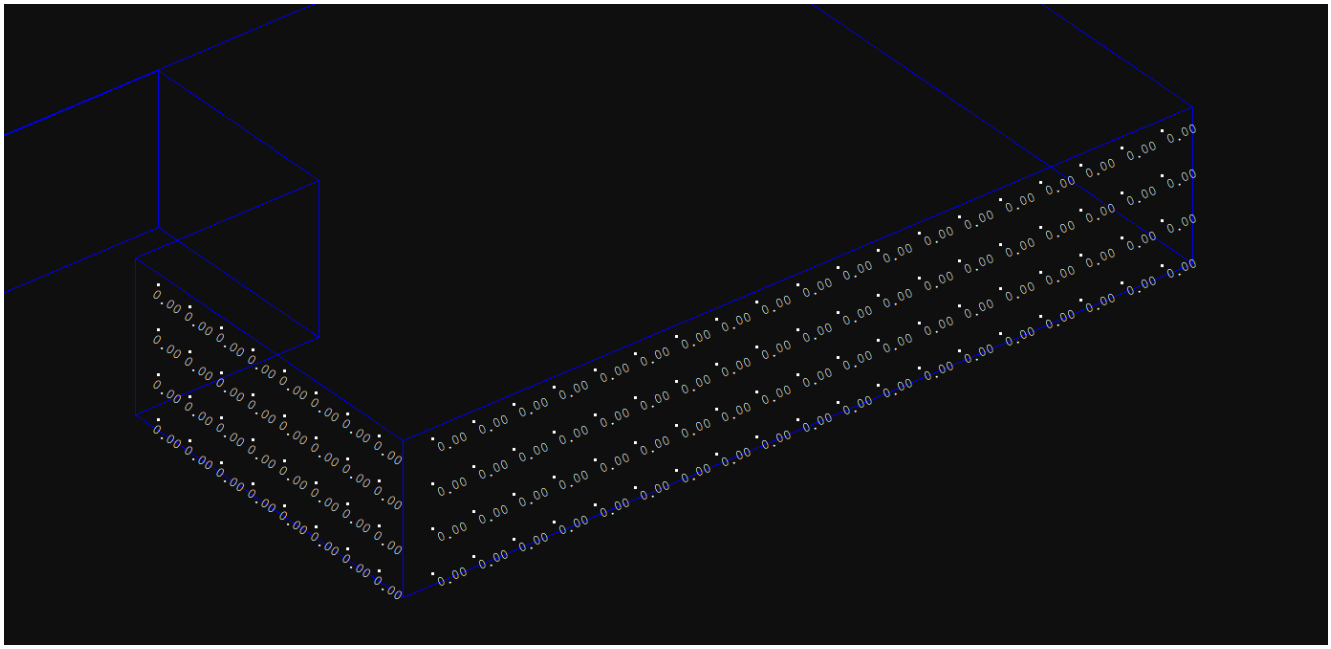
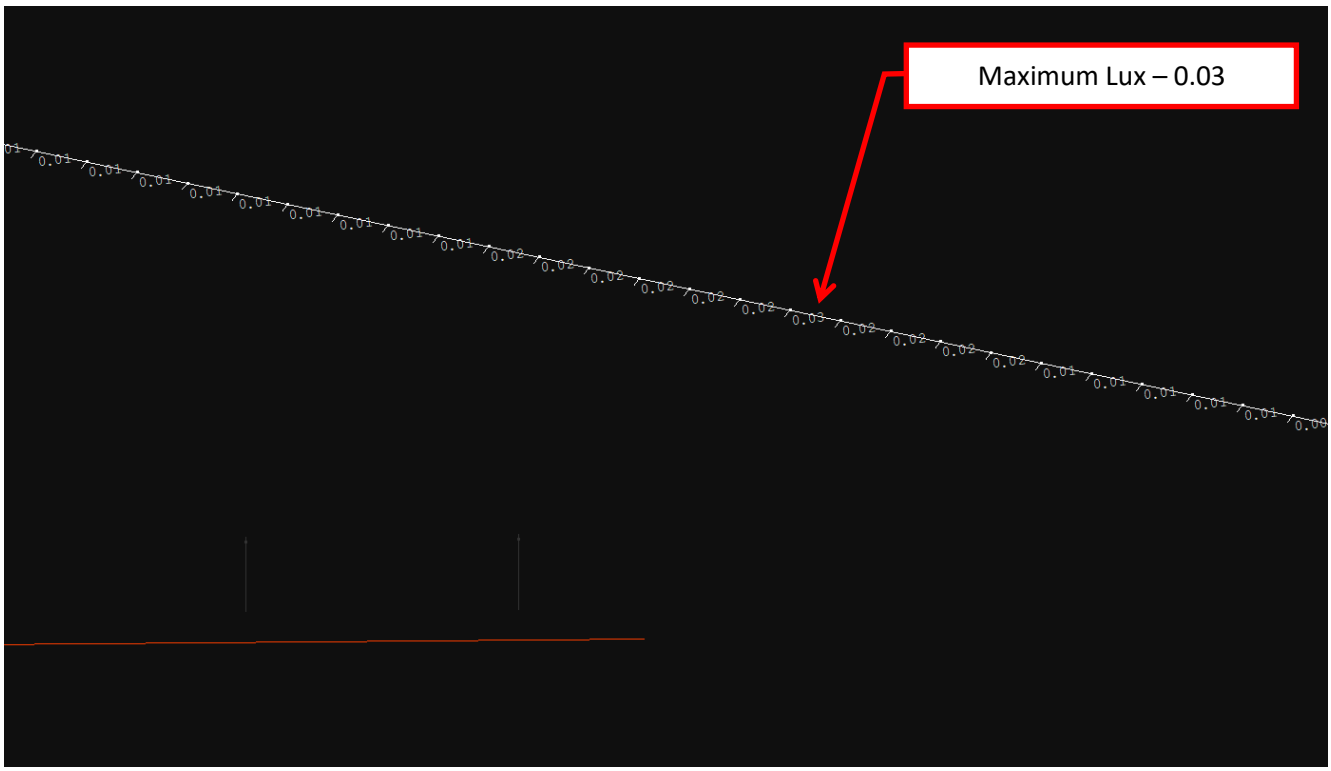


Figure 4 shows the zero lux calculation results on the facades of the nearest receiver while the figure below shows the 10 metre boundary setback calculation line in the same direction

Figure 5 10 metre setback line



10 metres from the property boundaries the light levels peaked at 0.03 Lux, well below the requirement of 1 Lux.

The modelling shows that the site can meet the requirements of AS 4282:2019, and also incorporate the recommendations of the Dark Sky Planning Guideline while meeting the lighting requirements of the site.

To determine the cumulative skyglow effect of the site, the N2N rail line and other sites which are part of the project would require modelling or testing which outside the scope of this study. The main factors affecting this are:

- The distance between the source and the Siding Springs Observatory. At 140 kilometres the MDC will have a relatively low impact when compared to closer lighting installations.
- The quantity of light. The site contains a significant amount of lighting and measures should be taken to minimise this effect such as shielding and only having lights switched on as required.
- The type of light emitted. This refers to the distribution of the light wavelength. As previously stated the colour temperature of the lighting should be below 3500 kelvin. The modelling showed that this requirement could be met while also meeting the light spill requirements.
- The direction of the light. Lights should be shielded and correctly aimed. Lights with zero upward waste light ratio have been recommended and used in the model. Surfaces of buildings and materials should be considered with regard to their reflective properties.

7 Recommendations

The lighting design should aim to mitigate any light spill from the proposed development. In order to achieve the best performance outcome for the site's use while having a minimal impact on the surroundings. The following recommendations should be kept in mind when producing the detail design and have been incorporated into the modelling exercise detailed in Section 6.

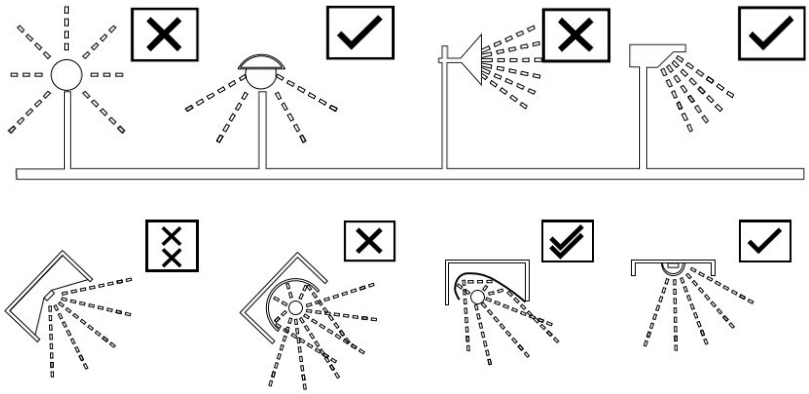
7.1 General Mitigation

The following general mitigation methods should be incorporated into the detail design.

AS 4282-2019 Control of the Obtrusive Effect of Outdoor Lighting sets out general principles that should be applied when designing outdoor light to minimise any adverse effect of the light installation.

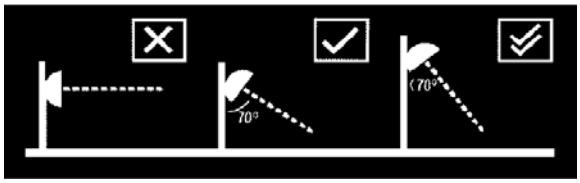
- Direct lights downward as much as possible.
- Use luminaires that are aimed to minimise light spill, e.g. full cut off luminaires where no light is emitted above the horizontal plane. Less spill light means that more of the light output can be used to illuminate the area and a lower power output can be used. The energy consumption for the fitting can thus be reduced without decreasing the illuminance of the area. Refer **Figure 6**.

Figure 6 Minimise Light Spill



- Do not waste energy and increase light pollution by over-lighting.
- Keep glare to a minimum by keeping the main beam angle less than 70°. Refer **Figure 7**.
- Wherever possible use floodlights with asymmetric beams that permit the front glazing to be kept at or near parallel to the surface being lit

Figure 7 Minimise Glare



- Use floodlights with asymmetric beam where possible.

- Direct the site lighting away from sensitive locations such as residential properties.
- Where possible position site lighting as far away from site boundaries as possible

7.2 Site Specific Recommendations

The following recommendations are based on the findings of the modelling exercise along with the Dark Sky Planning Guideline if not already mentioned above.

- Chose full cut off luminaires, additional shielding or baffles could also be added if required.
- Various site areas to be on different circuits so that lighting can be turned off when not needed for tasks or safe movement.
- Any lights placed on the outside of buildings should be kept as low as possible and correctly aimed to prevent light spilling on to areas where it is not needed or above the horizontal plane.
- Buildings to be painted with dark matt colours as recommended in the Dark Sky Planning Guideline to reduce upward reflected light.
- Lights used on site will have a colour temperature below 3500 K.

APPENDIX F

Noise and Vibration Assessment

NARWONAH MATERIAL DISTRIBUTION CENTRE

Noise and Vibration Assessment

Prepared for:

Australian Rail Track Corporation
Level 16, 180 Ann Street
Brisbane QLD 4000

SLR Ref: 0-0033-906-EMN-R1-RP-0002_D
Revision: D
March 2022

EXECUTIVE SUMMARY

Australian Rail Track Corporation (ARTC) has engaged SLR Consulting Australia Pty Ltd (SLR) to undertake noise and vibration assessment of the proposed Narwonah Material Distribution Centre (MDC) as part of the Inland Rail project.

The MDC is located just north-east of Narwonah station along Cragie Lea Lane on Lots DP/16//755131, DP/232//755131, DP/233//755131, DP/17//755131 and DP/1//1198931 at the south-end of the proposed Narromine to Narrabri (N2N) rail section. The facility is proposed to be used for material handling and distribution to assist with the construction of the Inland Rail. The key activities on site include rail preparation with associated welding, grinding and supply of rails, ballast and sleepers required for the Inland Rail project.

The site is surrounded by a few isolated rural residential properties. The existing background noise levels were established based on the previous noise monitoring conducted by ARTC as part of the Environmental Impact Statement (EIS) for the N2N project. The background levels were determined to be the minimum assumed level of 35 dBA during the day, and 30 dBA during the evening and night assessment periods (as recommended in the NSW Noise Policy for Industry). To quantify impacts, a 2 km radius around the project was used to define a study area for the assessment. Twenty residential receivers and two industrial receivers were identified within the study area.

3-D Noise modelling was undertaken using SoundPLAN 8.2. Considering the temporary nature of this MDC operation to support the construction of Inland Rail, the assessment has been undertaken in accordance with the *Interim Construction Noise Guidelines* (ICNG) with guidance from Inland Rail NSW Construction Noise and Vibration Framework (0-0000-902-EMN-00-SP-0001_1).

The activities were separated into two phases:

- Establishment of the site involving clearing, ground preparation and installation of facilities. These activities are relatively short-term (lasting 4 – 6 months).
- Material preparation, handling and distribution involving preparation of rail, ballast and sleeper supply and distribution. These activities are relatively long term in nature occurring up to 5 years to support the construction of Inland Rail.

Activities are modelled based on the proposed site layout prior to any mitigation and management measures implemented to determine the worst-case impacts. The following sections summarise the assessment outcomes for the unmitigated scenarios.

Site Establishment

The activities under site establishment are expected to occur generally during standard working hours. However, certain site activities may occur outside these hours in certain unavoidable circumstances. Based on the noise modelling undertaken, the following outcomes are determined:

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- There are up to two receivers where noise levels are predicted to exceed the standard hours Noise Management Level (NML) of 45 dBA. The impacts predicted at these receivers are considered worst-case, when the works occur close to the site boundaries adjacent to these receivers. When works occur further inside the site, these predicted levels are expected to be lower.
- On occasions where these works could occur outside standard working hours, an additional five receivers (seven in total) are predicted to exceed the Out of Hours (OOH) NML of 35 dBA. However, it is acknowledged that works such as ground compaction and clearing are expected to occur only during standard hours. Whilst the construction details of any unavoidable night works are currently unknown, it is expected that these works will be minimal and relatively short-term.

Daily Operations

These activities are proposed to occur 24 hours a day, 7 days a week. Based on the modelling, the following key outcomes are determined:

- The rail preparation activities are identified to be the noisiest activity on site. The main sources of noise are identified to be rail grinding and sandblasting. There is one receiver (ID 324738) that is predicted to exceed the standard hours NML of 45 dBA by up to 1 dBA. However, there are seven receivers identified to exceed the OOH NML of 35 dBA. The exceedance above OOH NML is predicted to be from 1 dBA to up to 11 dBA.
- Ballast stocking and handling is predicted to exceed the out of hours NML of 35 dBA at five receivers. The dominant source of noise is identified to be ballast loaded on to empty wagons, with exceedances up to 9 dBA. However, no exceedance above standard hours NML is predicted.
- The maintenance and repair activities in the workshop are predicted to exceed OOH NML of 35 dBA at two receivers. These receivers are the closest to the proposed workshop location with potential line-of-sight to the open sections of the building shed. However, these activities are not considered a daily operation, and is expected to only occur sporadically as needed for repair or maintenance.
- During the overall operations of the MDC (all daily activities combined), there are two residential receivers predicted to exceed the NMLs when works occur during standard hours, with exceedances up to 7 dBA above Standard Hours NML. There are eleven (11) residential receivers predicted to exceed the Out of Hours NML, with exceedances up to 17 dB above NML.
- There are up to four residential receivers that are predicted to exceed the sleep disturbance NMLs during the overall operations of the MDC (including the two that exceed during the site establishment). The dominant components during MDC operations that have the potential for sleep disturbance are anticipated to be:
    - Rail grinding and sandblasting
    - Rail movements over tight rail curves and points, along with potential use of train horns for safety purposes.
    - Rail and ballast loading and unloading activities due to the metal-on-metal and stone ‘clanging’ that could occur on site.

EXECUTIVE SUMMARY

Mitigation and Management Measures

The Inland Rail Construction Noise and Vibration Framework (IR Framework) is applicable to all NSW Inland Rail projects. The IR Framework establishes the requirements for the management of construction noise and vibration.

The MDC plans and layout are currently at a concept design stage, and hence detailed mitigation and management measures have not yet been finalised to be able to assess them and quantify residual impacts. These measures are expected to be developed during the detailed design stage. Once the mitigation measures recommended in this report are considered and the layouts are finalised, a mitigated design is recommended to be modelled, and this report shall be expanded to quantify any residual impacts.

The project, via the appointed contractor, is recommended to develop a Construction Noise and Vibration management Plan (CNVMP) which stipulate detailed mitigation and management measures to be implement for the project in accordance the IR Framework.

Mitigation measures on site including appropriate construction staging by minimising night works, control of noise at the source including dampening rubber pad bases to wagons and trucks, non-tonal beepers and equipment mufflers, and acoustic shielding or enclosures to equipment/activity would need to be considered. These measures would assist in further mitigating the level of exceedances predicted in this assessment. Where there are residual impacts other management measures are also recommended including community consultations, verification monitoring and at-property treatments where relevant.

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1 Introduction

Australian Rail Track Corporation (ARTC) has engaged SLR Consulting Australia Pty Ltd (SLR) to undertake a noise and vibration assessment of the proposed Narwonah Material Distribution Centre (MDC) as part of the Inland Rail project.

1.1 Inland Rail Project Overview

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland (QLD). Inland Rail is a major national program that will enhance Australia's existing national rail network and serve the interstate freight market.

The Inland Rail route, which is about 1,700 kilometres (km) long, involves:

- using the existing interstate rail line through Victoria and southern NSW
- upgrading about 400 km of existing track, mainly in western NSW
- providing about 600 km of new track in NSW and south-east Queensland.

The Inland Rail program has been divided into 13 sections, seven of which are located in NSW. Each of these projects can be delivered and operated independently with tie-in points on the existing railway.

1.2 Narwonah Material Distribution Centre

ARTC requires the development of a new MDC to service multiple Inland Rail projects (Narromine to Narrabri (N2N), North Star to Border (NS2B), and Illabo to Stockinbingal (I2S)) in the vicinity of the current Narromine South Multi-Function Compound included in the N2N Environmental Impact Statement (EIS).

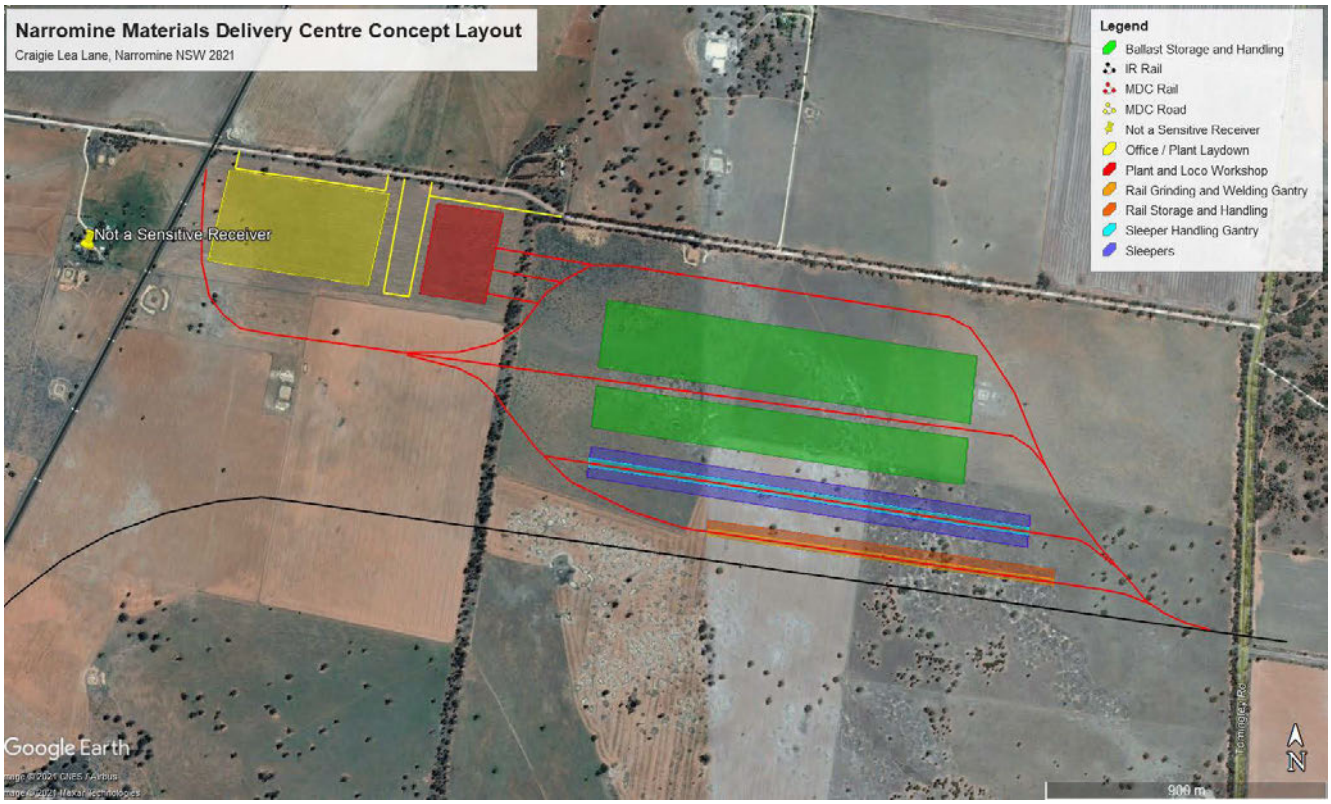
The facility is proposed to be used for material storage, preparation, and distribution to assist with the construction of the Inland Rail project. The key activities on site include materials handling, rail preparation with associated welding, grinding and supply of rails, ballasts and sleepers required for the Inland Rail project. The facility is currently proposed to operate 24 hours a day, 7 days a week subject to further review as the construction plans progress.

ARTC has determined that the MDC is permissible without consent under State Environmental Planning Policy (Transport and Infrastructure) 2021 and is subject to assessment under Division 5.1 of the Environmental Planning and Assessment Act 1979.

1.2.1 Site location

The MDC is located just north-east of Narwonah Silo along Cragie Lea Lane on Lots DP/16//755131, DP/232//755131, DP/233//755131, DP/17//755131 and DP/1//1198931 (see **Figure 1**).

Figure 1 Site location



Note: Preliminary Layout provided by ARTC (Aconex reference: IR2500-RTRFI-000180)

1.2.2 Site Activities

The site, located at the south end of the N2N section of Inland Rail, is proposed to be used for material storage and distribution to assist with the construction of the Inland Rail. The key activities in the site during daily operations of the MDC are proposed to include:

- Storage and distribution of ballast, sleepers and rails,
- Welding and grinding of rails,
- Temporary train movements (connecting the Parkes-Narromine line and the proposed N2N section) within the site for distribution of materials,
- A locomotive workshop to maintain machinery, vehicles and locomotives that are used at the centre for construction purposes,
- Truck movements to and from site,
- General site office activities for site and materials management.

The MDC site establishment works are proposed to occur between March 2022 until August 2022, with material handling phase to support construction of Inland Rail from August 2022 to July 2027. The site establishment is anticipated to occur predominantly during standard hours. However, the materials handing and distribution activities post site establishment are currently anticipated to occur 24 hours a day, 7 days a week subject to further review as construction plans progress.

For the purposes of this report, the MDC activities are split into two phases:

- Site establishment phase involving the construction of the MDC.
- Daily operations phase of the MDC in support of the Inland Rail Construction.

Both the above-mentioned phases are related to the overall construction of the Inland Rail Project, and hence are assessed accordingly as described in the Sections below.

2 Assessment Framework

The guidelines used to assess construction impacts from the project are listed in **Table 1**. ARTC have classified the MDC as a temporary construction yard to support the construction of the Inland Rail Project. Hence, operations of the MDC are assessed with considertation to the *Interim Construction Noise Guidelines* and the Inland Rail NSW Construction Noise and Vibration Framework (ARTC 2021).

Note that the assessment and recommendations provided in this report are in line with ARTC's Environment Protection Licence 3142.

Table 1 Referenced Noise and Vibration Guidelines

Document	Application in the assessment
NSW EPA 2007 , Assessing Vibration A Technical Guideline	Guideline values for probability of human annoyance from ground borne vibration
BS 7385-2: 1993 Evaluation and measurement for vibration in buildings – guide to damage levels from ground borne vibration	Guideline values for vibration thresholds for building damage
NSW Construction Noise and Vibration Framework, Inland Rail Specification (0-0000-902-EMN-00-SP-0001_1), 2021	Assessment and management protocols for airborne noise, ground-borne noise and vibration impacts for construction of rail infrastructure projects
DIN 4150-3: 2016 Vibration in buildings – effects on Structures	Guideline values for vibration thresholds for building and buried services damage
Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change (DECC), 2009	Assessment of airborne noise and ground-borne noise impacts on sensitive receivers
Noise Policy for Industry (NPfI), Environmental Protection Authority (EPA), 2017	Ambient noise monitoring and analysis procedures, and assessment of sleep disturbance
NSW EPA Road Noise Policy (RNP)	Guideline for assessing construction road traffic on public roads

2.1 Referenced Documents

The following documents and information were referenced in preparation of this report:

- EIS Technical Report 8 - Noise and vibration assessment – construction and other operations (2-0001-250-EAP-00-RP-0007)
- ARTC's response to SLR RFI (Aconex reference: IR2500-RTRFI-000180)
- ARTC's response to SLR clarifications (Aconex reference: IR2500-RTCLR-000031)
- Narromine MDC - Preliminary Functional Requirements_DRAFT
- Narromine MDC Concept Layout, provided by ARTC on 17 November 2021

- Narromine Out of Hours Noise Application Example, provided by ARTC on 17 November 2021
- RCP Material Logistics and Yard Comms Prese 20210701, provided by ARTC on 17 November 2021

3 Existing Environment

3.1 Sensitive Receptors

Receivers potentially sensitive to noise and vibration have been categorised as residential buildings, commercial/industrial buildings, or 'other sensitive' land uses which includes educational institutions, child-care centres, medical facilities, places of worship, outdoor recreation areas, etc.

The buildings that were clearly identified from aerial imagery as non-sensitive, such as garages, sheds and warehouses were not considered for the assessment but were retained in the 3D model as they could provide screening of construction noise at nearby sensitive receptors. Construction noise and vibration levels were not assessed at the non-sensitive buildings.

The study area covered sensitive receivers within a 2 km radius of the proposed MDC. Noise impacts are expected to be within the 2 km study area, and mitigation proposed would minimise impacts to these sensitive receivers and those further away from the MDC.

There were 20 sensitive residential dwellings identified within this study area. The closest receiver is approximately 165 m from the site boundary. There are also two identified industrial buildings within the study area, the AWB GrainFlow Limited located on The McGrane Way, and Narwonah Silo located along the Parks to Narromine (P2N) rail line. These receivers, along with their receiver IDs, are shown in **Appendix A**. Note that residential dwellings on Cragie Lea Lane to the immediate west of the P2N rail line are proposed to be acquired by the project, and hence are not included as a sensitive receiver for this assessment.

3.2 Existing Noise Levels

Specific noise monitoring was not undertaken for this assessment. However, the N2N Environmental Impact Statement (EIS Technical Report 8 - Noise and Vibration Assessment – Construction and other Operations) has undertaken noise monitoring at locations in proximity to the MDC which will be used for this assessment.

The EIS identifies two noise logger locations M01 and M13 located within 2 kms to the proposed MDC where noise levels were monitored in November 2018. These locations are north of Cragie Lea Lane along the P2N rail line and Tomingley Road respectively. The Rating Background Levels are presented in **Table 2**. These noise levels measured are considered to be representative of the acoustic environment in 2022 and have been applied to sensitive receivers within the study area. The monitoring locations are indicated in **Appendix A.**

Table 2 Rating Background Levels adjacent to proposed MDC

Location ID	Description	L_{A90} RBL noise levels (dB) Period of Day		
Period		Day[1]	Evening[1]	Night[1]
M01	100m North west of MDC	35[2]	37	34
M13	400m North east of MDC	35[2]	30[2]	30[2]

Notes: 1. Periods as defined by the Noise Policy for Industry (EPA 2017)
2. Levels defined as the minimum in accordance with NPfI where measured levels are less than 30 dBA

The study area includes a radius of 2 kms from the proposed MDC site, with the majority of the sensitive receivers sufficiently distant from major road or railway corridors. In this regard, an RBL level of 35 dBA for Day, and 30 dBA for Evening and Night has been adopted across the study area for the purposes of this assessment to avoid any potential under-prediction of construction noise impacts.

4 Project Criteria

4.1 Construction Airborne Noise Guidelines

The NSW *Interim Construction Noise Guideline* (ICNG) contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers. The realistic 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impacts.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

The NMLs are provided in the following sections for residential receivers. The NML for industrial and commercial uses are $L_{Aeq,\ 15\ min}$ 75 dBA and 70 dBA respectively in accordance with ICNG when the facilities are in use. There are no identified other non-residential sensitive uses (such as schools, hospitals, and community centres) within the study area.

4.1.1 Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 3**.

Table 3 ICNG NMLs for Residential Receivers

Time of Day	NML L_{Aeq}(15minute)	How to Apply
Standard Construction Hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

	Highly Noise Affected 75 dBA	The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise.
		• Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account:
		  ◦ Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences.
		  ◦ If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of Day	NML L_{Aeq}(15minute)	How to Apply
Outside Standard Construction Hours:	RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Noise Policy for Industry* (NPfI).

Site establishment is expected to be completed during Standard Construction Hours, however works may occasionally be required outside the standard day time hours. More stringent requirements are placed on works that are required to be completed outside of Standard Construction Hours (i.e. during the evening or night-time) which reflects the greater sensitivity of communities to noise impacts during these periods.

Major infrastructure projects often require certain works to be completed during the night-time. Where night works are located close to residential receivers there is potential for sleep disturbance impacts.

Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be completed.

4.1.1.1 Sleep Disturbance

Sleep disturbance assessments are generally undertaken on infrastructure projects as a best-practice approach to quantifying noise impacts. ICNG does not provide specific guidance or threshold values for sleep disturbance assessments. The most current method for assessing sleep disturbance from NSW transport infrastructure projects is contained in the EPA's *Noise Policy for Industry* (NPfI). Although the NPfI sleep disturbance criteria relate to industrial noise, they are considered relevant for reviewing potential impacts from construction noise in the absence of any other suitable guidance.

The NPfI defined sleep disturbance criteria is 52 dBA $L_{AFmax,\ 15\ min}$ or the prevailing background level plus 15 dB, whichever is the greater. These criteria are external free field levels.

The summary of NMLs established for this assessment is provided in **Table 4**.

Table 4 Established Noise Management Level for Assessment

Assessment Parameter	NML (dBA – external free-field levels)
Standard Construction Hours ($L_{Aeq,\ 15\ min}$)	45 (RBL + 10 dB)
Out of Hours ($L_{Aeq,\ 15\ min}$)	35 (RBL + 5 dB)
Sleep Disturbance Screening ($L_{AFmax,15\ min}$)	52

4.2 Off-site Traffic on Surrounding Roads

The potential impacts from project related traffic on the surrounding public roads are assessed using the NSW EPA *Road Noise Policy* (RNP).

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB. Where this is considered likely, further assessment is required using the RNP criteria shown in **Table 5**.

Table 5 RNP/NCG Criteria for Assessing Traffic on Surrounding Public Roads

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am – 10 pm)	**Night-time (10 pm – 7 am)**
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

4.3 Construction Ground-borne Noise Guidelines

Construction works can cause ground-borne (or regenerated) noise impacts in nearby buildings when vibration intensive equipment is in use, such as during vibratory compaction and excavations. Vibration can be transmitted through the ground and into nearby buildings, which can then create audible noise impacts inside the building. Ground-borne NMLs are defined in the ICNG as shown in **Table 6**.

The NMLs are applicable to activities where ground-borne noise components could be greater than the airborne noise levels.

Table 6 Construction Ground-borne Noise Criteria

Period	Residential	Commercial
Daytime	45 dBA $L_{Aeq(15minute)}$	50 dBA $L_{Aeq(15minute)}$
Evening	40 dBA $L_{Aeq(15minute)}$	n/a
Night-time	35 dBA $L_{Aeq(15minute)}$	n/a

4.4 Construction Vibration Guidelines

The effects of vibration from construction works can be divided into three categories:

- Those in which the occupants of buildings are disturbed (human comfort)
- Those where building contents may be affected (building contents)
- Those where the integrity of the building may be compromised (structural or cosmetic damage).

The criteria for these categories are taken from a number of guidelines and are discussed in the following sections. It is noted that a number of assessment parameters are used to assess the various vibration impacts.

4.4.1 Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings.

Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDVs for human comfort impacts are shown in **Table 7**.

Table 7 Vibration Dose Values for Intermittent Vibration

Building Type	Assessment Period	Vibration Dose Value[1] ($m/s^{1.75}$)	
		Preferred	**Maximum**
Critical Working Areas (e.g. operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

4.4.2 Cosmetic Damage Vibration

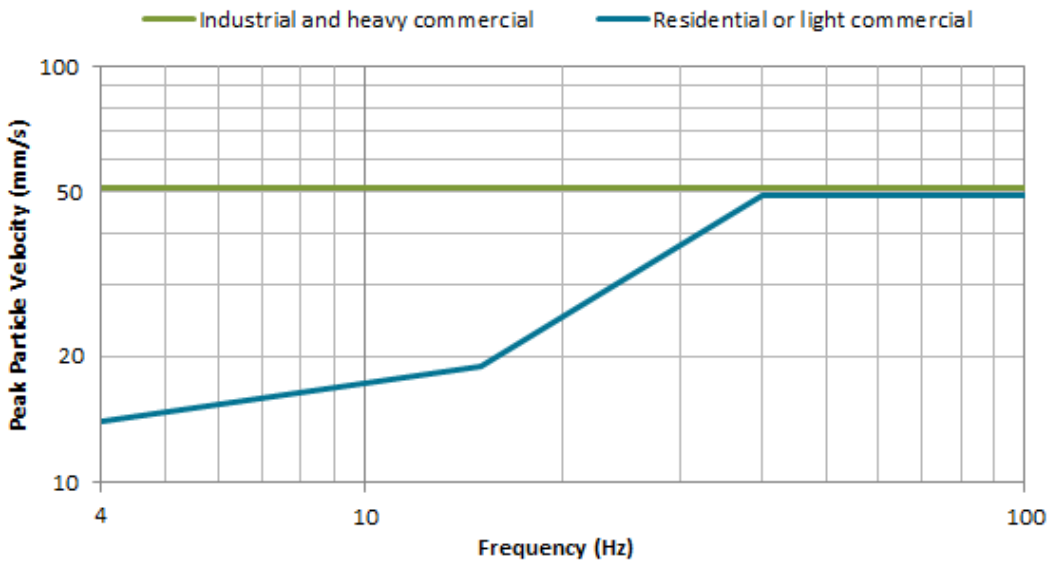
If vibration from construction works is sufficiently high, it can cause cosmetic damage to elements of affected buildings. Examples of damage that can occur includes cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints. The levels of vibration required to cause cosmetic damage tends to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration.

Industry standard cosmetic damage vibration limits are specified in Australian Standard AS 2187-2, British Standard BS 7385 and German Standard DIN 4150, which are referenced in the assessments. Cosmetic damage vibration limits for residential, commercial buildings, heritage buildings and utilities are provided below.

4.4.2.1 General Cosmetic Damage Vibration Screening Criterion

The BS 7385 recommends limits for transient vibration which correspond to minimal risk of cosmetic damage for residential and industrial buildings. The limits are shown in **Figure 2**.

Figure 2 Transient Vibration Values for Minimal Risk of Cosmetic Damage



The Standard notes that where dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at lower frequencies where lower guide values apply, then the guide values in **Figure 2** may need to be reduced by up to 50 percent. On this basis, the following conservative cosmetic damage screening limits shown in **Table 8** are recommended.

Table 8 Transient Vibration Values for Minimal Risk of Cosmetic Damage

Type of Building	Peak Particle Velocity (PPV)[1]
Reinforced or framed structures. Industrial and heavy commercial buildings	25 mm/s
Unreinforced or light framed structures. Residential or light commercial type buildings	7.5 mm/s

Note 1: Cosmetic damage vibration limits are reduced by 50 percent to account for dynamic loading caused by continuous vibration dynamic magnification due to resonance.

4.4.2.2 Heritage Structures

Special guidance for structures that are sensitive to vibration is provided in DIN 4150-3 as PPV thresholds to consider in the absence of any other detailed limits established for these structures. It is recommended that a structural analysis of the structure is undertaken to update these threshold values as deemed relevant. The threshold values for sensitive heritage-listed structures are provided in **Table 9**.

Table 9 Construction Vibration thresholds for heritage-listed structures

Type of structure	Vibration velocity (PPV) in mm/s			
	At foundation at a frequency of			Vibration at horizontal plane of highest floor (all frequencies)
	< 10 Hz	10 Hz - 50 Hz	50 Hz - 100 Hz	
Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (heritage-listed buildings)	3	3 to 8	8 to 10	8

4.4.2.3 Utilities and Other Vibration Sensitive Assets

Construction of the site may affect other utilities and assets which may be sensitive to vibration (yet to be identified). Examples include pipelines, tunnels, fibre optic cable routes and high-pressure gas pipelines.

German Standard DIN 4150 provides the guideline vibration limits for buried pipework shown in **Table 10**.

Table 10 DIN 4150 Guideline Values for Short-term Vibration on Buried Pipework

Line	Pipe Material	Guideline Values Vibration Velocity at the Pipe (mm/s)
1	Steel, welded	100
2	Vitrified clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastics	50

For other potentially affected assets, specific vibration limits should be determined on a case-by-case basis in consultation with the asset owner.

4.5 Inland Rail Construction Noise and Vibration Framework

The Inland Rail Construction Noise and Vibration Framework (IR Framework) is applicable to all NSW Inland Rail projects. The IR Framework establishes the requirements for the management of construction noise and vibration.

4.5.1 Construction Hours

The IR framework establishes construction hours consistent with the ICNG as for Standard Hours:

- 7:00am to 6:00pm Monday to Friday
- 8:00 am to 1:00pm Saturday

Works may also be undertaken outside standard Construction hours as follows:

- As defined in section 2.3 of the IR Framework (Rail Possession Works), or
- When Program Environmental Approvals and conditions for the Construction Works permit alternative hours.

Works may be conducted outside of the standard program construction hours if one or more of the following (defined in section 2.2 of the IR Framework) applies:

- The delivery of oversized plant or structures that police or other authorities have determined requires special arrangements to transport along public roads;
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm;
- Works that do not exceed the noise management level adopted in the Construction Noise and Vibration Management Plan (CNVMP) at the nearest receiver;
- Works that do not exceed the 'preferred' human exposure vibration level adopted in the Construction Noise and Vibration Management Plan (CNVMP) at the nearest receiver;
- Where agreement is reached between the Contractor and/or ARTC and potentially affected sensitive receivers. Agreements must be made in writing (refer to Section 7.2.2 of the ICNG for further guidance);
- Works to ensure construction personnel, road user or public safety;
- Works that cannot be undertaken during the day due to ambient daytime temperatures that may be carried out during the night;
- Rail tamping where the stress-free temperature of the rail cannot be achieved during the Standard Program Working Hours; and
- Works required to be conducted during a track possession.

4.5.2 Mitigation Measures

The IR framework provides details of standard mitigation and additional management measures to be considered for the project. The level of management protocol to be implemented is dependent on the level of exceedance above the NML. These categories of noise level exceedances are presented here to provide context for the analysis of results discussed later in this report.

The additional management measures for airborne noise are provided in **Table 11**, and are discussed further in the report under **Section 8**.

Table 11 Airborne noise thresholds for additional management measures

Time Period		Exceedance of NML	Perception	Duration	Communication category / management measure
OOHW Rest Period Evenings	Monday – Sunday 6pm – 10pm (including public holidays)	<5	Noticeable	Any	CO1
		5-15	Clearly audible	Any	CO1
		15-25	Moderately intrusive	Any	CO1, CO2
		>25	Highly intrusive	Any	CO1, CO2
				>2 consecutive rest periods	CO1, CO2, RO
OOHW		<5	Noticeable	Any	CO1
		5-15	Clearly audible	Any	CO1

Time Period		Exceedance of NML	Perception	Duration	Communication category / management measure
Sleep period Night	Monday – Sunday 10pm – 6am (including public holidays)	15-25	Moderately intrusive	Any	CO1, CO2, RO
		>25	Highly intrusive	Any	CO1, CO2, RO
				>2 consecutive sleep periods	CO1, CO2, RO, AA

Notes: CO1 – General communication; CO2 – Personalised communication; RO – Respite offer; AA - Alternate Accommodation.

Additional measures for ground-borne noise at sensitive receivers are provided in **Table 12**.

Table 12 Ground-borne noise thresholds for additional management measures

Time Period		Exceedance of NML	Perception	Duration	Communication category / management measure
OOHW Rest Period Evenings	Monday – Sunday 6pm – 10pm (including public holidays)	<5	Noticeable	Any	CO1
		5-15	Clearly audible	Any	CO1
		15-25	Moderately intrusive	Any	CO1, CO2
		>25	Highly intrusive	Any	CO1, CO2
				>2 consecutive rest periods	CO1, CO2, RO
OOHW Sleep period Night	Monday – Sunday 10pm – 6am (including public holidays)	<5	Noticeable	Any	CO1
		5-15	Clearly audible	Any	CO1
		15-25	Moderately intrusive	Any	CO1, CO2, RO
				>2 consecutive sleep periods	CO1, CO2, RO, AA
		>25	Highly intrusive	Any	CO1, CO2, RO
				>2 consecutive sleep periods	CO1, CO2, RO, AA

Notes: CO1 – General communication; CO2 – Personalised communication; RO – Respite offer; AA - Alternate Accommodation.

Table 13 relates to exceedances of the human comfort vibration values for continuous, impulsive and intermittent vibration at sensitive receivers.

Table 13 Additional management measures - Vibration

Time Period		Duration	Exceedance of 'Preferred' value	Exceedance of 'maximum' value
OOHW Rest Period Evenings	Monday – Sunday 6pm – 10pm (including public holidays)	Any	CO1, CO2	CO1, CO2, RO
OOHW Sleep period Night	Monday – Sunday 10pm – 6am (including public holidays)	Any	CO1, CO2, RO	CO1, CO2, RO, AA

Notes: CO1 – General communication; CO2 – Personalised communication; RO – Respite offer; AA - Alternate Accommodation.

5 Noise Assessment

The sections below detail the construction scenarios assessed, the methodology and results. Note that all proposed activities have been assessed prior to any mitigation being considered/implemented and are considered worse case.

5.1 Modelling Scenarios

The MDC site will initially be established prior to the proposed daily activities and operations occurring on site. The daily operations of the MDC to support Inland Rail constructions occur at various locations within the site boundary as indicated in in **Figure 1**. The scenarios modelled for noise assessments are detailed in **Table 14**.

Note that Scenario #1 (site establishment) may occur for 3 – 4 months initially, predominantly during standard construction hours. However, impacts for any potential works occurring outside standard hours are also predicted in the event of these activities occurring during those periods.

Scenarios #2 to #6 relate to individual noisy activities that may occur as part of the daily operations of the MDC. Scenario #7 is a combination of scenarios #2 to #6. It assumes that all activities occur simultaneously and presents the worst-case daily operations scenario for the MDC. Note that the daily operations (represented by Scenarios #2 to #7) will occur for up to 5 years during the construction of Inland Rail, with works potentially occurring 24 hours a day, 7 days a week, subject to further review during detailed design stage.

Table 14 Noise modelling scenarios

Scenario #	Scenario	Equipment/activity considered
1	Site Establishment[1]	Vibratory rollers Dump trucks Chainsaws Bobcat
2	Rail stocking and preparation	Gantry crane winches and bogies Gantry Generators Loading/unloading of rails Roller conveyors and motor drives Sandblasting and grinding Welding and generators

Scenario #	Scenario	Equipment/activity considered
3	Sleeper stockpile and handling	Gantry crane winch, and bogie Gantry generators Forklifts Loading/unloading of sleepers
4	Ballast stockpile and handling	Discharge conveyor Loading conveyor Loader Ballast stocking
5	Workshop activities	General maintenance works (assumed a reverberant internal noise level)
6	Rail movements	Movement of locomotives and wagons on tracks with corrections for curves and turnouts
7	Overall MDC operations	Scenarios 2 to 6 combined assuming they occur simultaneously

Note: 1. The full equipment list and construction method for slab works, workshop buildings, etc. are not available at this concept stage. However, the equipment for ground preparation works is modelled along the site boundary closest to the sensitive receivers.

Note that the site eventually will be decommissioned after the construction of Inland Rail and such activities may cause potential noise impacts of a similar magnitude to establishment and operations.

5.2 Noise Modelling Methodology

A 3D noise model was constructed within the modelling software SoundPLAN 8.2 to predict noise levels at the nearby sensitive receivers.

Noise modelling was conducted using the ISO 9613-2[1] algorithms incorporated in the noise modelling software. The ISO 9613-2 algorithm predicts the A-weighted sound pressure levels under meteorological conditions favourable to propagation from sources of known sound power levels to sensitive receivers. This enhanced propagation is equivalent to downwind propagation or a moderate ground-based temperature inversion. The model also includes attenuation due to air absorption, ground attenuation and shielding.

5.2.1 General Modelling Assumptions

The following general assumptions are made based on best-practice modelling method to suit the project:

- The reflection-order of other buildings was set to two (2), indicating that the noise model allowed for two (2) reflections off façades.
- Source heights were set according to the source item, e.g. trucks and large mobile plant (loaders, dozers etc.) are 3.5 m above ground, crane winch drives 6 m, crane bogies 0.5 m etc.
- Receivers were set 2 m above ground level.
- Activities of mobile plant were modelled within the nominated work area or linear zones such that the sources were the closest to each receiver to represent a worst-case scenario. Fixed sources were modelled as point sources. Each scenario applied the worst-case modelling assumption that all construction activity was positioned at the nearest possible location to each sensitive receiver.
- All equipment are assumed to be in operation for the entire 15-minute assessment period.

[1] ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

- Ground topography within 6 km of the MDC was sourced from publicly available 5 metre elevation models published by the NSW Government Spatial Services.
- Ground absorption is modelled by a single number parameter between 0 (hard – reflective) and 1 (soft – absorptive). All ground within the MDC footprint and as well as 600 m of the rail line was modelled as hard ground. All other ground was assigned an absorption parameter appropriate with rural land of 0.6.

5.2.2 Equipment Noise Levels

Detailed list of equipment and activity noise levels are provided in **Appendix B** along with their references. The overall noise levels for each modelled scenario are provided in **Table 15**.

Table 15 Scenario Noise Levels for each Construction and Operation Scenario

Scenario #	Description	Overall Sound Power Level, $L_{eq\ 15\ min}$, dBA	L_{Fmax}, dBA (maximum noise event)
1	Site preparation	112	119
2	Rail stockpile and preparation	129	129
3	Sleeper stockpile and handling	103	120
4	Ballast stockpile and handling	117	120
5	Workshop activities	85[1]	100[1]
6	Rail movements	103[2]	120[3]

Note:

1- Reverberant internal sound pressure level.

2- Assumed across the entire rail line closest to the assessed receiver SWL/m.

3- Additional corrections are applied to rail curves (+8) and points (+6)

5.3 Predicted Noise Impacts

The predicted airborne noise impacts are provided in the Sections below. The individual receiver results are tabulated in **Appendix C**. The noise contours for each scenario modelled are provided in **Appendix D**.

5.3.1 Site establishment

Based on the noise modelling described in **Section 5.2**, the $L_{Aeq,\ 15\ min}$ noise level has been predicted at nearby noise sensitive receptors for each scenario. The number of residential receivers within the predicted noise ranges are shown in **Table 17**. The Table below indicates how many sensitive receivers fall under the predicted noise level range. A brief description or relevance of each noise level range is provided in bracket for context in accordance with ICNG and IR Framework.

Table 16 Number of residential receivers within the predicted noise ranges – Site establishment

Predicted noise level range ($L_{eq,\ 15\ min}$), dBA	Number of residential receivers within the predicted noise level ranges for Scenario #1 (site establishment)
< 30 (below OOH RBL)	3
30 – 35 (35 – out of hours ICNG NML)	10

Predicted noise level range ($L_{eq, 15\ min}$), dBA	Number of residential receivers within the predicted noise level ranges for Scenario #1 (site establishment)
35 – 40 (noticeable)	2
40 – 45 (45 – Standard hours ICNG NML)	3
45 – 50 (clearly audible)	1
50 – 60 (moderately intrusive)	1
> 60 (highly intrusive)	0

The results indicate that there are up to two receivers where noise levels are predicted to exceed the standard hours NML of 45 dBA. These receiver IDs are 239764 (receiver immediate north of Cragie Lea Lane) and 324738 (east of Tomingley Road), located in close proximity to subject site. The impacts predicted at these receivers are considered worst-case, when the works occur close to the site boundaries adjacent to these receivers. When works occur further inside the site, these predicted levels are expected to be lower.

On occasions where these works could occur outside standard working hours, an additional five receivers (seven in total) are predicted to exceed the OOH NML of 35 dBA. However, it is acknowledged that works such as ground compaction and clearing are expected to occur only during standard hours. Whilst the construction details of any unavoidable night works are currently unknown, it is expected that these works will be minimised and relatively short-term.

5.3.2 Daily MDC Operations

Scenarios #2 to #6 as described in **Table 14** cover the main daily activities on the site to support the Inland Rail Construction. Scenario #7 indicate the overall operations assuming Scenarios #2 to #6 could occur simultaneously. The $L_{Aeq, 15\ min}$ noise level has been predicted at nearby noise sensitive receptors for each scenario. The number of residential receivers within the predicted noise ranges are shown in **Table 17**. A brief description or relevance of each noise level range is provided in bracket for context in comparison with the IR Framework.

Table 17 Number of residential receivers within the predicted noise ranges

Predicted noise level range ($L_{eq, 15\ min}$), dBA	Number of residential receivers within the predicted noise level ranges					
Assessment scenario	#2	#3	#4	#5	#6	#7 (Overall)
< 30 (below OOH RBL)	5	18	11	15	17	0
30 - 35 (35 - out of hours ICNG NML)	8	2	4	3	2	9
35 - 40 (noticeable)	3	0	4	1	0	5
40 – 45 (45 - Standard hours ICNG NML)	3	0	1	0	1	4
45 - 50 (clearly audible)	1	0	0	1	0	1
50 - 60 (moderately intrusive)	0	0	0	0	0	1
> 60 (highly intrusive)	0	0	0	0	0	0

The results indicate the following:

- The rail preparation (Scenario #2) is identified to be the noisiest activity on site. The main sources of noise are identified to be rail grinding and sandblasting. There is one receiver (ID 324738) that is predicted to exceed the standard hours NML of 45 dBA by up to 1 dBA. However, there are seven receivers identified to exceed the OOH NML of 35 dBA. Noise levels exceed the OOH NML by 1 - 11 dBA.
- Sleeper stacking and handling (Scenario #3) is predicted to be compliant with the noise management levels.
- Ballast stockpiling and handling (Scenario #4) is predicted to exceed the out of hours NML of 35 dBA at five receivers. The dominant source of noise is identified to be ballast loaded on to empty wagons, with exceedances up to 9 dBA. However, no exceedance above standard hours NML is predicted.
- The maintenance and repair activities in the workshop (Scenario #5) are predicted to exceed OOH NML of 35 dBA at two receivers (IDs 239764 and 324738). These receivers are the closest to the proposed workshop location with potential line-of-sight to the open sections of the building shed. However, these activities are not considered a daily operation, and is expected to only occur sporadically as needed for repair or maintenance.
- The locomotive movements on site (Scenario #6) are not predicted to exceed the Standard hours NML. However, one receiver (ID 239764) is predicted to exceed the OOH NML by up to 8 dBA.
- During the overall operations of the MDC (Scenario #7), there are two residential receivers predicted to exceed the NMLs when works occur during standard hours, with exceedances up to 7 dBA above Standard Hours NML. There are eleven (11) residential receivers predicted to exceed the OOH NML, with exceedances up to 17 dB above NML.
- No sensitive receiver is predicted to exceed the 'highly noise affected' category (> 75 dBA) under ICNG.

The two industrial buildings identified within the study area are predicted to be less than 45 dBA Leq, 15 min during the operation of the MDC and hence are predicted to be compliant with the ICNG NMLs.

The impacts from daily operations of the MDC are considered long-term given the usage of the site for up to 5 years, and hence the mitigation measures detailed in this report are recommended to be carefully considered to minimise impacts.

5.3.3 Sleep Disturbance

The number of residential receivers within the predicted L_{AFmax} noise ranges are shown in **Table 18**. The results are presented for site establishment (#1), and overall operations of MDC (#7) which considers the loudest activity within the individual operational scenarios (#2 to #6) modelled given they may happen simultaneously.

Table 18 Sleep disturbance – Number of Affected Receivers

Predicted noise level range (L_{Fmax}), dBA	Number of residential receivers within predicted noise level ranges for each modelled scenario #	
	#1	#7
<52 (sleep disturbance NML)	18	16
52 - 62	1	3
62 - 72	1	1
> 72	0	0

There are up to two receivers predicted to exceed the sleep disturbance management level, with exceedances up to 11 dBA. These receivers are in close proximity to the subject site as discussed in **Section 5.3.1**. Note that these impacts are only relevant when works occur during night. Considering the activities associated with site establishment, works are generally anticipated to occur during standard hours where sleep disturbance effects are not typically considered.

There are up to four residential receivers that are predicted to exceed the sleep disturbance NMLs during the overall daily operations of the MDC (including the two that exceed during the site establishment). The dominant components during MDC operations that have the potential for sleep disturbance are anticipated to be:

- Rail grinding and sandblasting
- Rail movements over tight rail curves and points, along with potential use of train horns for safety purposes.
- Rail and ballast loading and unloading activities due to the metal-on-metal and stone 'clanging' that could occur on site.

5.3.4 Construction Road Traffic Noise

It is anticipated that the MDC may have up to 25 truck movements (entry and exit combined) within a week and the truck movements for supply and delivery of materials are anticipated to be during daytime only. Assuming an equal distribution of these movements during each day, it is anticipated that there could be 4 – 5 truck movements each day in relation to the operation of MDC.

The site is accessed via Cragie Lea Lane which currently is assumed to have no heavy vehicle movement. Receiver ID 239764 is the closest identified sensitive receiver approximately 150 m from this Lane. Assuming a sound exposure level of 80 dBA for a single truck pass-by at 15 m, the levels are predicted to comply with the RNP criteria (see **Table 5**).

The trucks are proposed to reach the site using McGrane Way (on the west) and/or Tomingley Road (on the west). There are sensitive receivers identified on Tomingley Road within the study area, where these truck movements may have increased noise effects. Whilst no existing traffic data is available for McGrane Way, the EIS Technical Report 8 provides an indication of increase in traffic numbers on Tomingley Road as a result of the overall construction of the N2N project (including MDC), and these are presented in **Table 19**.

Table 19 Construction Road traffic noise increase

Road	Light vehicles (hourly)				Heavy vehicles (hourly)			
	Existing	**Proposed**	**Change**	**dBA increase**	**Existing**	**Proposed**	**Change**	**dBA increase**
Tomingley Road	15.1	15.3	2%	<1	8.5	19.9	135%	4

The analysis suggests that there may be a noticeable increase in road traffic noise on Tomingley Road. However, based on the predictions undertaken in the EIS technical Report 8, the levels are expected to be compliant with the Road Noise Policy (see **Table 20**).

Table 20 Predicted construction traffic noise levels

Road	Criteria (dBA)	Existing level (dBA)	With Construction Level (dBA)	Exceeds criteria
Tomingley Road	60 ($L_{eq,15\ hr}$)	56	60	No
Cragie Lea Lane	55 ($L_{eq,1hr}$)	-[1]	52[1]	No

Notes: 1 – Assumes no existing traffic and up to 5 trucks an hour during the day for construction travelling at 60 kmph.

6 Vibration Assessment

Ground vibrations are likely to occur during the site establishment activities of the MDC. Rail movements within the site may also induce vibrations, but rail-induced vibrations of slow-moving locomotives and wagons are typically negligeable at distances greater than 80 m from surface ballasted tracks on ground based on previous experience.

The assessment below focusses on construction activities associated with the site establishment of the MDC. Note that there are no heritage buildings or structures identified within the study area, and hence no assessment to that regard has been undertaken.

6.1 Minimum Safe Working Distance

At this stage of the project, it is not possible to accurately model the levels of construction vibration. This is due to variable factors such as ground conditions, working distances, specifications of equipment used and the structural design of surrounding buildings.

Preliminary guidance is provided below using the "safe working distances" recommended by Transport for New South Wales (TfNSW). This guidance represents a conservative approach. The TfNSW Construction Noise and Vibration Strategy (CNVS) provides "safe working distances" for both cosmetic damage of nearby buildings and human comfort for members of the community, as shown in **Table 21**.

Table 21 Recommended Safe Working Distances for Vibration Intensive Plant

Plant Item	Rating/Description	Minimum working distance (m)	
		Cosmetic damage	**Human comfort**
Vibratory roller	< 50 kN (Typically 1–2 tonnes)	5	15 to 20
	< 100 kN (Typically 2–4 tonnes)	6	20
	< 200 kN (Typically 4–6 tonnes)	12	40
	< 300 kN (Typically 7–13 tonnes)	15	100
	> 300 kN (Typically 13–18 tonnes)	20	100
	> 300 kN (> 18 tonnes)	25	100
Small hydraulic hammer	(300 kg – 5 to 12 t excavator)	2	7
Medium hydraulic hammer	(900 kg – 12 to 18 t excavator)	7	23
Large hydraulic hammer	(1600 kg – 18 to 34 t excavator)	22	73

Plant Item	Rating/Description	Minimum working distance (m)	
		Cosmetic damage	Human comfort
Vibratory pile driver	Sheet piles	2 to 20	20
Pile boring	≤ 800 mm	2 (nominal)	4
Jackhammer	Hand held	1 (nominal)	2

6.1.1 Predicted Ground-borne Vibration Impacts

The closest building adjacent to the work boundary is approximately 130 m away, and the closest sensitive receiver (ID 239764) is approximately 165 m from the site boundary. The primary and the most dominant source of vibration is expected to occur during vibratory compaction in preparation of the site. Based on the recommended safe working distances listed in **Table 21**, no adverse vibration impacts are anticipated.

Currently, the locations of buried pipework are not available and hence a vibration impact assessment to these structures could not be carried out. As details emerge during the detailed design phase of the Project, it is recommended a detailed vibration study be conducted to minimise the risk of vibration from construction activities causing damage to nearby buried pipework.

This assessment of vibration impacts is indicative as the safe working distances provided in the CNVS do not account for the variations in particular items of plant and local geotechnical conditions. However, it provides a suitable screening level assessment such that where vibration impacts are predicted, feasible and practicable mitigation measures described in **Section 8** should be applied.

6.2 Ground-borne Noise

The ground-borne noise effects are generally noticeable and intrusive only when the airborne noise contributions are not significant. Considering the offset distances (>160 m) and the machinery used in the MDC, it is expected that the ground-borne noise component will be significantly lower than the airborne component (by more than 10 dB lower), even when considering façade attenuation through closed windows. The ground-borne noise levels are predicted to be compliant with the criteria (<35 dBA) established in **Table 6**.

Ground-borne vibration and noise are dependent on the building foundations, structural integrity and wall construction types. As such, levels can vary depending on each building scenario. However, this screening assessment still indicates that the potential risk of exceedance of ground-borne noise and vibration levels are low.

7 Cumulative Impacts

The MDC is located in close proximity to the proposed N2N line. For receivers in proximity to the proposed main line, noise levels are predicted to be dominated by the main line construction for the periods they occur and are not predicted to have additional noise impacts from the operations of MDC for majority of the receivers. For receivers further away (>300 m) from the proposed main line and the proposed MDC, the cumulative noise levels may increase by up to 2 - 3 dB, which is generally regarded as not significant. As such no major cumulative noise impacts as part of the project (in addition to the impacts presented in this report) are predicted in relation to the MDC.

8 Construction Noise and Vibration Management

The ICNG acknowledges that due to the nature of construction works it is inevitable that there will be impacts where construction is near to sensitive receivers. Mitigation and management measures which could be applied to minimise the impacts are provided below.

8.1 Construction Environmental Framework

The contractor responsible for managing site establishment and daily operations of the MDC will be required to develop a Construction Environmental Management Plan (CEMP). As part of the CEMP, a Construction Noise and Vibration Management Plan (CNVMP) should be prepared for their scope of works in line with the requirements of the ICNG, and applicable Inland Rail specifications (including the NSW Construction noise and Vibration Management Framework). The CEMP and CNVMP should be developed separately for the site establishment and the daily operational phases of the MDC to adequately manage the predicted impacts.

The CNVMP would be prepared before any works begin and would define how the predicted impacts would be mitigated and managed. The CNVMP would include:

- Identification of nearby sensitive receivers
- Description of works, construction equipment and working hours
- Criteria for the project and relevant licence and approval conditions
- Requirements for noise and vibration monitoring
- Details of how community consultation would be completed
- Procedures for handling complaints
- Details on how respite would be applied where ongoing high impacts are seen at certain receivers.

Management measures within CNVMP may include controlling noise and vibration at the source, through the source-receiver transmission path and at the sensitive receiver, any other measures necessary to comply with conditions of approval, Environmental Protection Licence 3142 or regulatory requirements, such as information contained within the ICNG and IR Framework. Where it is found that these mitigation measures are not sufficient to reduce the predicted levels to below the construction management levels, additional management measures, such as specific consultation and responses with affected sensitive receivers, are to be detailed. Sections **8.2** provide further recommendations to be considered for the CNVMP.

The CNVMP should also consider the likelihood for ‘construction fatigue’ from the project which may have substantial consecutive night-time works.

8.2 Management and Mitigation Measures

Noise impacts can be expected during the construction and operation of the MDC. The below sections provide the relevant mitigation and management measures to be considered for each phase of the project.

8.2.1 Site Establishment Phase

The site establishment activities are proposed to be undertaken predominantly during standard construction hours. There are currently two receivers identified to be above the standard hours NML. The level of exceedance is expected to reduce when the mitigation measures (as per **Table 23**) are considered and appropriately implemented. In addition, measures provided in the IR Framework (as detailed in the table as additional measures) are recommended to be implemented for any residual exceedances, depending on the level of residual exceedance in accordance with **Section 4.5.2**.

Table 22 Proposed Mitigation and Management Measures – Site establishment

Aspect	Proposed Mitigation Measures
Detailed Impact Assessment	At this stage, the information available is preliminary in nature and is subject to change. The construction noise impact assessment in this Report should be updated to reflect the final locations of construction activities and construction scheduling to inform the development of the Noise and Vibration Sub-plans (Respite and Relocation Management Plan and Community and Stakeholder Engagement Management Plan) to achieve the construction management levels and inform the Construction Noise and Vibration Management Plans.
Construction Noise and Vibration Management Plan	Develop and implement a Construction Noise and Vibration Management Plan (CNVMP) as detailed in **Section 8.1**.
Notification and community engagement	A telephone, email and web-based community information service shall be established to allow the community to obtain information on construction activities, provide feedback or make a complaint.
Building condition surveys	There are currently no adverse vibration impacts predicted for sensitive receivers. However, building condition surveys are recommended to be undertaken for sensitive receivers within 200 m from the proposed MDC to ensure there is sufficient information to respond to any potential complaints. Surveys are to take place prior to commencement and on completion of vibration generating works.
Staging of works	Review construction staging methodology to identify opportunities to schedule noisy works during the day, or where relevant, evening time period. Review construction staging methodology to identify opportunities where simultaneous operation of noisy equipment can be separated out to operate individually.
Staff training	Staff training is to be undertaken so that unnecessary sources of noise and vibration are avoided. Training must include the understanding and adoption of the CNVMP, and best-practice behaviours on site to minimise noise and vibration. The behaviours and implementation of CNVMP shall be enforced through regular checks and reminders.
Plant selection	Selection of quieter construction equipment shall be investigated where feasible and practicable. This is especially important for any out of hours works where predicted noise levels indicate high levels of noise impacts to nearby sensitive receivers.

Aspect	Proposed Mitigation Measures
Appropriate equipment usage	Where feasible and practicable, plant and equipment used intermittently or no longer in use shall be throttled or shut down. Equipment will be operated and maintained in a manner as detailed by the manufacturer. This includes the replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and repair of leakages in compressed air lines.
Mechanical plant and activity management	All mechanical plant near sensitive receivers shall be modified to reduce noise where feasible and practicable, such as: • Internal combustion engines are fitted with a suitable muffler in good repair, operating as per the manufacturer's specifications • Pneumatic tools are fitted with an effective silencer on their air exhaust port • Aggregate bins, loaders and chutes are lined with a rubber material to dampen the vibration of the structure
Acoustic shielding and enclosure	Install localised acoustic shielding in the form of acoustic semi-enclosures and blankets to shield noisy construction equipment from the nearest residences where practicable. • Acoustic enclosures should be installed as close to the works area as possible • Acoustic blankets should be arranged to overlap such that no air gaps are present between blankets Acoustic shielding is particularly effective for stationary plant that is scheduled to work for lengthy periods. Guidance for acoustic enclosures should be taken from *AS 2436-2010 - Guide to noise and vibration control on construction, demolition and maintenance sites*.
Material delivery	Tonal reverse beepers can increase the perceived impact of construction noise while not necessarily contributing to an increase in measured noise level. As such, non-tonal reversing beepers (or an equivalent mechanism) be fitted and used on all construction vehicles and mobile plant regularly used on the site and for any out of hours works. Site access points and roads shall be sited as far as practicable from sensitive receivers. Delivery vehicles shall be fitted with straps rather than chains where feasible. Sites are to be designed so that reversing of delivery vehicles is minimised so that they can drive through the site were possible.
Construction traffic	Where feasible and practicable: • Unsealed haul roads shall be regularly graded. Sealed access roads and hardstand areas shall have potholes filled in a timely fashion. • Night-time construction traffic shall be limited as far as possible. If unavoidable, they should be redirected away from noise sensitive receivers, in accordance with the Construction Traffic Management Plan. • Appropriate construction traffic speed limits shall be established and enforced near noise sensitive receivers.

Aspect	Proposed Mitigation Measures
Additional Management Measures (for residual impacts)	
Communication (CO1; CO2)	The level of noise and vibration impact and duration shall guide communication with receivers by the Contractor and/or ARTC. Accurate and timely communication is recommended to manage and understand community expectations for out of hours works (OOHW). Two categories of communication have been developed commensurate with the scale of the impact. The purpose of the communication is described below, but the method of communication will be at the discretion of the Contractor and detailed in the Contractor's Communications and Stakeholder Management Plan. It is intended that this will compliment, and be referred to, in all relevant Communications and Stakeholder Management Plans to achieve the engagement outcomes described below. Category 1 CO1: Communication to provide information on the proposal via letter box drop, email, newsletter, media advertisements and/or website a minimum of 5 days prior to the works commencing. Category 2 CO2: Communication should be personalised (e.g. door knock, meeting, telephone call). Contact with these residents should commence early to enable feedback to be considered by the proposal. At minimum the information provided to Stakeholders (CO1 or CO2) will include: • The reason the Works are required to be undertaken outside of the standard program construction hours • A diagram that identifies the location of the proposed works in relation to nearby cross streets and local landmarks • The nature, scope and duration of the works, including start and finish times • The expected noise impacts on receivers • Information on how to obtain further information or make a complaint, including an after-hours number and Inland Rail Program website.
Respite Offer (RO)	Residential receivers subject to lengthy periods of noise or vibration may be eligible for a respite offer. The purpose of such an offer is to provide residents with respite from an ongoing impact and may comprise of pre-purchased movie tickets, dinner vouchers or similar. Respite offers are not applicable to non-residential receivers. Respite can also be provided by limiting high noise generating works and allowing at least a one-hour respite period between blocks of work. Where possible, the timing of this respite should be discussed with the impacted community.
Alternate Accommodation (AA)	Alternate accommodation options (i.e. accommodation in motels away from the worksite) may be provided for residents living in close proximity to construction sites. Acceptable accommodation measures shall be developed by the Contractor and ARTC for the affected community and be approved by the ATRC Representative prior to discussion with the resident.

8.2.2 Daily Operations of MDC

The daily operations of the MDC are currently anticipated to occur during day and night, for a period of up to 5 years. Therefore, the mitigation measures listed below (in **Table 23**) are recommended to be carefully considered and implemented as far as feasible. The residual impacts should then then be predicted based on the implementation of these mitigation measures and construction staging. The mitigation measures shall be implemented such that the works do not exceed the noise management levels as far as possible. Additional management measures (as provided in the table) should then be considered based on the residual impacts.

Table 23 Proposed Mitigation and Management Measures – Daily Operations

Aspect	Proposed Mitigation Measures
Detailed Noise Impact Assessment	At this stage, the information available is preliminary in nature and is subject to change. The noise impact assessment in this Report should be updated to reflect the final locations of proposed activities and construction scheduling to inform the development of the Noise and Vibration Sub-plans (Respite and Relocation Management Plan and Community and Stakeholder Engagement Management Plan) to achieve the noise management levels and inform the Construction Noise and Vibration Management Plans.
Construction Noise and Vibration Management Plan	Develop and implement a Construction Noise and Vibration Management Plan (CNVMP) as detailed in **Section 8.1**.
Notification and community engagement	Regular communications on the activities and progress of the proposal shall be provided to the community (e.g. via newsletter, email and/or website).
Staging of works	Review works staging methodology to identify opportunities to schedule noisy works during the day, or where relevant, evening time period. Review construction staging methodology to identify opportunities where simultaneous operation of noisy equipment can be separated out to operate individually. Specifically, the following should be considered: • The use of sandblasting and grinding equipment (part of rail preparation Scenario #2) are the most dominant noise sources, and hence are recommended to be undertaken during standard hours where possible.
Staff training	Staff training is to be undertaken so that unnecessary sources of noise and vibration are avoided. Training must include the understanding and adoption of the CNVMP, and best-practice behaviours on site to minimise noise and vibration. The behaviours and implementation of CNVMP shall be enforced through regular checks and reminders.
Plant selection	Selection of quieter construction equipment shall be investigated where feasible and practicable. This is especially important for any out of hours works where predicted noise levels indicate potential for high levels of noise impacts to nearby sensitive receivers.

Aspect	Proposed Mitigation Measures
Appropriate equipment usage	Where feasible and practicable, plant and equipment used intermittently or no longer in use shall be throttled or shut down. Equipment will be operated and maintained in a manner as detailed by the manufacturer. This includes the replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and repair of leakages in compressed air lines.
Mechanical plant and activity management	All mechanical plant near sensitive receivers shall be modified to reduce noise where feasible and practicable, such as: • Internal combustion engines are fitted with a suitable muffler in good repair, operating as per the manufacturer's specifications • Pneumatic tools are fitted with an effective silencer on their air exhaust port • Install suitable rubber pads on wagons, loaders and ground prior to unloading of rails, ballast and sleepers to minimise short-term noise impacts • Aggregate bins, loaders and chutes are lined with a rubber material to dampen the vibration of the structure
Acoustic shielding and enclosure	Install localised acoustic shielding in the form of acoustic semi-enclosures and blankets to shield noisy construction equipment from the nearest residences where practicable. • Acoustic enclosures should be installed as close to the works area as possible • Acoustic blankets should be arranged to overlap such that no air gaps are present between blankets Acoustic shielding is particularly effective for stationary plant that is scheduled to work for lengthy periods. Guidance for acoustic enclosures should be taken from *AS 2436-2010 - Guide to noise and vibration control on construction, demolition and maintenance sites*. Other options for acoustic screening include: • Temporary site building • Fencing • Storage/shipping containers • Use of retaining walls around ballast stockpiles and rail loading/unloading areas.
Material delivery	Tonal reverse beepers can increase the perceived impact of noise while not necessarily contributing to an increase in measured noise level. As such, non-tonal reversing beepers (or an equivalent mechanism) be fitted and used on all vehicles and mobile plant regularly used on the site and for any out of hours works. Site access points and roads shall be sited as far as practicable from sensitive receivers. Delivery vehicles shall be fitted with straps rather than chains where feasible. Sites are to be designed so that reversing of delivery vehicles is minimised so that they can drive through the site were possible.

Aspect	Proposed Mitigation Measures
Vehicle traffic	Where feasible and practicable: • Unsealed haul roads shall be regularly graded. Sealed access roads and hardstand areas shall have potholes filled in a timely fashion. • Night-time site vehicle traffic shall be limited as far as possible. If unavoidable, they should be redirected away from noise sensitive receivers, in accordance with the Traffic Management Plan. • Appropriate traffic speed limits shall be established and enforced near noise sensitive receivers.
At-property treatments	The provision of at-property treatment should be considered for any noise impacts given the 24-hour operational duration of the MDC. This may include: • Investigating potential for local at-property solid fencing. • Offering alternative ventilation where the windows are to remain closed. • Upgrading the acoustic performance of specific elements of the building envelope (e.g. windows and doors). Note that these at-property treatments would require prior investigations and assessments of the existing conditions in order to assess the most-effective acoustic treatment to the potentially affected properties. If these treatments are considered effective, specific agreements between the property owners and the proponent would be required to execute the works.
Additional Management Measures (for residual impacts)	
Verification monitoring	For scenarios which have been predicted to exceed the noise management levels after the implementation of mitigation measures, noise monitoring shall be undertaken at a sample of these noise affected sensitive receivers to confirm modelling predictions and verify on site noise levels. As a minimum, monitoring is recommended at representative properties that exceed standard hours NMLs. Currently there are two sensitive receivers identified in this category (IDs 239764 and 324738). The verification monitoring shall be used to re-visit the mitigation controls and update CNVMP where relevant.
Community consultations and agreements	Where residual exceedances are predicted, direct face-to-face or virtual personalised consultation with potentially affected receivers to communicate potential impacts and understand any personal needs from receivers. The predicted residual impacts (if any) and potential management measures to be implemented should be mutually agreed in accordance with ICNG.
Long-term noise monitoring	Where possible, install long-term noise monitoring devices at appropriate locations to continuously measure noise and update management plans where necessary. The monitoring data can be collected real-time where possible to actively manage any noise impacts, and also used to supplement any on-going communications with the community. If the above is not feasible, routine compliance monitoring should be undertaken, and the monitoring plans and compliance assessments should be included within the CNVMP.

9 Conclusion

Noise and vibration impact assessment of the proposed Material Distribution Centre at Narwonah has been undertaken based on the typical usage of the centre to assist with the construction of the Inland Rail Project. The assessment has been undertaken with consideration to the ICNG with additional guidance taken from the IR Framework.

The results indicate that the centre, during its establishment have the potential to exceed the standard hours noise management levels at up to two residential receivers, and out of hours management levels at up to seven residential receivers. The works are however anticipated to occur predominantly during standard construction hours, and the implementation of mitigation measures is expected to reduce the level of impacts predicted.

When the centre is operational 24 hours a day, 7 days a week, noise levels can exceed the ICNG night-time noise management levels at up to eleven (11) residential receivers generally located within 2 km from the facility. There are up to two (2) residential receivers predicted to exceed the noise management levels during standard operational hours. No adverse vibration impacts are predicted.

Mitigation measures on site including appropriate construction staging by minimising night works, control of noise at the source including dampening rubber pad bases to wagons and trucks, non-tonal beepers and equipment mufflers, and acoustic shielding or enclosures to equipment/activity would need to be considered. These measures would assist in further mitigating the level of exceedances predicted in this assessment. Where there are residual impacts other management measures are also recommended including community consultations, verification monitoring and at-property treatments where relevant.

The revised site layout along with the reasonable and feasible mitigation measures shall be assessed as the detail in the design and strategy develops further. Residual exceedances shall also be documented to inform the consideration of specific additional management measures as required.

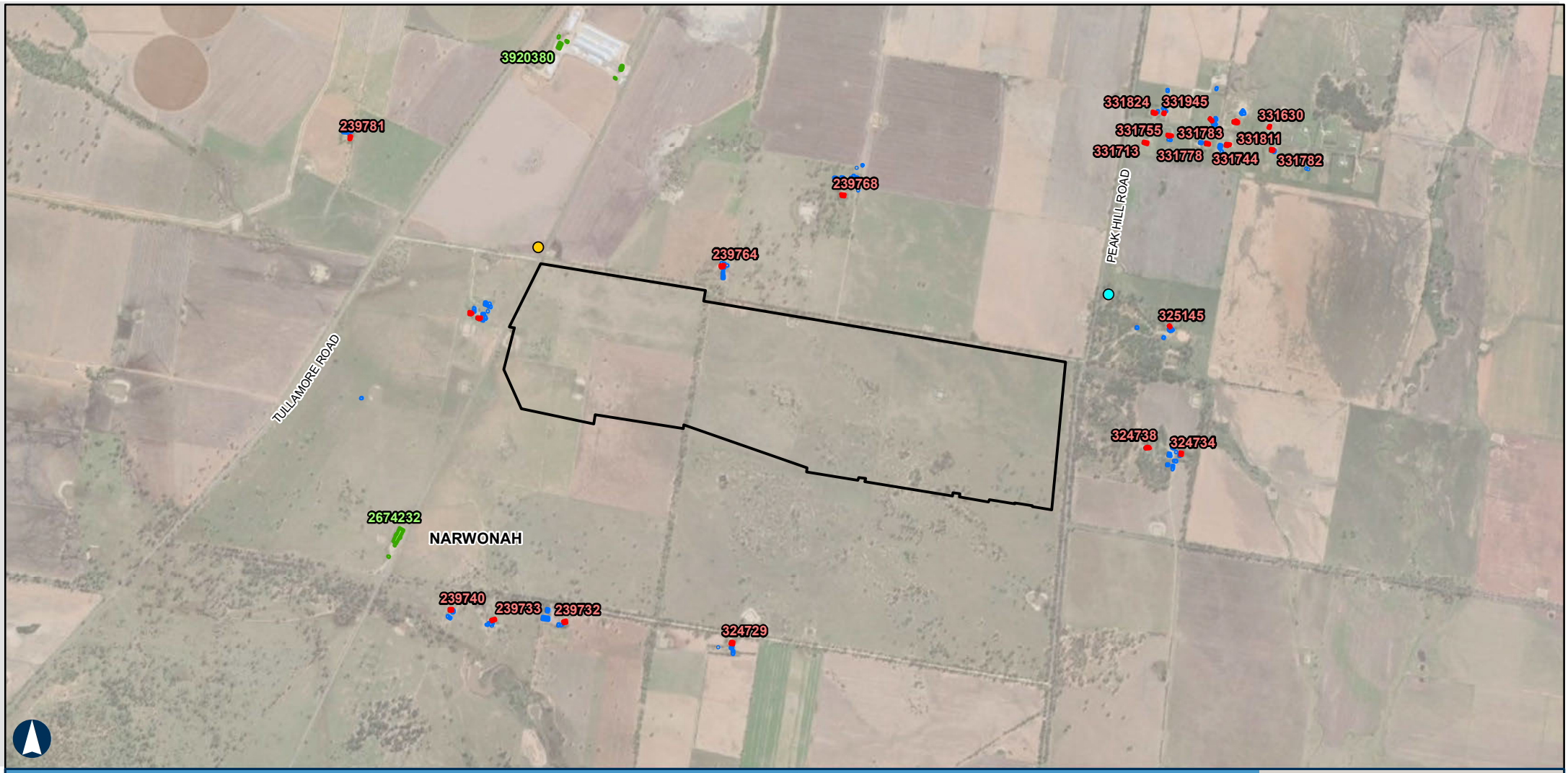
The determined mitigation and management measures should be captured in the Construction Noise and Vibration management Plan (CNVMP) for each of the site establishment and daily operational phases, and the predicted impacts are recommended to be updated as the project progresses.

APPENDIX

F

Noise and Vibration Assessment

Appendix A Sensitive receivers



NARWONAH MDC

Sensitive Receivers

APPENDIX A

1 km

Coordinate System: GDA 1994 MGA Zone 55

Paper: A4 Scale: 1:35,000
Date: 14-Mar-2022
Author: JG

- MDC Yard Footprint

Sensitive Receivers

- Residential
- Industrial
- Other
- M01 Noise monitor
- M13 Noise monitor

ARTC InlandRail

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

APPENDIX

F

Noise and Vibration Assessment

Appendix B Equipment source levels

Qty	Equipment	Frequency (dBZ)								dBA	Z (m)	
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**			**Source**
	1: Site Establishment											
1	Vibratory rollers	110	108	104	101	98	98	91	87	**105**	3.5	BS 5228-1:2009 Table C.5:28
1	Dump trucks	108	106	99	98	102	96	93	89	**105**	3.5	BS 5228-1:2009 Table C.5:12
1	Chainsaws	103	102	104	104	104	103	103	102	**110**	1.2	Based on SoundPLAN (SP) spectrum
1	Bobcat	102	100	99	99	97	95	88	79	**102**	1.0	S770 SWL spec with SP Loader spectrum
	Daily Operation											
	2.1: Short Rail Stockpile											
1	Gantry crane winch	88	87	84	93	92	89	83	80	**96**	6.0	Ryan & Deivasigamani (2018)
2	Gantry Crane Bogie	89	83	78	76	76	76	73	70	**82**	0.5	Ryan & Deivasigamani (2018)
1	Gantry Crane Diesel Generator	91	92	87	88	88	86	79	72	**92**	2.0	Ryan & Deivasigamani (2018)
1	Unloading rails to stockpile									**110**	2.0	Inland Rail Tech report 8 N2N EIS (no spectrum data available)
	2.2: Rail Shorts End Prep & Transfer to Rollers											
1	Hydraulic roller conveyor	86	80	80	71	71	70	75	75	**81**	0.5	BS 5228-1:2009 Table C.10:23
21	Electric motor conveyor drives	93	96	98	101	101	100	95	87	**105**	0.5	Empirical - Bies and Hansen
1	Prep - Sandblasting	111	107	109	112	118	122	125	121	**129**	1.5	Health and Safety Executive, 1997
1	Prep - grinding	91	104	98	96	96	96	92	85	**102**	1.5	Spectrum estimated, 6 inch grinder SWL
	2.3: Flushbutt Weld & Quench											
1	Welding unit	95	96	97	96	97	94	89	84	**101**	1.5	BS 5228-1:2009 Table C.3:31
1	Generator for welder	103	95	87	80	76	72	69	61	**85**	0.5	BS 5228-1:2009 Table C.3:33
	2.4: Grinding Stations											
3	Grinders, profile, web and underfoot	91	104	98	96	96	96	92	85	**102**	1.5	Spectrum estimated, 6 inch grinder
3	Electric motors powering grinders	93	96	98	101	101	100	95	87	**105**	0.5	Empirical - Bies and Hansen

Qty	Equipment	Frequency (dBZ)								dBA	Z (m)	
	2.5: Long Welded Rail Stockpile and Handling											
17	Stationary gantry cranes	88	87	84	93	92	89	83	80	**96**	6.0	Ryan & Deivasigamani (2018)
1	Loading rails for transport to site									**110**	2.0	Inland Rail Tech report 8 N2N EIS (no spectrum data available)
	3: Sleeper Stockpile and Handling											
1	Gantry crane winch	88	87	84	93	92	89	83	80	**96**	6.0	Ryan & Deivasigamani (2018)
2	Gantry Crane Bogie	89	83	78	76	76	76	73	70	**82**	0.5	Ryan & Deivasigamani (2018)
1	Gantry Crane Diesel Generator	91	92	87	88	88	86	79	72	**92**	2.0	Ryan & Deivasigamani (2018)
1	Forklifts	90	86	85	84	85	84	80	69	**90**	0.7	SoundPLAN library
1	Loading and unloading sleepers									**108**	2.0	Inland Rail Tech report 8 N2N EIS (no spectrum data available)
	4: Ballast stockpile and handling											
1	Discharge conveyor	86	80	80	71	71	70	75	75	**81**	0.5	BS 5228-1:2009 Table C.10:23
1	Loading conveyor	86	80	80	71	71	70	75	75	**81**	0.5	BS 5228-1:2009 Table C.10:23
1	Loader	112	116	109	102	102	99	94	93	**108**	3.5	BS 5228-1:2009 Table C.10:5
1	Ballast noise									**117**	2.0	Inland Rail database (no spectrum data available)
	5: Workshop											
77,264m^2	Transmission through walls and roof	61	71	61	58	55	51	42	33	**61**	-	Assume 85dBA Lp rev inside and transmission through Rw 25 cladding (SWL/m^2)
245m^2	Open doors	74	87	81	79	79	79	75	68	**85**	-	Assume three large entrances to shed (SWL/m^2)
	6: Train movements											
Closest track to resident	Train (Locomotive Idling)	87	91	74	77	97	100	88	68	**103**	4.0	SLR database

APPENDIX

F

Noise and Vibration Assessment

Appendix C Detailed results

Table 24 presents the predicted noise levels at each assessed residential receiver ($L_{eq,\ 15\ min}$ dBA) for the site establishent, and overall operational phases of the MDC life. Source contributions for separate operational tasks are presented in **Table 25**. In the event of predicted exceedances against night-time noise management levels (highlighted in tables), dominant source contributions are also highlighted.

Detailed L_{max} results for residential receivers are presented in **Table 26**.

Table 24 Detailed Results: predicted noise levels

Receiver ID	Predicted noise levels ($L_{eq,15\ min}$ dBA) for each scenario	
	1. Site Establishment	**7. Operational (2. to 6. Combined)**
239732	32	39
239733	36	36
239740	38	38
239764	56	52
239768	43	44
239781	33	32
324729	34	44
324734	43	44
324738	47	47
325145	45	41
331630	28	30
331713	30	34
331744	31	33
331755	35	36
331778	32	33
331782	27	31
331783	31	32
331811	29	32
331824	34	35
331945	34	34

Highlighted values exceed 35 dBA (sleep disturbance noise management level).

Table 25 Activity Contributions and Overall $L_{eq,\ 15\ min}$ dBA

Receiver ID	Predicted noise levels Leq,15min dBA for each scenario				
	2. Rail stocking, prep, grinding and welding	**3. Sleeper stockpile**	**4. Ballast stockpile**	**5. Workshop**	**6. Trains**
239732	36	25	34	29	17
239733	33	22	31	29	20
239740	34	23	32	32	21
239764	43	32	44	50	43

Receiver ID	Predicted noise levels Leq,15min dBA for each scenario				
	2. Rail stocking, prep, grinding and welding	3. Sleeper stockpile	4. Ballast stockpile	5. Workshop	6. Trains
239768	39	26	40	37	31
239781	25	17	27	27	20
324729	43	28	36	31	23
324734	41	28	39	29	27
324738	45	32	40	30	33
325145	40	26	35	26	21
331630	28	16	24	21	9
331713	32	19	27	24	13
331744	30	19	28	22	12
331755	34	20	29	25	14
331778	30	18	28	24	12
331782	29	16	26	21	10
331783	29	17	25	23	10
331811	29	18	26	23	11
331824	33	20	29	25	13
331945	31	19	29	23	13

Table 26 Detailed Results: Sleep disturbance assessment

Receiver ID	Predicted noise levels L_{Fmax} dBA for each scenario	
	1. Site Establishment	7. Operational (2-6 Combined)
239732	40	48
239733	44	47
239740	45	48
239764	63	65
239768	50	56
239781	41	48
324729	42	48
324734	50	54
324738	55	59
325145	52	52
331630	36	42
331713	40	46
331744	39	44
331755	42	48
331778	39	44
331782	35	44

Receiver ID	Predicted noise levels L_{Fmax} dBA for each scenario	
	1. Site Establishment	**7. Operational (2-6 Combined)**
331783	38	44
331811	37	43
331824	42	47
331945	42	46

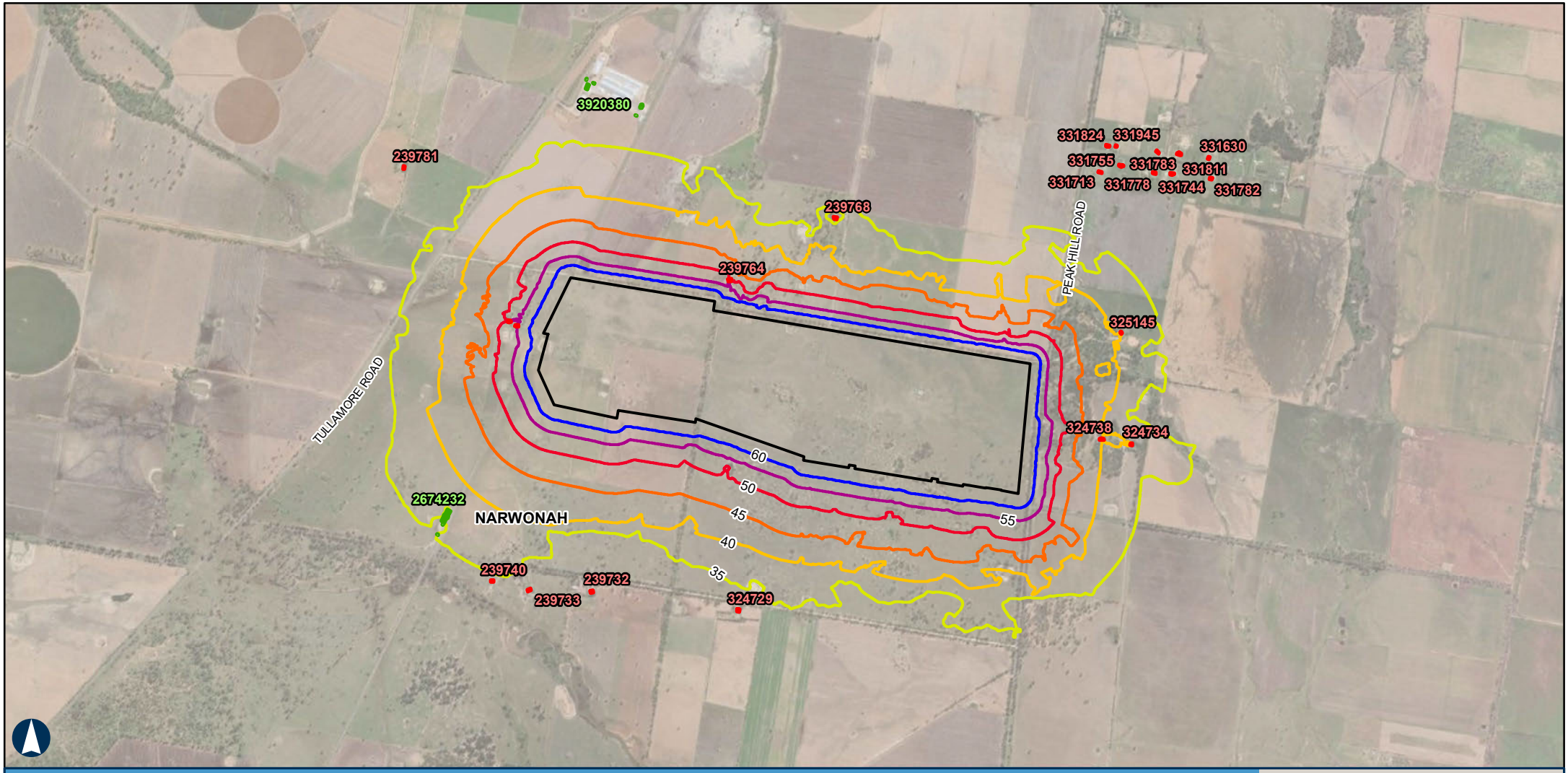
Highlighted values exceed 52 dBA (sleep disturbance noise management level).

APPENDIX

F

Noise and Vibration Assessment

Appendix D Noise contours



NARWONAH MDC

Noise Contours - 1. Site Establishment - $L_{eq,\ 15\ min}$

APPENDIX D

1 km

Coordinate System: GDA 1994 MGA Zone 55

Paper: A4 Scale: 1:40,000
Date: 14-Mar-2022
Author: JG

MDC Yard Footprint

Sensitive Receivers

- Residential
- Industrial

Noise Level (dBA)

- 35
- 40
- 45
- 50
- 55
- 60

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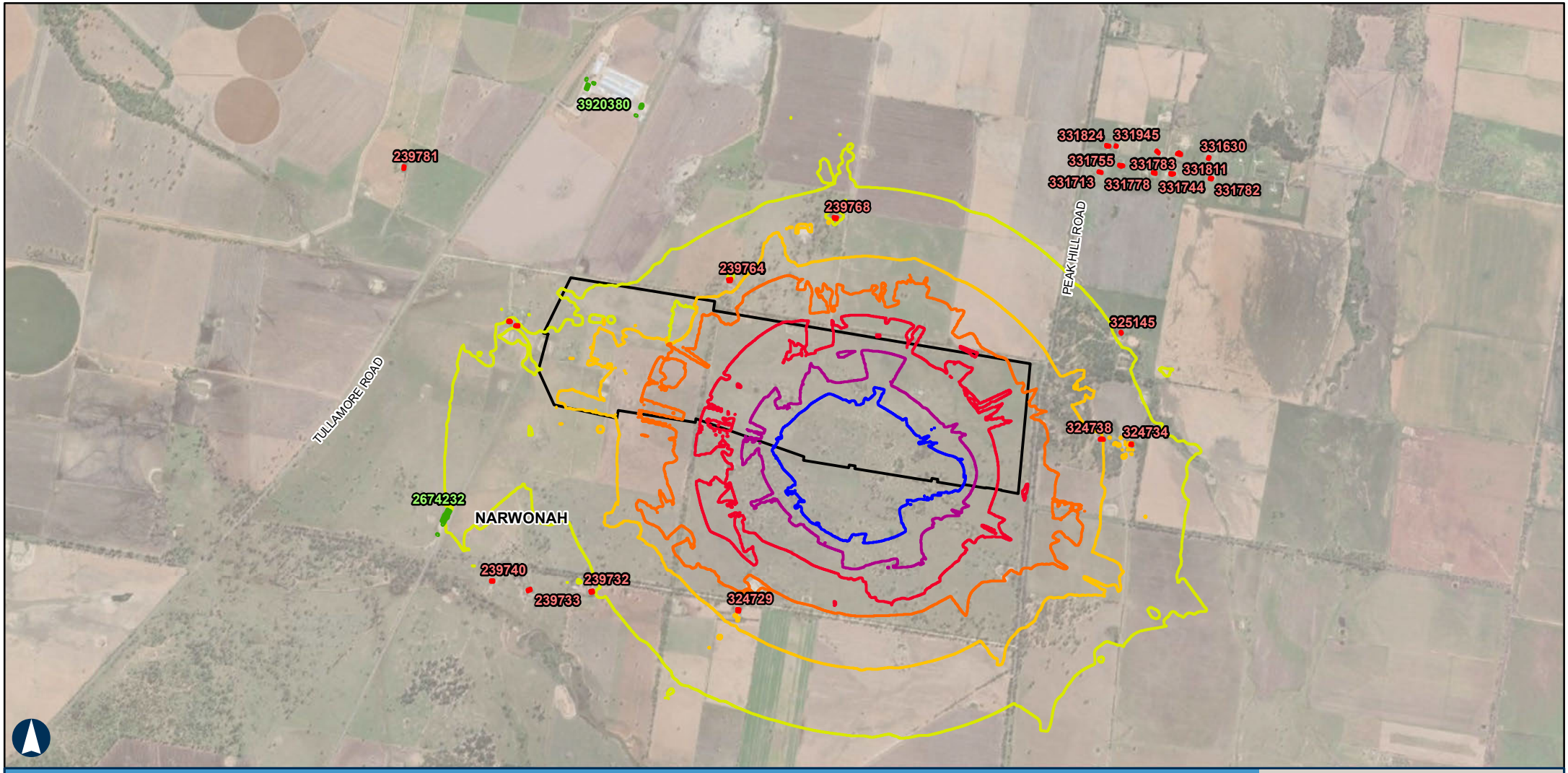

NARWONAH MDC

Noise Contours - 2. Rail Stocking, Preparation, Grinding and Welding - $L_{eq, 15\ min}$

APPENDIX D

1 km

Coordinate System: GDA 1994 MGA Zone 55

Paper: A4 Scale: 1:40,000
Date: 14-Mar-2022
Author: JG

MDC Yard Footprint

Sensitive Receivers

- Residential
- Industrial

Noise Level (dBA)

- 35
- 40
- 45
- 50
- 55
- 60

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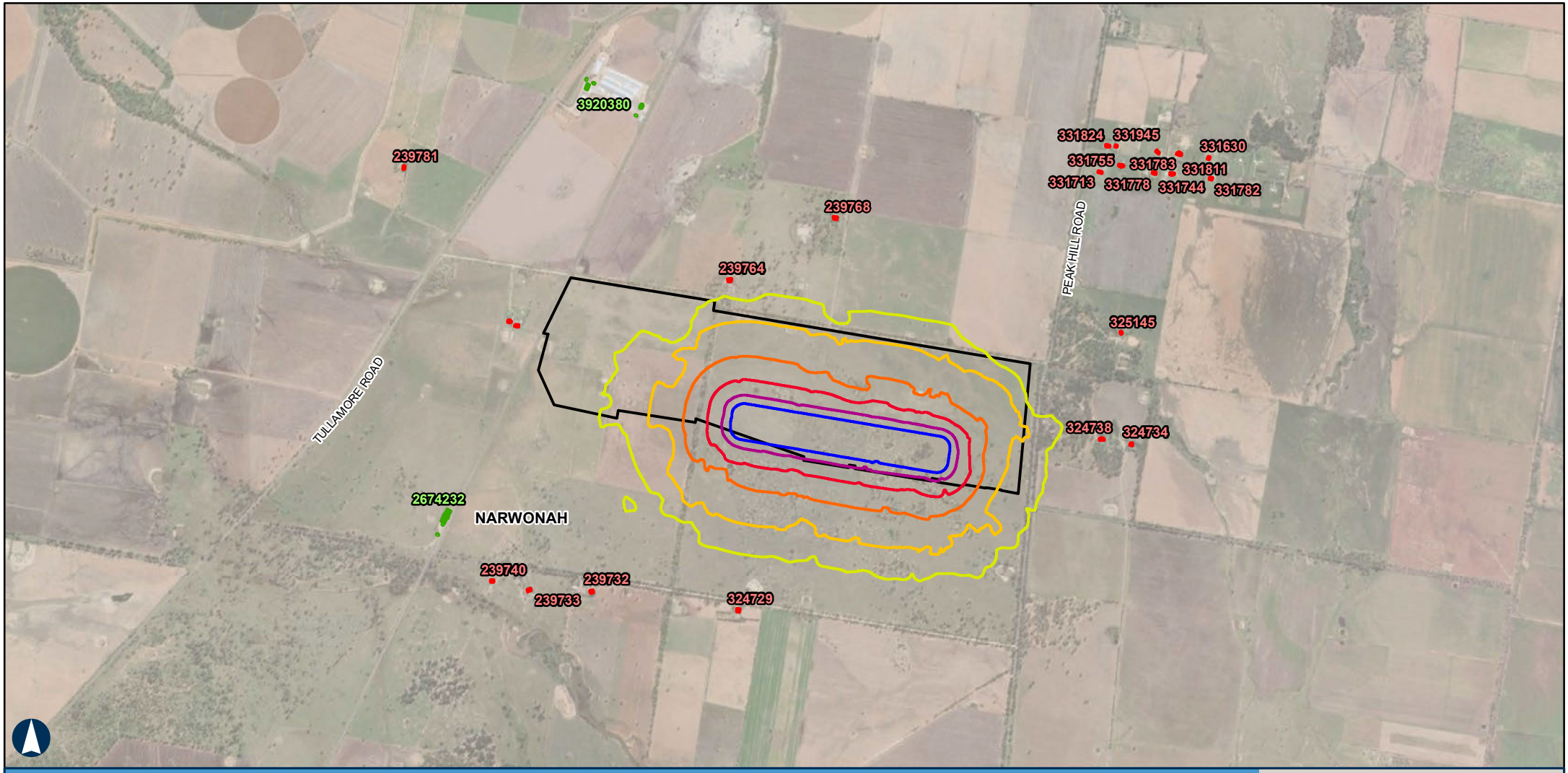

NARWONAH MDC

Noise Contours - 3. Sleeper Stockpile - $L_{eq, 15\ min}$

APPENDIX D

1 km

Coordinate System: GDA 1994 MGA Zone 55

Paper: A4 Scale: 1:40,000
Date: 14-Mar-2022
Author: JG

MDC Yard Footprint

Sensitive Receivers

Residential

Industrial

Noise Level (dBA)

35
40
45
50
55
60

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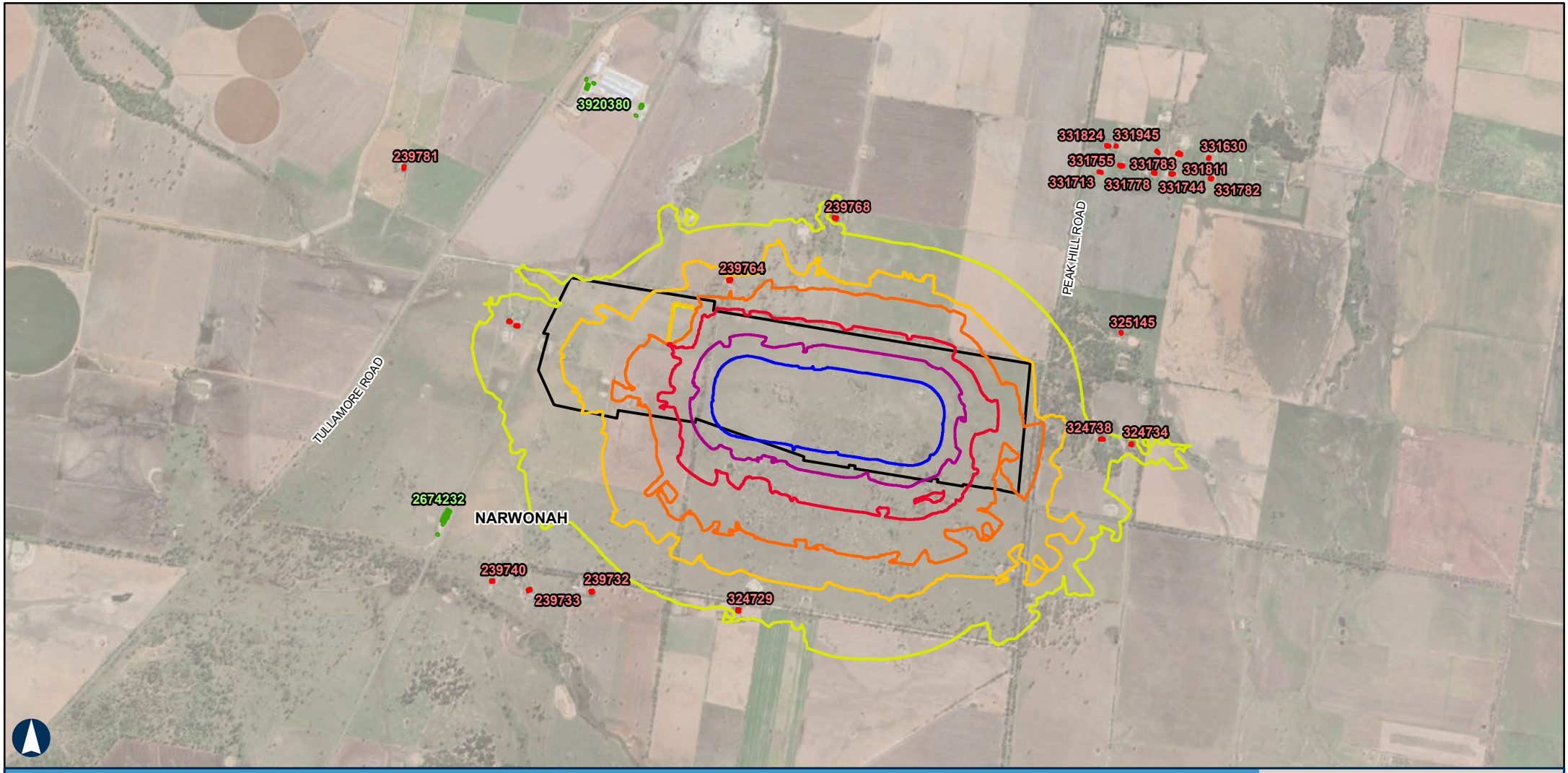

NARWONAH MDC

Noise Contours - 4. Ballast Stockpile - $L_{eq,\ 15\ min}$

APPENDIX D

1 km

Coordinate System: GDA 1994 MGA Zone 55

MDC Yard Footprint

Sensitive Receivers

- Residential
- Industrial

Noise Level (dBA)

- 35
- 40
- 45
- 50
- 55
- 60

Paper: A4 Scale: 1:40,000
Date: 14-Mar-2022
Author: JG

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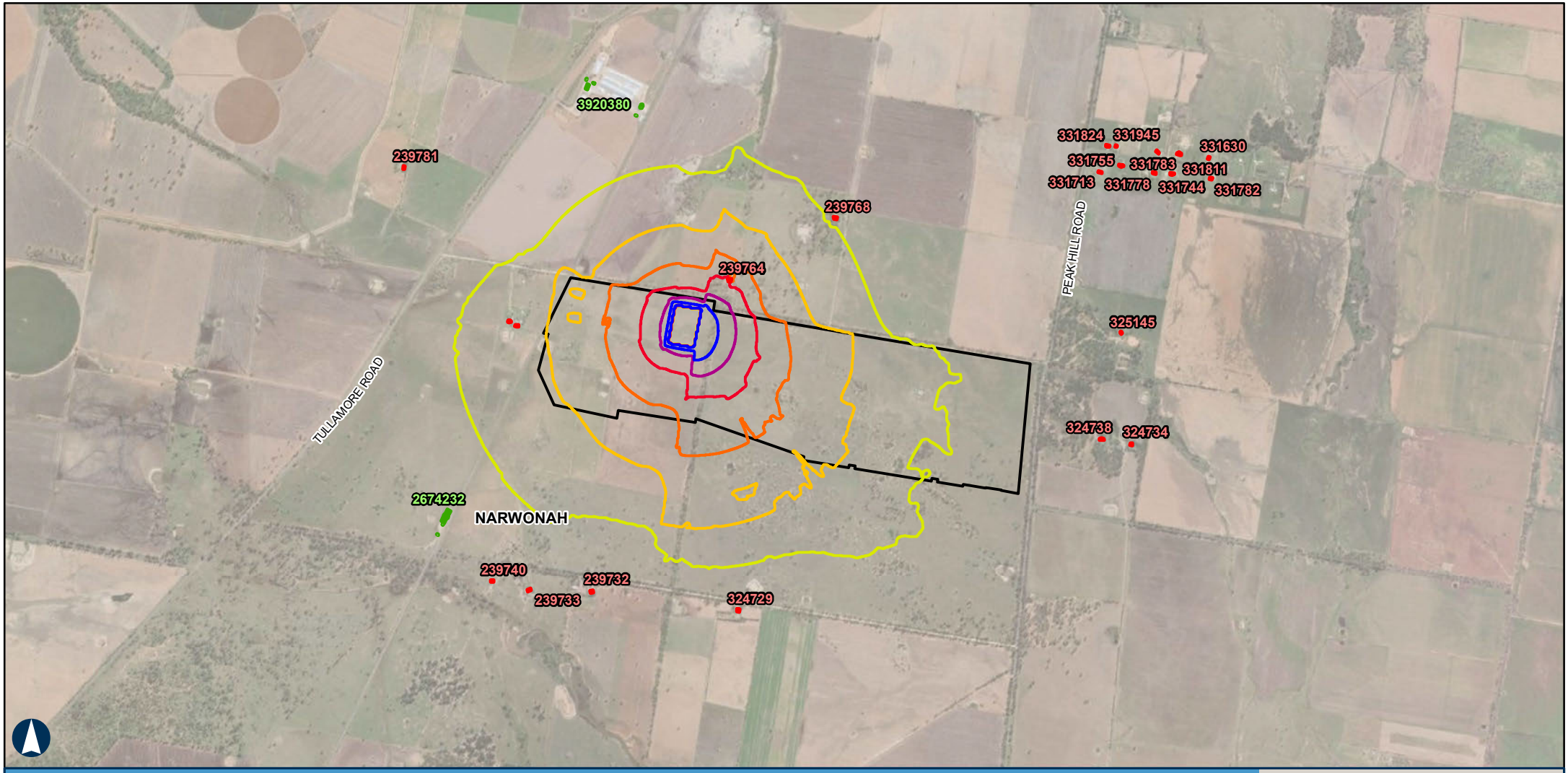
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



NARWONAH MDC

Noise Contours - 5. Workshop - $L_{eq, 15\ min}$

APPENDIX D

1 km

Coordinate System: GDA 1994 MGA Zone 55

MDC Yard Footprint

Sensitive Receivers

- Residential
- Industrial

Noise Level (dBA)

- 35
- 40
- 45
- 50
- 55
- 60

Paper: A4 Scale: 1:40,000
Date: 14-Mar-2022
Author: JG

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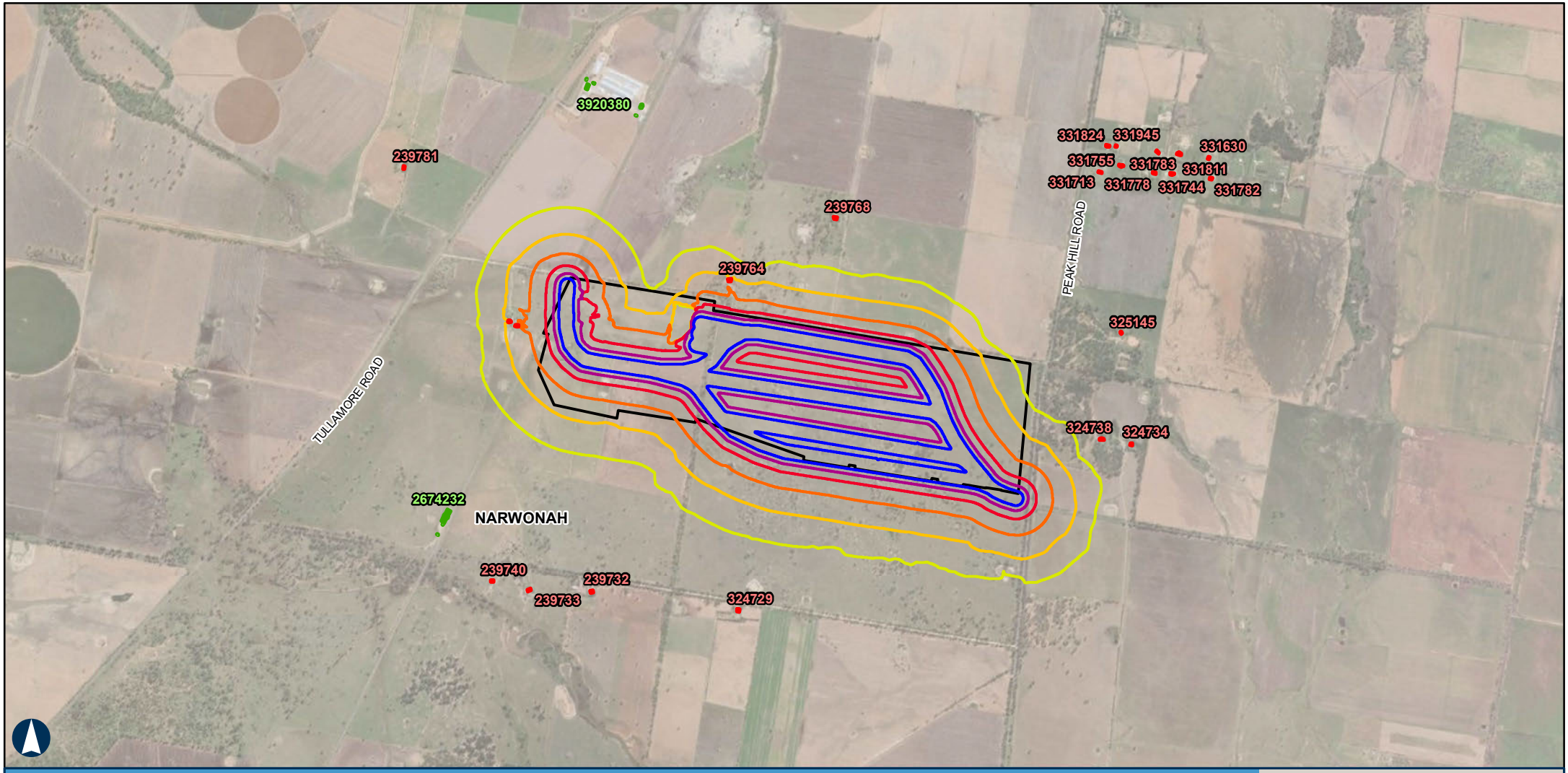

NARWONAH MDC

Noise Contours - 6. Train Movements - $L_{eq, 15\ min}$

APPENDIX D

1 km

Coordinate System: GDA 1994 MGA Zone 55

MDC Yard Footprint

Sensitive Receivers

- Residential
- Industrial

Noise Level (dBA)

- 35
- 40
- 45
- 50
- 55
- 60

Paper: A4 Scale: 1:40,000
Date: 14-Mar-2022
Author: JG

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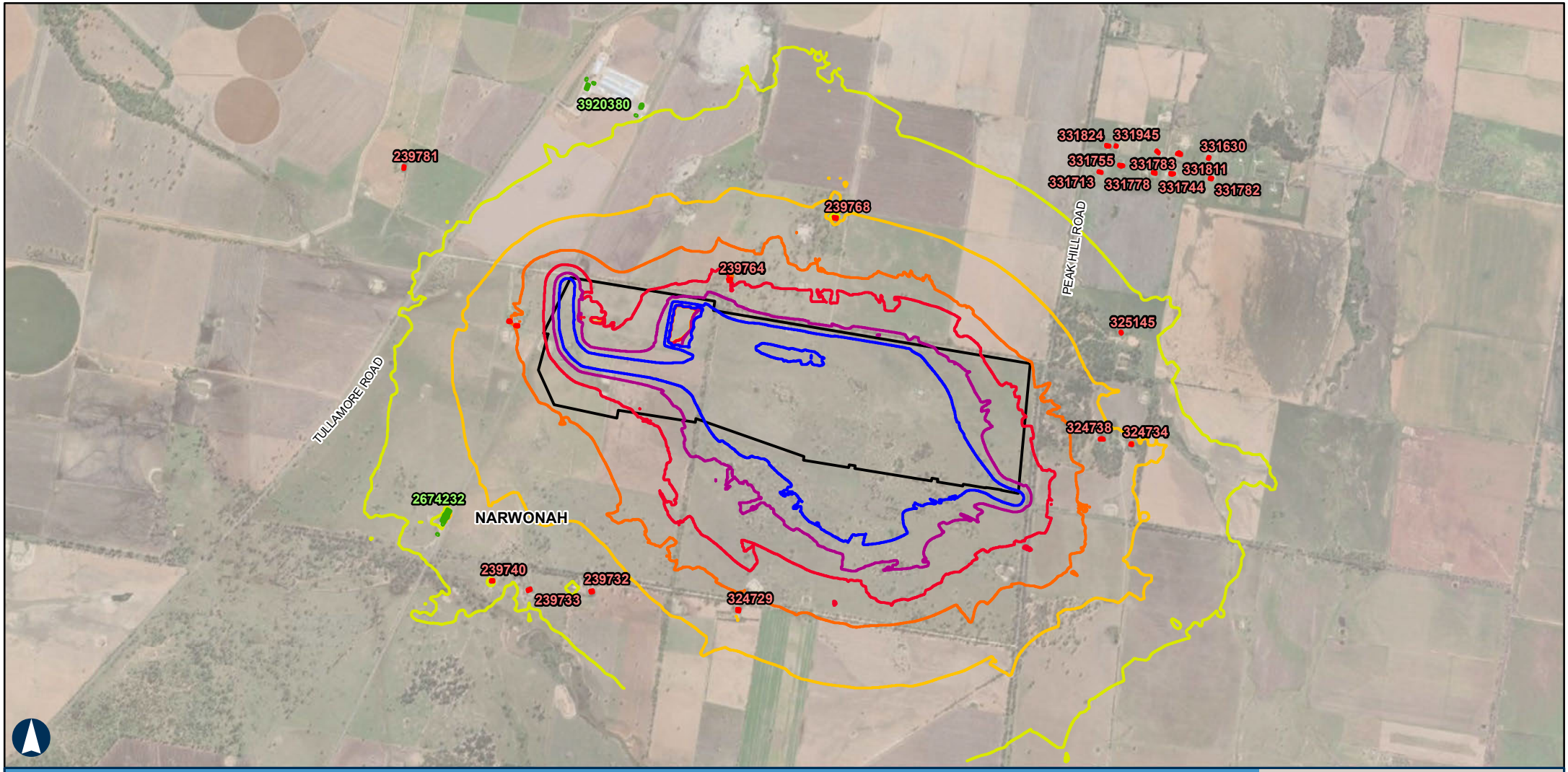
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



NARWONAH MDC

Noise Contours - 7. Overall Operations - $L_{eq,\ 15\ min}$

APPENDIX D

1 km

Coordinate System: GDA 1994 MGA Zone 55

Paper: A4 Scale: 1:40,000
Date: 14-Mar-2022
Author: JG

MDC Yard

Sensitive Receivers

- Residential
- Industrial

Noise Level (dBA)

- 35
- 40
- 45
- 50
- 55
- 60

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